UNIVERSITÀ DEGLI STUDI DI TRENTO

UNIVERSITÀ DEGLI STUDI FIRENZE

Doctoral School of Social Sciences
PhD Programme in Development Economics and Local Systems
Curriculum in Development Economics

South-South Trade, Export Sophistication, and Terms of Trade: Empirical Studies on Developing Countries from 1995 to 2014

A thesis submitted in partial fulfilment of the requirements for the doctoral degree (PhD) in Development Economics and Local Systems

Yue Teng
2018/2019

Supervisors:
Professor Geremia Gios
Professor Giuseppe Folloni

Referees:
Dr Antonio Andreoni (SOAS University of London)
Dr Miriam Manchin (University College London)

Examination Committee:
Professor Heinz-Dieter Kurz (University of Graz)
Professor Sergio Vergalli (University of Brescia)
Professor Fabio Pieri (University of Trento)
Professor Anne-Celia Disdier (Paris School of Economics)

Abstract

Industrialisation and trade are two major contributors to growth and development. Historical experience has clearly demonstrated the importance of industrialisation and manufactured exports in the transformation from a backward country to an advanced country. Moreover, industrialisation is not only an efficient way to increase productivity and welfare, but also an effective way to promote social and cultural changes. Over the recent decades, two trends in developing countries' industrialisation and trade have been well documented in the literature. First, manufactures have taken increasingly important share in many developing countries' export basket. Second, the fast-growing trade between developing countries, say, South-South trade, has been highlighted. Given the importance of industrialisation and trade in development process, this PhD thesis aims at contributing to knowledge on the evidence, mechanism, and determinants of developing countries' trade and industrialisation, centring on South-South trade, export upgrading, export directionality, and terms of trade over the recent two decades from 1995 to 2014. Each of the four topics is addressed in one of the following four chapters from Chapter 2 to Chapter 5.

Chapter 2 criticises the existing approach towards the definition of the Global South and South-South trade, and clarifies that the delightful picture of South-South trade highlighted in the literature is actually an "illusion". Including *de facto* developed countries (e.g., the Asian Tigers) and emerging countries in the group of developing countries strongly inflates the size and growth of South-South trade. If these countries are excluded, then the relative size of South-South trade becomes quite small. In particular, this chapter demonstrates that including these *de facto* developed and emerging countries in South-South trade statistics heavily overstates technological and manufacturing capabilities of the so-called "Global South". Moreover, this chapter also explores the composition of developing countries'

exports to different trade partners and their trade potential with the rest of the world. It reveals great differences in the composition between developing countries' different export directions and significant asymmetries in mutual trade potential between developing countries and the rest of the world.

Chapter 3 examines the determinants of developing countries' export upgrading with a particular interest in the role of China and productive investment. Amongst general factors, access to sea, human capital, productive investment, and trade openness are found to be major contributors to developing countries' export upgrading. The robust effect of productive investment reflects the importance of political and social agents' motivations of industrialisation and, perhaps more importantly, endemic political-economic embeddedness that determines the motivations. This echoes the centrality of strong and developmentally-oriented elites in the developmentalist model of industrialisation and development. Developing countries' absolute gains from trade with China, as reflected by the significant improvement in their income terms of trade *vis-à-vis* China, promote their export upgrading. Importantly, mediation analysis shows that this export-upgrading effect operates, to a large extent, through the enhancing effect of trade with China on developing countries' productive investment. This export-upgrading effect of absolute gains from trade with China is stronger and more robust in the period of 2002-2014 than 1995-2014, which is consistent with the growing role of China in the global economy since the early 2000s, reflecting on China's commodity boom and its strong performance in manufactured exports. That is to say, trade with China serves as a source of investment for developing countries' export upgrading. This finding provides a new and indirect channel to understand the influence of China on developing countries' industrialisation, going beyond the conventional perspectives of the "crowding-out" effect and the "re-primarisation" effect. It suggests that, for developing countries, China serves more as a stimulator of capital accumulation than a competitor in manufacturing market or a predator of natural resources. Therefore, the priority for developing countries is the appropriate use of gains from trade for productive purpose.

Chapter 4 provides the latest evidence to the discussion in the 1980s on developing countries' export directionality, and explores the determinants of this directionality. Between 1995 and 2014, more than half of developing countries tended to have more sophisticated Southbound exports than Northbound exports, while the opposite is true for the rest. Productive capabilities are found to be a major and robust determinant of this directionality of export sophistication. Productively more advanced developing countries are more likely to have more sophisticated Northbound exports than Southbound exports, which is likely to be due to their ability to access the more competitive markets of developed and emerging countries and/or the downstream value chains with their relatively sophisticated products. In contrast, productively less advanced developing countries have to access developed and emerging countries' markets and/or the downstream value chains with their less sophisticated products, due to the lack of competitiveness in more sophisticated products. This finding suggests that the conventional argument that South-South trade is more beneficial to developing countries than North-South trade should be interpreted conditionally, because, for those productively more advanced developing countries, Northbound exports are likely to be more sophisticated. Another important contributor to the directionality of export sophistication is geographical distance. Larger distance to other developing countries reduces a developing country's Southbound export sophistication or increases its Northbound export sophistication, which is consistent with the argument of the gravity model in a broad sense.

Chapter 5 examines the recent trends of developing countries' terms of trade under the trichotomous global economic hierarchy consisting of developed, emerging, and developing countries. Time-series analysis shows that developing countries,

especially those specialising in fuels or minerals, have experienced an improvement in their net barter terms of trade *vis-à-vis* developed countries over the recent two decades. In contrast, developing countries' net barter terms of trade *vis-à-vis* China and other emerging countries tends to show negative or trendless behaviour, except those specialising in mineral fuels. In summary, on a global scale, developing countries specialising in fuels or minerals have tended to hold a favourable position, whereas those specialising in agricultural products or manufactures have experienced a less favourable or even unfavourable situation. On the other hand, income terms of trade of all groups of developing countries *vis-à-vis* the rest of the world, regardless of developed countries, China or other emerging countries, has significantly improved. This indicates developing countries' absolute gains from trade with the rest of the world. However, the rest of the world has comparable improvement in their income terms of trade *vis-à-vis* developing countries. Therefore, despite the favourable income terms of trade facing developing countries, the condition for global (North-South) convergence does not hold. As a consequence, developing countries have to mobilise more resources to maintain the favourable income terms of trade, which impedes their domestic consumption and investment, and the unequal global exchange has remained. Particularly, this global inequality is magnified by the persistent North-South gap in productivity and technology and by developing countries' high population growth. The global inequality is rooted in the competitive nature of the markets for primary commodities and simple manufactures and the oligopolistic nature of the markets for sophisticated manufactures. In this sense, the findings are in line with the Prebisch-Singer hypothesis.

Keywords: Developing Countries, Industrialisation, South-South Trade, Export Sophistication, Terms of Trade

JEL Classification: F14, F63, O14, O19, O25

Acknowledgements

The PhD life over the past four years is a really long journey. It may be the longest time interval in my life to concentrate on a single particular task, and I owe debt to many people. Without them, the completion of this thesis and the PhD journey may not be possible.

First of all, I would like to express the greatest gratitude to my supervisor, Professor Giuseppe Folloni. The first time we met is in the July more than four years ago when I came to Trento for the PhD interview, which is still a fresh memory in my mind today. Besides his warm guidance and professional advice on the thesis and my academic activities over the past four years, I am really grateful to Professor Folloni for his understanding of my research ideas, some of which may not be that mainstream, and for the freedom he gave to me for carrying out extra research, which is for my own academic interests but goes beyond the PhD thesis. These supports are invaluable. Without him, my PhD project would be very tough, if not impossible. I would also like to thank Professor Geremia Gios for joining my PhD committee and for his support for my PhD project.

A special gratitude should go to Dr Dic Lo who hosted my visit at the Department of Economics, SOAS University of London. His unique academic viewpoints on China and the world economy have inspired some important research questions of this thesis. Particularly, I am honoured to have him as the second author of Chapter 3 of my thesis.

Moreover, I would like to particularly thank Dr Antonio Andreoni and Dr Miriam Manchin for their reviews on this thesis. Their comments have made the thesis theoretically and empirically stronger and provided new insights into the empirical findings and the theoretical and policy implications.

I would also like to thank some professors at both the University of Trento and the University of Florence for their efforts and supports for not only my own PhD project but also the PhD programme, especially the coursework in the first year. They are (listed by initials) Professor Gabriella Berloffa, Professor Alessandro Cigno, Professor Giovanni Andrea Cornia, Professor Gianna Claudia Giannelli, Professor Giorgia Giovannetti, Professor Luciana Lazzeretti, Professor Donato Romano, Professor Lorenzo Sacconi, Dr Chiara Tomasi, and Professor Ermanno Celeste Tortia. I also owe my debt to Mr Davide Santuari and Ms Nicole Bertotti of the School of Social Sciences for their great help and support for administrative issues.

The warmest gratitude must also be expressed to my fellow students in Trento and Florence, in not only economics but also sociology. They have become part of my everyday life, academically and emotionally. It is my fortune to meet you in my life. They are Alejandro, Ali, Anna, Blerita, Claudia, Clementina, Cristina, Diletta, Eleonora, Emanuele, Filippo, Francesca, Gabriele, Hamid, Lei, Luca, Marco, Nicoletta, Riccardo, Samuele, Sara, Silvio, and Stefania. I have my greatest wishes for all of you for your life and career.

Finally, the greatest gratitude to my family, my parents and grandparents. This thesis is also for you.

Contents

List of Tables

Chapter 2

Chapter 3

Chapter 4

Chapter 5

List of Figures

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 1. Introduction

1.1. Background

Industrialisation and trade are two major contributors to growth and development. Historical experience since the industrialisation of the United Kingdom in the late 18th century has shown that almost all successful economic catch-ups are associated with industrialisation, in particular the industrialisation of export structure (Szirmai, 2012; Cimoli, Fleitas, and Porcile, 2013). The wave of industrialisation spread from Northwestern Europe to Central Europe in the middle 1800s and then to Southern and Eastern Europe and Japan in the late 1800s and the early 1900s. The first half of the 20th century also witnessed partial industrialisation in some offshoots of Europe, mainly in large Latin American countries (e.g., Argentina and Brazil), as early attempt of import substitution industrialisation after the Great Depression. In the aftermath of the Second World War, developing countries started or, for some of them, re-started their own industrialisation. This wave of industrialisation was inspired by the structuralist economic thoughts led by Raúl Prebisch and economists of the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) and the success of the Soviet state-led industrialisation. During this period, Latin American countries and those newly independent countries in other world regions carried out industrialisation mainly in the form of import substitution. However, the import substitution industrialisation model eventually failed to reach its goal of industrialisation and economic growth. The reason of this failure is complicated and there is a great body of literature on this topic, which is beyond the scope of this thesis. However, it must be noted that the failure of the import substitution industrialisation model is, to a large extent, due to biased interpretation of structuralist economics and problematic implementation[1], in addition to external

[1] The original proposal of the United Nations Economic Commission for Latin America and the

shocks (e.g., the debt crisis in the 1980s).

In contrast, the Asian Tigers have demonstrated another scenario of late industrialisation. These countries followed a mixed path of initially import substitution-based and later export-led industrialisation. According to Wade (2015), the Asian Tigers are among the only seven non-western countries that became developed since the industrial revolution[2]. It must be noted that the mainstream view, in particular amongst neoclassical economists, tends to ascribe the East Asian miracle simply to a market-conforming export-oriented industrialisation (EOI) and structural transformation. This viewpoint, however, is biased, as it, perhaps intentionally, neglects the fact that the material basis of East Asian countries' technology-intensive exports is the accumulation of technology and capability as a result of import substitution and that the East Asian model features developmental state and large manufacturing companies under oligopoly rather than perfect competition (Ocampo, 2003). Later studies, such as the famous report of "The East Asian Miracle" (World Bank, 1993), moderately and even trickily alter the earlier neoliberal interpretation of the East Asian model and recognise that the East Asian state is "market-friendly" interventionist, but this new viewpoint is just a distorted documentation of state intervention in East Asia and actually serves as a *de facto* defence of the neoclassical paradigm of industrialisation (Amsden, 1994; Kiely, 1998). The debate over the East Asian model echoes the fact that trade and industrial policies are the most contentious issues in development economics (Chang, 2003).

The East Asian experience perfectly demonstrates the essential role of

---

Caribbean (ECLAC), represented by Raúl Prebisch, was not an autarky development path, as misunderstood by many policy makers in Latin America. Instead, the ECLAC suggested to promote regional integration and to upgrade Latin America's position in the global labour division (Toye, 2003; Ocampo and Ros, 2011). Despite criticisms from ECLAC, policy makers in Latin America did not effectively correct their biased implementation of import substitution industrialisation (Love, 2005).

[2] The other three are Japan, Russia, and Israel. However, in a broad sense, Russia and Israel can be regarded as western countries.

industrialisation and trade in development, as well as an active role of the state. As suggested by Amsden (1980), export that is preceded by import substitution industrialisation, as shown by the East Asian case, is the core approach for developing countries to promote growth and expand employment. Johnson, Ostry, and Subramanian (2010) document the growth experience of twelve fast-growing countries, among which eight are in East and Southeast Asia, reaching a conclusion that what constrain economic growth are not those so-called "first-order problems" (e.g., institutions, macroeconomic stability, trade openness, education, and inequality) but manufactured exports. Almost all of the twelve benchmark countries in their study have adopted promotion policies for manufactured exports, and these countries have indeed experienced rapid growth in manufactured exports. This importance of export and its composition for developing countries has become even greater under the globalisation era (Lall, Weiss, and Zhang, 2006).

Real-world experience has demonstrated the essential role of trade in the process of industrialisation. Limited size of domestic market restricts not only demand for manufacturing outputs but also the realisation of the externalities of manufacturing, especially for developing countries. Thus, trade policy has become a major component of industrial policy, and preferential policies for manufactured exports are necessary (Pack and Westphal, 1986; Harrison and Rodríguez-Clare, 2010). In turn, developing countries' export performance is also closely associated with their manufacturing growth (Pacheco-López and Thirlwall, 2013). At the initial stage of industrialisation, demand for agricultural inputs (e.g., fertiliser and equipment) drives domestic industrial production, whereas at later stages exports take over the role of agriculture as the major source of demand for manufacturing (Thirlwall, 2003; Kaldor, 2007). However, if the scale of domestic agricultural production is limited, then agriculture's role as a contributor to early-stage industrialisation may be restricted. The problem of domestic market size is relevant to many developing countries. For example, Singer (1998) suggests that many Sub-Saharan African countries are geographically too small to support their industrial development "on a national basis". Thus, foreign market is the only option for these countries, not only due to foreign demand but also due to the productivity-enhancing effect of exporting activities (Page, 2010 and 2012; Ajakaiye and Page, 2012). In brief, it is safe to argue that industrialisation and trade are closely interrelated and manufactured exports act as the intersection of these two pillars of development.

Given its essential role in development process, it is of particular importance to understand the mechanism underlying the development of developing countries' manufactured export. Two issues thus arise: what developing countries export and where developing countries' exports go to. These two questions are relevant to two major trends in developing countries' trade over the recent decades, which have been well documented in the literature. Since the late 1970s, the earlier industrialisation strategy based on import substitution has been replaced by the strategy of export-oriented industrialisation (Milberg and Winkler, 2010). Contemporaneously, there has been a shift in many developing countries' export composition to become manufacture-dominant (Sarkar and Singer, 1991; Szirmai, 2012). While developing countries' industrialisation efforts are a contributor to this shift, a more important and fundamental contributor is the structural and organisational change in the global capitalist labour division led by developed countries. In other words, the industrialisation of developing countries' exports in the post-import substitution period is largely a result of and a stage in the evolution of the global capitalism. Less skill-intensive industries have declined in developed countries during the process of technological progress and demographic change, and are then transferred to developing countries. Meanwhile, the emergence of multinational enterprises and global value chain during the globalisation era involves developing countries in the internationalisation of manufacturing production. Therefore, the 19th-century pattern that developed countries export manufactures and developing countries export primary commodities has come to an end (Baer, 1972; Havrylyshyn and Wolf, 1987).

However, an important question comes: has the shift towards a manufacture-dominant export pattern reversed developing countries' long-term plight in the unequal international exchange system (i.e., the centre-periphery system)? The answer seems to be negative. This issue has been well explored by Hans Singer in his revision of the original Prebisch-Singer hypothesis. During the post-war period, the advantageous position of developed countries in the global market does not stem from their role as suppliers of manufactures, which is different from the situation in the 19th and the early 20th century. Likewise, the disadvantageous position of developing countries in the global market is not simply due to their role as suppliers of primary commodities. Instead, developed countries' advantage and dominance in the global market stem from their capabilities of technological innovation. Kaplinsky (2006) summarise three aspects in this innovation-based explanation for the new logic of the global market (Singer, 1975). First, the determination of prices in the global market and countries' income growth is of a neo-Schumpeterian type, which means that capabilities in capturing the rents from innovation determine a country's competitiveness and power in the global market. Second, the capability and intensity of innovation are not evenly distributed across countries. The absolute majority of innovative activities take place in developed countries. This phenomenon implies the absolute advantages of developed countries over developing countries. These two points echo the world-system perspective that different country groups' positions in the global labour division are not just differentiated, but, more importantly, hierarchically stratified based on each country group's abilities to appropriate the surplus they produce (Evans, 1979). Third, manufactured exports of developing countries do not show favourable trend of net barter terms of trade *vis-à-vis* manufactures exported by developed countries (Sarkar and Singer, 1991; Maizels, Berge, Crows, and Palaskas, 2000). This unfavourable trend has further deteriorated after China's entry into the global market as a major supplier of low-end manufactures (Villoria, 2009).

Therefore, the shift from primary commodity-dominant export structure towards manufacture-dominant export structure has failed to reverse the disadvantageous position of developing countries in the unequal global exchange, which has its roots in the historical centre-periphery relationship. In the original Prebisch-Singer thesis, the world exchange system reflects the relationship between developing countries as suppliers of primary commodities and developed countries as suppliers of manufactures. However, in the post-war era, it is technology-based innovation that is the source of rents in the global market (Kaplinsky and Santos-Paulino, 2005). Accordingly, the old relationship in the original Prebisch-Singer thesis has transformed into a new relationship between developing countries as suppliers of standardised products without innovation rents or Schumpeterian rents and developed countries as suppliers of innovative products. In the words of Kaplinsky (2006), this is a relationship between producers of low-income economy goods and producers of high-income economy goods. Therefore, the challenge facing developing countries is not merely the task of transforming from primary commodity producers into manufacturers, but the task of transforming from simple manufacturers into sophisticated manufacturers. This argument closely echoes the recent burgeoning literature on export sophistication, pioneered by Hausmann, Hwang, and Rodrik (2007). Roughly speaking, a country is supposed to have (relatively) high export sophistication, if it exports products that are also exported by high-income countries. Robust evidence has been found to support the positive association between export sophistication and economic growth. More sophisticated products tend to be those with higher intensity of skill and technology and lower intensity of unskilled labour. Although unskilled labour-intensive manufacturing may be pro-poor and lead to inclusive growth, it is skill- and technology-intensive manufacturing that has externalities beneficial to the country as a whole (Lederman and Maloney, 2012). Moreover, as more and more developing countries have entered the world market of standardised manufactures as a result of low barriers to entry, there comes the problem of "fallacy of composition" (Sapsford and Singer, 1998; Mayer, 2002; Razmi and Blecker, 2008). Under such situation, developing countries have to choose to either cut their production costs, mostly wages (race to the bottom), or ascend the production ladder (Amsden, 1987). In this sense, the challenge facing developing countries' industrialisation comes from not only the innovative advantages of developed countries, but also price competition posed by other developing countries. This further urges developing countries to upgrade their export structure.

Another trend in developing countries' trade over the post-war period, especially since the middle 1970s, is the growth in exports from developing countries in general and exports between developing countries, namely, South-South trade, in particular. By 2006, total exports from the Global South had amounted to $4.3 trillion, accounting for 37% of the total world exports, and South-South exports had exceeded $2 trillion, accounting for 17% of the total world exports. Early development economists, represented by two Nobel laureates, Gunnar Myrdal and Sir Arthur Lewis, emphasise the political-economic benefits of South-South trade as a way to reduce the South's dependence on the North and to establish "collective self-sufficiency". Myrdal (1956) promotes economic cooperation, especially in manufacturing, between underdeveloped countries, in order to provide sufficient market absorption capacity for potential outputs of their industrialisation. Otherwise, idle production capacities in newly-established industries due to underdeveloped countries' small domestic market may hinder their industrialisation. Based on his Nobel Prize lecture in 1979, Lewis (1980) highlights the close association of the North's economic downturn with the South's export and economic growth, and proposes South-South trade as a channel to transform the South to be an alternative growth engine for itself.

Supports for South-South trade can be found among more radical economic schools as well. Structuralists regard South-South trade as an alternative to North-South trade, because South-South trade is expected to lead to more equal distribution than North-South trade in which the North seizes more profits by its superior position and the worsening terms of trade facing primary commodities, as demonstrated by the Prebisch-Singer thesis (Greenway and Milner, 1990). This uneven exchange widens the North-South gap. Following the vision of the Prebisch-Singer thesis, the neo-Marxist dependency theory further claims that the history and the structure of the capitalist world system generate development in the centre and underdevelopment in the periphery (Frank, 1969). Thus, according to both dependency theory and world-system theory, "de-linking" with this uneven centre-periphery relationship is the prerequisite for development in the periphery (Amin, 1974).

The later literature has shifted the focus from the political-economic benefits of South-South trade to its factor content. This shift took place along with the increase in the share of manufactures in South-South trade (Dahi and Demir, 2008). In the 1980s, some studies pointed out that South-South exports tended to contain more capital and skill than exports from the South to the North (e.g., Amsden, 1980; Amsden, 1986; Havrylyshyn, 1985; Klinger, 2009). This phenomenon is conceptualised as the directionality of export (Amsden, 1987). Given that more sophisticated export basket has better growth prospect, South-South exports should have greater developmental effect than South-North exports (Amsden, 1987; Lall, 1987). Thus, what matters for development is not only what a country exports, but also to whom it exports. Since the 1990s, the literature has focused on the technology appropriateness of South-South trade. Technology is context-embedded, instead of context-free. Acemoglu (2002) argues that the development of new technology is biased towards the optimal use of a country's abundant production factor; and thus, new technologies in developed countries, which are labour-scarce, tend to be more skill-biased and labour-saving. Instead, technologies developed in other developing countries, which can be transferred through South-South trade, are more appropriate and cheaper for producers in developing countries (UNIDO, 2006; Fu, Pietrobelli, and Soete, 2011; UNDP, 2013).

During the process of the industrialisation of developing countries' export basket, some countries have increasingly differentiated themselves from the rest of the developing world. In the late 1960s and the 1970s, the first generation of Newly Industrialised Countries (NICs) emerged in East Asia, namely, the Asian Tigers. By the 1990s, these countries had successfully joined the club of developed countries. Since the 1980s, the second generation of NICs has emerged, such as China, Thailand, and South Africa. These countries have formed a new group of emerging countries[3]. This phenomenon has transformed the traditional dichotomous division of the global economic hierarchy with developed countries and developing countries into a new trichotomous hierarchy with developed countries, emerging countries, and developing countries.

The majority of emerging countries differentiate themselves from developing countries in terms of higher income level, higher level of industrialisation, and the dominance of manufactures in exports. Thus, in studying developing countries' industrialisation and trade, it is of critical importance to separate these emerging countries and the Asian Tigers from the conventionally-defined developing countries. Otherwise, analysis of developing countries' manufacturing and trade performance will be subject to an upward bias. This issue has tended to be neglected in the literature, but it will be specifically considered in this thesis by introducing the industrialisation-based country grouping system (UNIDO, 2013) to define

[3] It should be noted that the concept of "emerging countries" in this thesis is established based on industrialisation and export performance rather than business and investment. The latter is usually used outside of the academia (e.g., the FTSE list and the MSCI list) to define the so-called "emerging markets". Section 2.2.2 will provide further discussion on the concept of emerging countries.

country groups. Moreover, considering that emerging countries, particularly China, have become increasingly important trade partners for developing countries, their role in developing countries' industrialisation and development is of great interest.

1.2. Research Questions

Based on the premise that industrialisation and trade are of essential and decisive importance in development process, this thesis is concerned with developing countries' trade performance, especially manufactured exports, and industrialisation. It aims to provide the latest evidence on South-South trade, developing countries' export upgrading, the directionality of developing countries' export sophistication, and trends of developing countries' terms of trade under the new global economic hierarchy. More specifically, it addresses the following four research questions.

Research Question 1: Clarifying the "South-South Trade Illusion"

Conventional approaches towards South-South trade tend to be based on an outdated definition of the Global South, which produces a seemingly delightful picture of South-South trade, say, an "illusion". For one thing, some *de facto* advanced countries (e.g., the Asian Tigers and some former European socialist countries) tend to be included in South-South trade statistics. For another thing, conventional approaches fail to distinguish between developing and emerging countries. By using the UNIDO country classification, Chapter 2 aims to clarify the "South-South trade illusion" from these two aspects and highlight the trade performance of those real developing countries. Moreover, this chapter also provides an analysis of the composition and the trade potential of developing countries' exports at a disaggregated level.

Research Question 2: Determinants of developing countries' export upgrading and

the role of China and productive investment

Since the end of the World War Two, the challenges facing developing countries are not simply to industrialise their export basket, but to continuously upgrade their export basket. Chapter 3 examines what factors contribute to developing countries' export upgrading. In particular, as a response to the recent debate on China's globalisation, a special interest lies in a new hypothesis that developing countries' trade with China may serve as a source of productive investment for their export upgrading. This provides an alternative to view how China has influenced developing countries' industrialisation, besides the conventional arguments of crowding-out and re-primarisation.

Research Question 3: The pattern of the directionality of developing countries' export sophistication and its determinants.

Since the 1980s, economists have observed that developing countries' Southbound exports tend to be more sophisticated than their Northbound exports. However, recent evidence on the directionality of developing countries' export sophistication is quite limited, and existing studies are subject to the inappropriate inclusion of emerging countries and *de facto* advanced countries in the group of developing countries. Chapter 4, therefore, aims to provide the latest evidence on developing countries' export directionality. Firstly, it provides the observation on the directionality of developing countries' export sophistication between 1995 and 2014. Secondly, it examines the determinants of this directionality, say what lead to a country to have more sophisticated Northbound or Southbound exports.

Research Question 4: Recent trends of developing countries' terms of trade vis-à-vis developed countries, emerging countries, and China

The recent rise of emerging countries as new global players has reshaped the global economic hierarchy. Developing countries' trade with emerging countries, in particular China, has experienced disproportionately high growth over the past two decades, especially in primary commodities, known as the commodity boom. This leads to great differences in export composition between developing countries' trade with emerging countries and that with developed countries. Furthermore, developing countries with different patterns of export specialisation have distinct trade performance in the global market. Given that export composition dominantly determines the behaviour of terms of trade, Chapter 5 comparatively examines the recent trends of developing countries' terms of trade *vis-à-vis* developed countries, emerging countries, and China, respectively. This will provide the latest evidence to the Prebisch-Singer hypothesis under the new global economic hierarchy.

1.3. Methodology

This thesis features an empirical and quantitative orientation. Chapter 2 on the "South-South trade illusion" relies on descriptive analysis. Chapter 3 on the determinants of developing countries' export upgrading, measured by export sophistication, uses dynamic linear panel model by System GMM (Blundell and Bond, 1998). The sophistication of a country's export basket is measured by the EXPY index (Hausmann *et al*., 2007), which associates the technological and productive level of a country's export basket with the income level of its exported products. Chapter 4 on the determinants of the directionality of developing countries' export sophistication uses static panel logit model, dynamic panel logit model (Heckman, 1981; Wooldridge, 2005), and dynamic linear panel model (dynamic linear probability model) by System GMM. Chapter 5 uses trend-stationary model, difference-stationary model, and autoregressive model to carry out time series analyses on the recent trends of developing countries' terms of trade.

This thesis uses two sources of export data. The descriptive analysis in Chapter 2 uses UNCTAD data at the level of pre-defined UNIDO country group from 1995 to 2014. Econometric analyses in Chapter 3, 4, and 5 use country-level data from the

BACI database at the Harmonised System (HS) 92 6-digit level, covering 5018 product categories from 1995 to 2014. The BACI database by CEPII adopts an original and unique statistical method to reconcile export and import data reported by around 150 countries in the UN COMTRADE database and expands the data coverage to more than 200 countries (Gaulier and Zignago, 2010). The number of reporting countries varies from the minimum of 212 in 1995 and 1996 to the maximum of 221 in 2013 and 2014. The number of annual observations of bilateral exports (e.g., Kazakhstan's exports in the HS 92 NO. 271012 product category of petroleum oils and oils from bituminous minerals to Germany in 1998) ranges from 4.4 million in 1995 to 7.36 million in 2014.

In order to reflect the trichotomous global economic hierarchy as a result of the rise of emerging countries over the recent two decades and to correct the inappropriate country classification in previous studies, this thesis adopts the 2013 UNIDO country grouping, which uses a country's industrialisation level (Manufacturing Value Added/MVA per capita) as the classification criterion. Based on the UNIDO grouping, the world is divided into (*corresponding UNIDO terminology in bracket*):

a. Developed Countries (*Industrialised Economies*)

b. Emerging Countries (*Emerging Industrial Economies*) and China[4]

c. Developing Countries (*Other Developing Economies* and *Least Developed Countries*).

A telling comparison between the UNIDO country grouping and country groupings in previous studies is that the Asian Tigers and Russian Federation are classified under developed/industrialised countries, rather than developing countries, in the UNIDO grouping. Details of the UNIDO country grouping are provided in Chapter 2. Chapter 2 uses the original UNIDO country grouping, because it uses export data on pre-defined UNIDO country groups from the UNCTAD database rather than

[4] According to the absolute threshold of MVA per capita, China belongs to EIEs, but in the UNIDO statistics China is separately listed due to its size.

country-level data. Chapter 3 also uses the original UNIDO grouping, despite its use of the country-level BACI export data. Chapter 4 and Chapter 5 use a slightly modified version of the UNIDO grouping. The modification is mostly concerned with moving some countries from *Emerging Industrial Economies* to *Industrialised Economies* (i.e., some advanced former European socialist countries, advanced former Soviet Republics, advanced constituent republics of the former Socialist Federal Republic of Yugoslavia, the Southern Cone, and Brunei). Montenegro is moved away from the group of *Other Developing Economies* to *Emerging Industrial Economies*, in order to be consistent with Serbia. Moreover, Angola, Cape Verde, Equatorial Guinea, and Maldives are moved away from the group of *Other Developing Economies* to *Least Developed Countries*, following the original UN definition. This modification is irrelevant to Chapter 3, because Chapter 3 is exclusively concerned with the group of developing countries and China and because it differentiates between different sub-groups within the group of developing countries based on export specialisation pattern rather than development level. Detailed explanations for this modification are documented in Appendix A of Chapter 4.

1.4. Theoretical Views

This section discusses the theoretical standpoint of this thesis and its position in the development economics literature. A question lying in the very core of research on development is "what development is". This question may seem to be too fundamental or philosophical to be part of the consideration in studies of specific development issues, either theoretical or empirical. However, this does not imply that it is not an important question, because the perception of "what development is" determines the direction of both theoretical and empirical research of development economics. Since the late 1960s, there has been a paradigm shift in the perception of development. Prior to that, classical development theories in the 1940s and the 1950s, which are represented by modernisation theory (e.g., the stage theory and the big push theory), equated development with the increase in industrial output and treated industrialisation to be synonymous with development. On the left side of the political spectrum, radical political economy represented by the structuralist school and dependency theory further consider industrialisation as the only way of upward mobility in the global division of labour. However, since then, the industrialisation-centred orthodoxy has been challenged by those who define development as improvement in the satisfaction of the basic needs of human being, such as education, nutrition, health, and environment, which is the modern variant of the so-called "neo-populism" or the "basic needs" approach in development theory (ILO, 1977; Streeten and Burki, 1978; Kitching, 1982; Kiely, 1998; Nielsen, 2011). This echoes the humanist perspective in the philosophical terms, represented by Aristotle in ancient times and Amartya Sen and his capability approach in the recent economic literature (Phelps, 2008). Practically, this shift has induced the emergence of a new strand of measures on development, represented by the Human Development Index, which contradicts the classical view on the relationship between industrialisation/growth and development (Kiely, 1998).

The paradigm shift in the conceptualisation of development in development theory has its counterpart in development economics, in the conceptual and analytical terms[5]. Since the late 1970s, the neoclassical paradigm shift in development economics has replaced the industrialisation-centred and developmentalist classical development economics by laissez faire, production homogeneity, and trade regime neutrality. The attention of mainstream development economic research has been redirected to "tiny" but analytically and technically sophisticated issues (Skarstein, 1997). Holistic and historical approaches towards underdevelopment problems have

[5] Admittedly, the "basic needs" approach features some major differences in comparison with orthodox neoclassical economics (e.g., challenging the use of utility as the measure of welfare). However, it shares fundamental similarity with neoclassical economics in terms of analytical framework (e.g., individualistic rather than holistic view and, thus, emphasis on consumption, exchange, and allocative efficiency rather than production and employment).

largely disappeared. Mainstream development economists tend to biasedly emphasise issues at the micro and individualistic level (e.g., poverty, health, nutrition, migration, and education), but ignore the social and historical background underlying underdevelopment and the importance of production and structural issues. As pointed out by Amin (1974, p. 6):

Current university economics......forbids itself from the outset to raise the question of the dynamic of systems (the transformation of structures)......calling it for a matter of historians.

As a result, mainstream development practice based on the individualistic approach has led to the so-called "Grass Root War on Poverty", which relies on "grass-root" poverty alleviation measures under the spirit of the capability approach, such as microfinance (Amsden, 2010 and 2012). This approach pins its anti-poverty hope on the supply of well-endowed individuals in terms of education, health, finance, and so on, all of which reside in the consumption side. The underlying rationale is Say's Law that supply automatically creates its own demand. However, it neglects that the fundamental cause of poverty falls within the demand side, say, the lack of jobs, especially productive jobs. The creation of (productive) jobs can be realised only through structural transformation from agriculture to manufacturing, which requires investment and industrial policy. Therefore, the spotlight has returned to industrialisation and production upgrading.

By definition, the concerns on the human aspects of development held by the basic needs-based development theorists are by no means wrong. However, what they neglect, intentionally or unintentionally, is that in order to make the cake tastier and to distribute it more equally, the first thing is to produce it and make it bigger and bigger. Without enough material basis, it does not make much sense to talk about human needs. In other words, what is essential is growth. As pointed by Kitching (1982), industrialisation is the most effective way to achieve growth and development because sustainable development needs technological progress and sectoral linkages, which are mostly generated by manufacturing sectors. By contrast, service and agriculture generate few backward and forward linkages in the sense of Albert Hirschman's linkage theory. Just as those new development theorists' bias in favour of how to distribute the "cake" and their neglect of how to make the "cake" bigger, mainstream economists have a bias in favour of how to allocate production factors and a neglect of how to produce them. Baer (1972) sharply points out that most energies of economists, including those focusing on developing countries, have been devoted to studying how to efficiently allocate production factors, and economists have hardly paid attention to how to make these production factors. For developing countries, it is safe to say that how to make production factors is more important than how to allocate them. With the example of the Latin American import substitution industrialisation (ISI), Baer (1972) argues that inefficiencies generated by the market-unfriendly ISI model indeed led to some negative outcomes in short term, but the long-term development effects brought about by import substitution industrialisation outweigh those short-term problems. On the contrary, ILO's neo-populist development strategy in the 1970s, as a counterexample to the ISI model, refused to sacrifice short-term static efficiency (e.g., creating employment through developing labour-intensive industry) for long-term dynamic efficiency through developing capital- and technology-intensive industry (Kiely, 1998). Amsden (1997) also criticises the bias of neoclassical economics in favour of "exchange" and its neglect of "production". Attentions have been exclusively paid to how to "get the prices right" rather than how to make production expand. For instance, new institutionalism ascribes problems of growth to high transaction costs and neglects production costs; and international trade studies focus on relative exchange prices between domestic and foreign markets and neglect how to generate production capacity based on which goods traded on domestic and foreign markets are produced. All in all, what neoclassical (development) economics pursues is an "allocative efficiency" on the exchange side rather than efficiency on the technical and productive side as emphasised in classical development economics (Nayyar, 2003).

What underlies the industrialisation-centred development economics is a sectoral approach towards development process: development is driven by those dynamic sectors, mostly manufacturing (Thirlwall, 2003). This is a vision of production heterogeneity. Marshallian externalities justify the superiority of specialising in manufacturing over specialising in others (Lederman and Maloney, 2012). In particular, manufacturing as the driving force of research and development spreads knowledge and technology to the rest of the economy through its strong forward and backward linkages (Cornwall, 1977; Kaplinsky, 2008; Lavopa and Szirmai, 2012). Thus, what matters is growth pattern or sectoral composition rather than simply growth rate (Singer, 1998). By contrast, neoclassical economics holds a production-homogeneity vision on development, assuming that all production activities have homogenous effects on growth and development. It ignores the difference between dynamic sectors (e.g., manufacturing) and static sectors (e.g., agriculture and mining). In the words of Amsden (1987), this is a "commodity blindness".

Consequently, since the late 1970s, comparative advantages have been enshrined again as a guidance to developing countries. Without the need of state intervention and industrial development, developing countries can achieve development by simply following the predetermined world labour division and export primary commodities and labour-intensive manufactures. In this regard, neoclassical economics excludes the space for late industrialisation. Put it differently, the conflict between the classical sectoral/production-heterogeneity approach and the neoclassical production-homogeneity approach is a conflict between (dynamic) technical efficiency and (static) allocative efficiency. The neoclassical production-homogeneity approach highlights the maximisation of a country's allocative efficiency with respect to the world-level resource endowment, which inevitably leaves developing countries at the bottom of the global labour division as exporters of primary commodities and standardised manufactures. Allocative efficiency of resource or endowment thus lies in the core of gains from trade in the neoclassical perspective. By contrast, the classical sectoral/production-heterogeneity approach emphasises developing countries' gains of technical efficiency generated by learning by doing and spillovers from dynamic sectors. As argued by Nayyar (1997), neoclassical economics biasedly emphasises allocative efficiency and has a "conspicuous silence" on technical efficiency.

Fundamentally speaking, the neoclassical approach towards development is established on the premise that there is equal and perfect competition between developing and developed countries on the global scale. The implicit, built-in logic is that countries are differentiated, rather than hierarchically stratified, within the global division of labour. That is to say, development can be realised through exercising endowed comparative advantages, no matter what they are, rather than upgrading to more sophisticated and value-added production. However, as emphasised by the structuralist school and the world-system theory, the world economy features structural inequality and different country groups' positions in the global labour division are not just differentiated, but, more importantly, hierarchically stratified based on each country group's abilities to appropriate the surplus they produce (Evans, 1979). Production, technology, and infrastructure concentrate in the Global North, which results in barriers to entry and unequal competition faced by developing countries in both global and domestic market (Kiely, 1998). In particular, since the end of the World War Two, the determination of prices in the global market has featured a neo-Schumpeterian type, and thus the capabilities of capturing the rents from innovation determine a country's competitiveness and power (Singer, 1975; Kaplinsky, 2006). The highly uneven global distribution of innovation implies the absolute advantages of developed countries over developing countries. As a result, in a structurally unequal world system, the neoclassical approach based on allocative efficiency, laisser-faire, and trade regime neutrality will not lead to global convergence but divergence. This global structural inequality implies that development can be realised only through upward mobility in the global division of labour and a certain level of state intervention is a must[6].

Recently, the industrialisation-centred development paradigm, also known as pro-manufacturing vision, has regained attention, especially since the financial crisis. This is a worldwide "manufacturing renaissance" (Andreoni and Gregory, 2013). Amongst others, Szirmai (2010) and Szirmai and Verspagen (2015) find that manufacturing is still the primary contributor to economic growth. In the recent literature on manufacturing development and structural transformation, export composition has become a spotlight. Some measures on the technological level of a country's exports have been developed (e.g., *EXPY* and *Product Space*) and have been increasingly used to examine developing countries' export composition and growth potential. A core argument of the recent literature is that a country will become what it produces and exports (Hausmann *et al.*, 2007). The dynamic feature of manufacturing suggested in the early development literature now shows its relevance again, and developing countries are suggested to actively upgrade their export and economic structure, instead of strictly following comparative advantages. Higher export sophistication, mostly implying more manufactured exports, has been found to be robustly associated with higher economic growth. What underlies the growth-enhancing effect of manufactured exports is not only manufactured products' higher value added, but also externalities generated by manufacturing *per se*, such as learning by doing, spillovers, and linkages. In order to obtain these externalities, deviation from policy neutrality is necessary. Otherwise, market forces

[6] Although industrialisation is at the core of policy implications of the leftist radical political economy, it is also emphasised by politically rightist or central-rightist schools, such as modernisation theory (Kiely, 1998). Therefore, it should be avoided to generate an illusion that industrialsiation is the "patent" of the left.

have a tendency to induce developing countries to specialise in sectors without sufficient externalities, due to the uneven distribution of productivity, technology, and power between developed and developing countries (Amsden, 1994; Kiely, 1998; Harrison and Rodríguez-Clare, 2010). A telling example is the production downgrading in Latin America and Sub-Saharan Africa after the shift in development paradigm from the state-led import substitution industrialisation to the market-led liberalisation. This justifies the role of industrial policy and state intervention in promoting manufacturing, which echoes the statement of classical development economists and goes against the neoclassical "trade regime neutrality".

The economic literature emphasises industrialisation as a sustainable source to increase productivity and welfare, but its role in development is not confined within the economic sphere. Wield, Johnson, and Hewitt (1992) define industrialisation in three ways, as the production of materials without directly involving land, as economic sectors of manufacturing and mining, and finally as a particular way to organise production that is associated with technological and social changes. While the first two definitions concern the technical and economic aspects of industrialisation, the third one highlights its social aspect. The social relevance of industrialisation entails two issues, say how industrialisation is socially determined and how industrialisation socially matters.

In order to answer these two questions, we should go beyond the economistic or technical approach towards industrialisation. That is to say, industrialisation should be considered as not only a technical or economic process but also a social process. In this sense, industrialisation and the associated technological changes are not neutral, as implied by the technical determinism, but are embedded in particular social and political contexts, which are established in historical process. Classical political economy and classical development theories recognise the role of social change and state intervention (e.g., the role of businessmen in the Smithian political economy, changes in social attitudes and structure in Rostow's stage theory, and the state's initial push in the big push model), but their analytics are focused on the technical and economic side of industrial development (e.g., structural change, employment, investment, and consumption), rather than the social and political side. More importantly, classical political economy and classical development theories implicitly assume the ex-ante existence of conditions for industrial development, such as investment and agricultural development. But this assumption may not hold, as particular political and social contexts have to be in place for such conditions to be established. This entails the role of agents in inaugurating industrialisation. Kiely (1998) proposes an agent-centred approach towards examining the determinants of industrialisation, focusing on the interests and motivations of social and political agents (e.g., entrepreneurs and the state) who inaugurate and sustain the actual process of industrialisation. The conditions for industrial development to be realised (e.g., investment, economies of scale, and work organisation) are not primarily technical or economic issues. Rather, they are largely the products of agents' decisions and motivations which are embedded in particular social and political contexts.

The social and political basis of industrialisation justifies the positive role of the state in late industrialisation, because, for late industrialisers, free market economy might not always be the condition for industrialisation to start and develop. Rather, free market economy might be the outcome of industrial development and the associated overall economic growth. The Asian Tiger's transition from oligopoly led by developmental state in the 1960s and the 1970s to free market economy since the 1980s offers perfect evidence. In particular, the state-business relation is an important aspect in implementing industrial policy and balancing short-term sacrifice and long-term efficiency. A principle is that the state should develop and maintain effective control of and intervention in the economy, especially in an autonomous way, and appropriately manage and coordinate interests of different social groups (Seddon and Belton-Jones, 1995). The state-business relations in the Asian Tigers demonstrate this principle, in contrast to the cases of South Asia and Latin America where weak industrial capitalists are constrained by the close relations between the state and landowning class (Kiely, 1998). However, as suggested by Kiely (1998), the Asian Tiger's experience cannot be transplanted to other countries, because of the special social, political, and historical contexts (e.g., the successful land reform). Therefore, the problem has returned to the aforementioned argument that agents' powers and roles and their social embeddedness should be the primary concern for research on industrialisation.

The second issue is how industrialisation influences the society. As argued by Kuznets (1973), changes in economic structure induce changes in a wide range of aspects of a society, such as mentality, mind-set, forms of family, and mode of life. This argument echoes the essence of the Marxist historical materialism that a given social formation is determined by the underlying material basis, say, productive forces and relations of production. Accordingly, industrial production has its resulting and compatible social form, which is different from that generated by agrarian production. In the UNIDO Constitution, industrialisation is defined as "a dynamic instrument of growth essential to rapid economic and social development" and "a multi-dimensional task". Industrialisation is a way to organise production, which is associated with continuous technological, organisational, and social changes and expansion of a society's production capacities (Hewitt, 1992; Pasinetti, 2007). The operation of modern manufacturing requires disciplined and responsible labourers, which are lacking in agrarian society. It is industrialisation that can transform poorly-organised and slack agricultural labour force into disciplined and responsible industrial labour force (Swianiewicz, 1965). Importantly, people's mind-set and behaviour undergo a modernisation during this industrialisation process as well. Thus, industrialisation can be regarded as a driver of social changes to address the social and cultural backwardness underlying underdevelopment. The transformation of Central Asia from a typical underdeveloped and agrarian/nomadic society into a relatively industrialised and modern society during the Soviet era provides an example of the social effect of industrialisation, which is systematically documented in the book *The Soviet Model and Underdevelopment* (Wilber, 1969).

Industrialisation can also generate social development in terms of political economy. Johnson *et al*. (2010) propose a possibility that industrialisation or, more specifically speaking, manufactured export benefits a society by creating and enlarging the middle class who has the strongest incentive to modernise institutions and politics and by adjusting the distribution of political power. Here, the role played by industrialisation lies in its enhancing effects on living standards. For developing countries, the pre-condition for the emergence and development of democracy is that the majority of the population should be politically and intellectually conscious, which has to be established on a certain level of material conditions (Kiely, 1998). Industrialisation is the most effective and efficient, if not the only, way to achieve this goal.

1.5. Organisation of Thesis

This thesis is organised in line with the aforementioned four research questions. Chapter 2 clarifies the "South-South trade illusion" and analyses the composition and the trade potential of developing countries' exports. Moreover, this chapter aims at providing a general picture of developing countries' trade, and thus its organisation is somewhat different from a standard quantitative paper and slightly resembles a report. Some findings on developing countries' trade in this chapter also serve as empirical basis for some discussions and arguments in the following chapters. Chapter 3 examines the determinants of developing countries' export upgrading with a particular interest in the role of productive investment and China.

Chapter 4 deals with the pattern and determinants of the directionality of developing countries' export sophistication. Chapter 5 examines the recent trends of developing countries' terms of trade *vis-à-vis* developed countries, emerging countries, and China. Chapter 6 concludes this thesis.

1.6. Conclusion

This thesis aims at providing the latest evidence on the mechanism and determinants of developing countries' trade and industrialisation, centring on South-South trade, export upgrading, export directionality, and terms of trade. Each of the four topics is addressed in one of the four chapters from Chapter 2 to Chapter 5. The descriptive analysis in Chapter 2 clearly demonstrates that the delightful picture of South-South trade highlighted in the literature is actually an "illusion", which is a result of inappropriate country classification. More importantly, it is an illusion of not only the size of South-South trade, but also the technological and manufacturing capabilities of the so-called "Global South". The illusion has two sources. First, the inclusion of *de facto* advanced countries (e.g., the Asian Tigers and advanced former European socialist countries) in the group of developing countries strongly inflates the size of South-South trade by more than doubling it. This inflation effect particularly comes from the strong performance of the Asian Tigers in skill- and technology-intensive manufactured exports. The second source of the illusion is the inclusion of emerging countries, especially China, in South-South trade statistics. If South-South trade is defined exclusively as trade between real developing countries, then its size becomes quite small. This chapter also analyses the composition and the trade potential of developing countries' exports. It highlights the great difference in composition between developing countries' exports to developed countries and those to emerging countries. While manufactures take a major share in the former, they only account for a minor share in the latter. Moreover, developed and emerging countries show high trade complementarity with developing countries, whereas developing countries' trade complementarity with developed and emerging countries is low. In other words, the needs of developing countries for the rest of the world are larger than the needs of the rest of the world for developing countries, which implies the disadvantageous and inferior position of developing countries in the world economy.

Chapter 3 examines determinants of developing countries' export upgrading. Amongst general factors, this chapter highlights the role of access to sea, human capital, productive investment, and trade openness. Landlocked countries are doomed to be at a disadvantageous position of export upgrading, a "curse of geography". On the other hand, efforts in improving human capital, accumulating productive investment, and promoting openness are definite ways to stimulate export upgrading. Particularly, the influence of motivations of political and social agents for industrialisation, which is the social determinant of export upgrading, is captured by the great and robust positive effect of productive investment. Higher productive investment reflects greater motivations of political and social agents to promote industrial production, either for economic profits or for political benefits. This finding also reflects the influence on export upgrading of endemic political-economic embeddedness that shapes the motivations of various agents, which echoes the centrality of strong and developmentally-oriented elites in the developmentalist model of industrialisation and development (Leftwich, 1995). Moreover, developing countries' absolute gains from trade with China, reflected by significant improvement in their income terms of trade *vis-à-vis* China, promote their export upgrading. The absolute gains are a result of the commodity boom, great growth in the volume of developing countries' exports to China, and cheap manufactures from China. Mediation analysis shows that this export-upgrading effect largely works through the role of trade with China in enhancing developing countries' productive investment. This effect is stronger and more robust in the period of 2002-2014 than 1995-2014, which is consistent with the growing role of

China in the global economy since the early 2000s, especially China's commodity boom and its strong performance in manufactured exports. This finding provides an alternative perspective to view the influence of China on developing countries' industrialisation through the role of trade with China as a source of productive investment. It suggests that, for developing countries, China serves more as a stimulator of capital accumulation than a competitor in manufacturing market or a predator of natural resources. Therefore, the priority for developing countries is the appropriate use of gains from trade for productive purpose.

Chapter 4 presents the evidence of the directionality of developing countries' export sophistication and examines the determinants of this directionality. It shows that, between 1995 and 2014, more than half of developing countries tended to have more sophisticated Southbound exports than Northbound exports on average, and the opposite is true for the others. A country's productive capabilities are found to be a major and robust determinant of the directionality of its export sophistication. Developing countries that have higher productive capabilities are less likely to have more sophisticated Southbound exports than Northbound exports, whereas the reverse is true for those with lower productive capabilities. This finding may be explained by the technological and productive gap between exporting country and importing country. Productively more advanced developing countries are able to export relatively sophisticated products to the more competitive market of developed and emerging countries and/or enter the downstream value chains. Those with lower productive capabilities are not able to enter developed and developing countries' markets and/or the downstream value chains with their relatively sophisticated products, if any. Instead, they have to export less sophisticated products to these markets, and markets of other developing countries are an outlet for their relatively sophisticated products. In this sense, the conventional argument that South-South trade is more beneficial to developing countries than North-South trade should be treated conditionally, because, for those productively more advanced developing countries, Northbound exports tend to be more sophisticated. Another important contributor to the directionality of export sophistication is distance.

Finally, Chapter 5 examines the recent trends of developing countries' terms of trade, which provides the latest evidence to the Prebisch-Singer hypothesis under the new global economic hierarchy. It shows significant differences between developing countries' terms of trade *vis-à-vis* developed countries and *vis-à-vis* China and other emerging countries on the one hand, and differences between terms of trade of different groups of developing countries on the other. Developing countries' net barter terms of trade *vis-à-vis* developed countries tends to show significant positive trends, which is stronger for those specialising in fuels or minerals and weaker for those specialising in agricultural products or manufactures. This trend may be explained by the large share of manufactures in developing countries' exports to developed countries, developed countries' diverse demand for primary commodities from developing countries, and the commodity boom led by emerging countries. This improvement, however, is likely to be a period-specific phenomenon. Importantly, it may not intrinsically contradict the core of the Prebisch-Singer hypothesis, which lies in factoral terms of trade rather than simply net barter terms of trade. Given the great and persistent gap in productivity between developed and developing countries, the delightful picture drew from the positive trends of net barter terms of trade is likely to be weakened or even reversed.

On the other hand, developing countries' net barter terms of trade *vis-à-vis* China tends to show negative or trendless behaviour, except those specialising in fuels. This finding may be explained by three factors: the concentration of China's fast-growing demand on fuels and metals, cheap manufactured exports from China, and the marginalisation of manufactures in developing countries' exports to China. Developing countries specialising in "soft commodities" (e.g., agricultural products), rather than "hard commodities" (e.g., fuels and minerals), tend not to benefit from China's commodity boom, at least in relative terms. Furthermore, developing countries specialising in manufactures have experienced the greatest deterioration in their net barter terms of trade *vis-à-vis* China. This phenomenon indicates these countries' relatively disadvantageous position in the trade relationship with China, because they may directly compete with China in manufactures and tend not to benefit from China's commodity boom. However, developing countries' income terms of trade *vis-à-vis* China shows great positive trends due to great growth in export volume, regardless of export specialisation. This is a signal of their absolute gains from trade with China. Developing countries' net barter terms of trade *vis-à-vis* other emerging countries shares a similar unfavourable situation with that *vis-à-vis* China, but to a lesser extent. In brief, on a global scale, developing countries specialising in agricultural products or manufactures are at a much weaker position in the current global market than those specialising in fuels or minerals, in terms of the distribution of gains from trade.

Improvement in income terms of trade as a result of trade growth, however, tends not to lead to global (North-South) convergence or effectively mitigate the unequal structure of the world economy, because developed and emerging countries have comparable improvement as well. As a result, developing countries have to mobilise more resources to maintain the favourable income terms of trade, which may impede their domestic investment and consumption. This points to the necessity for developing countries to upgrade production structure through industrialisation, if they want to climb to a more favourable position in the global division of labour. However, although absolute gains from trade due to trade growth cannot lead to global convergence, they provide a kind of material condition for developing countries to industrialise. As found in Chapter 3, absolute gains from trade promote export upgrading through their enhancing effects on productive investment. Therefore, the challenge faced by developing countries is whether and how they can channel these gains to productive investment. How can this be realised? With both external constraints on a global scale and the lack of a development-conducive social and political context, developmentally-oriented elites (e.g., developmental states and entrepreneurs) should be in place to promote industrialisation. However, do developing countries have endogenous mechanism to generate such groups of social and political agents? This question relates to the political economy of social embeddedness. It may be a good point of reference for future research on the social, rather than the economistic or technical, determinants of industrialisation.

References

Acemoglu, D. (2002). Directed technical change. *The Review of Economic Studies*, *69*(4), 781-809.

Ajakaiye, O., & Page, J. (2012). Industrialisation and Economic Transformation in Africa: Introduction and Overview. *Journal of African Economies*, *21*(suppl_2), 3-18.

Amin, S. (1974). *Accumulation on a world scale*. Monthly Review Press.

Amsden, A. H. (1980). The Industry Characteristics of Intra-Third World Trade in Manufactures. *Economic Development and Cultural Change*, *29*(1), 1-19.

Amsden, A. H. (1986). The direction of trade—past and present—and the 'learning effects' of exports to different directions. *Journal of Development Economics*, *23*(2), 249-274.

Amsden, A. H. (1987). The directionality of trade: historical perspective and overview. In Exports of developing countries: how direction affects performance. World Bank Conference South-South versus South-North Trade (No. PROG IV-E71 H388). Banco Mundial, Washington, DC.

Amsden, A. H. (1994). Why isn't the whole world experimenting with the East Asian model to develop?: Review of the East Asian miracle. *World Development*, *22*(4), 627-633.

Amsden, A. H. (1997). Bringing production back in—Understanding Government's economic role in late industrialization. *World Development*, *25*(4), 469-480.

Amsden, A. H. (2010). Say's law, poverty persistence, and employment neglect. *Journal of Human Development and Capabilities*, *11*(1), 57-66.

Amsden, A. H. (2012). Grass roots war on poverty. *World Social and Economic Review*, *2012*(1, 2012), 114.

Andreoni, A. (2013). The Industrial Competitiveness of Nations-Looking back, forging ahead.

Andreoni, A., & Gregory, M. (2013). Why and how does manufacturing still matter: Old rationales, new realities. *Revue d'économie industrielle*, (144), 21-57.

Baer, W. (1972). Import substitution and industrialization in Latin America: experiences and interpretations. *Latin American Research Review*, *7*(1), 95-122.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, *87*(1), 115-143.

Chang, H. J. (2003). Trade and industrial policy issues. *Rethinking development economics*, *1*, 257-276.

Cimoli, M., Fleitas, S., & Porcile, G. (2013). Technological intensity of the export structure and the real exchange rate. *Economics of Innovation and New Technology*, *22*(4), 353-372.

Cornwall, J. (1977). *Modern capitalism: its growth and transformation*. Martin Robertson.

Evans, P. (1979). Beyond center and periphery: A comment on the contribution of the world system approach to the study of development. *Sociological Inquiry*, *49*(4), 15-20.

Fu, X., Pietrobelli, C., & Soete, L. (2011). The role of foreign technology and indigenous innovation in the emerging economies: technological change and catching-up. *World Development*, *39*(7), 1204-1212.

Gaulier, G., & Zignago, S. (2010). BACI: international trade database at the product-level (the 1994-2007 version).

Harrison, A., & Rodríguez-Clare, A. (2010). Trade, foreign investment, and industrial policy for developing countries. In *Handbook of Development Economics* (Vol. 5, pp. 4039-4214). Elsevier.

Hausmann, R., Hwang, J., & Rodrik, D. (2007). What you export matters. *Journal of Economic Growth*, *12*(1), 1-25.

Havrylyshyn, O., & Wolf, M. (1987). What have we learned about South-South trade?. *Exports of developing countries: How direction affects performance*.

Heckman, J. J. (1981). The Incidental Parameters Problem and the Problem of Initial Conditions in Estimating a Discrete Time-Discrete Data Stochastic Process, in Charles F. Manski and Daniel McFadden, eds., *Structural analysis of discrete data with econometric applications*. *MIT Press, Cambridge, MA*, 179-195.

Hewitt, T. (1992). Brazilian industrialisation. *Industrialisation and Development*.

Wield, D., Johnson, H., & Hewitt, T. (Eds.). *Industrialization and Development*. Oxford: Oxford University Press.

International Labour Office. (1977). Employment, Growth and Basic Needs: A One-world Problem: The International 'Basic-Needs Strategy' Against Chronic Poverty Prepared by the ILO International Labour Office, and the Decisions of the 1976 World Employment Conference. Praeger for the Overseas Development Council.

Johnson, S., Ostry, J. D., & Subramanian, A. (2010). Prospects for sustained growth in Africa: benchmarking the constraints. *IMF Staff Papers*, *57*(1), 119-171.

Kaplinsky, R., & Santos-Paulino, A. (2005). Innovation and competitiveness: trends in unit prices in global trade. *Oxford Development Studies*, *33*(3-4), 333-355.

Kaplinsky, R. (2006). Revisiting the revisited terms of trade: will China make a difference?. *World Development*, *34*(6), 981-995.

Kaplinsky, R. (2009). China and the terms of trade: The challenge to development strategy in Sub-Saharan Africa. In *Global Giant* (pp. 115-134). Palgrave Macmillan, New York.

Kaldor, N. (2007). *Causes of growth and stagnation in the world economy*. Cambridge University Press.

Kiely, R. (1998). *Industrialization and Development: An Introduction*. Taylor & Francis Limited.

Kitching, G. (1982). *Development and Underdevelopment in Historical Perspective*. (Milton Keynes).

Lall, S. (1987). India’s economic relations with the South. *Exports of developing countries: How direction affects performance*.

Lall, S., Weiss, J., & Zhang, J. (2006). The "sophistication" of exports: a new trade measure. *World Development*, *34*(2), 222-237.

Lavopa, A., & Szirmai, A. (2012). Manufacturing growth, manufacturing exports and economic development, 1960-2010. In *14th ISS Conference, Brisbane, Australia*.

Lederman, D., & Maloney, W. (2012). *Does what you export matter? In search of empirical guidance for industrial policies*. The World Bank.

Leftwich, A. (1995). Bringing politics back in: Towards a model of the developmental state. *The Journal of Development Studies*, *31*(3), 400-427.

Love, J. L. (2005). The rise and fall of structuralism. *Economic Doctrines in Latin America*, 157-181.

Maizels, A., Berge, K., Crowe, T., & Palaskas, T. B. (2000). The manufactures terms of trade of developing countries with the United States, 1981-97. *Documento de trabajo*, *36*.

Mayer, J. (2002). The fallacy of composition: a review of the literature. *World Economy*, *25*(6), 875-894.

Milberg, W., & Winkler, D. (2011). Economic and social upgrading in global production networks: Problems of theory and measurement. *International Labour Review*, *150*(3-4), 341-365.

Nayyar, D. (Ed.). (1997). *Trade and Industrialization*. Oxford University Press, USA.

Nayyar, D. (2003). Globalization and development. *Rethinking Development Economics*, *1*, 61.

Nielsen, L. (2011). Classifications of Countries Based on Their Level of Development: How it is Done and How It Could be Done [Electronic resource]. IMF Working Paper.

Ocampo, J. A. (2003). Development and the global order. *Rethinking Development Economics*, *1*, 83-104.

Ocampo, J. A., & Ros, J. (Eds.). (2011). *The Oxford Handbook of Latin American Economics*. Oxford University Press.

Pacheco-López, P., & Thirlwall, A. P. (2013). *A New Interpretation of Kaldor's First Growth Law for Open Developing Countries* (No. 1312). School of Economics Discussion Papers.

Pack, H., & Westphal, L. E. (1986). Industrial strategy and technological change: theory versus reality. *Journal of Development Economics*, *22*(1), 87-128.

Page, J. (2010). Should Africa Industrialize?.

Page, J. (2012). Can Africa industrialise?. *Journal of African Economies*, *21*(suppl_2), 86-124.

Pasinetti, L. L. (2007). *Keynes and the Cambridge Keynesians: A 'Revolution in Economics' to be Accomplished*. Cambridge University Press.

Phelps, E. S. (2008). The Good Life and the Good Economy: The Humanist Perspective of Aristotle, the Pragmatists and Vitalists, and the Economic Justice of John Rawls.

Razmi, A., & Blecker, R. A. (2008). Developing country exports of manufactures: moving up the ladder to escape the fallacy of composition?. *The Journal of Development Studies*, *44*(1), 21-48.

Sapsford, D., & Singer, H. W. (1998). The IMF, the World Bank and commodity prices: A case of shifting sands?. *World Development*, *26*(9), 1653–1660. 1-19.

Sarkar, P., & Singer, H. W. (1991). Manufactured exports of developing countries and their terms of trade since 1965. *World Development*, *19*(4), 333-340.

Singer, H. W. (1975). The distribution of gains revisited. In *The strategy of international development* (pp. 58-66). Palgrave Macmillan, London.

Singer, H. W. (1998). *Growth, Development and Trade*. Edward Elgar Publishing.

Skarstein, R. (1997). *Development theory: A guide to some unfashionable perspectives*. Oxford University Press, USA.

Streeten, P., & Burki, S. J. (1978). Basic needs: some issues. *World Development*, *6*(3), 411-421.

Swianiewicz, S. (1965). Forced labour and economic development. An enquiry into the experience of Soviet industrialization.

Szirmai, A. (2012). Industrialisation as an engine of growth in developing countries, 1950-2005. *Structural Change and Economic Dynamics*, *23*(4), 406-420.

Szirmai, A., & Verspagen, B. (2015). Manufacturing and economic growth in developing countries, 1950–2005. *Structural Change and Economic Dynamics*, *34*, 46-59.

Thirlwall, A. P. (2003). *The nature of economic growth: an alternative framework for understanding the performance of nations*. Edward Elgar Publishing.

Toye, J. (2003). Changing perspectives in development economics. *Rethinking Development Economics*, *1*, 21-40.

UNDP. (2013). Human Development Report 2013. The rise of the South: Human progress in a diverse world. New York: United Nations.

UNIDO (2006). Industrial development, trade and poverty reduction through South-South cooperation. Vienna: United Nations.

UNIDO (2013). Country grouping in UNIDO statistics. Vienna: United Nations.

Villoria, N. B. (2009). China and the manufacturing terms-of-trade of African exporters. *Journal of African Economies*, *18*(5), 781-823.

Wade, R. (2015). Living where you don't make the rules: Development in Palestine-one of the world's last colonies. *International Development*.

Wilber, C. (1969). The Soviet Model and Underdevelopment.

World Bank. (1993). The East Asian Miracle: Economic Growth and Public Policy. Oxford: Oxford University Press.

Wooldridge, J. M. (2005). Simple solutions to the initial conditions problem in dynamic, nonlinear panel data models with unobserved heterogeneity. *Journal of Applied Econometrics*, *20*(1), 39-54.

Chapter 2. The Size, Growth, and Composition of Developing Countries' Exports

2.1. Introduction

The rapid growth of South-South trade has been highlighted in the recent literature, serving as an opportunity for the Global South to realise development. However, the existing studies have tended to neglect a seemingly easy but always neglected issue that is which countries should be classified under the Global South and then included in South-South trade statistics. In the South-South trade literature, there is a tendency to treat the world in a dichotomous way as a North, which represents developed countries, and a South, which represents the rest of the world. Accordingly, South-South trade is naturally defined as trade between countries in this "rest of the world". This dichotomous approach, however, has become problematic since the 1990s, because several countries in this "rest of the world" have joined the club of developed countries (e.g., the Asian Tigers) and some emerging countries (e.g., China and Thailand) have increasingly differentiated themselves from other countries in the broad-sense Global South. That is to say, the so-called "rest of the world" is no longer homogenous. Instead, it comprises several largely, if not completely, distinct country groups. In this regard, defining South-South trade based on the commonly-used but problematic definition of the Global South certainly leads to misleading and distorted conclusions on trade performance of those real developing countries.

Considering this problem, this chapter aims at providing an alternative picture of the so-called "South-South trade" by means of alternative definition of the Global South and South-South trade that better reflects the growingly divergent development trajectories. To this end, this chapter introduces the industrialisation-based country grouping system by UNIDO (2013) and then divides the world into the North (developed countries), the Emerging South (emerging countries), and the Developing South (developing countries)[7]. The Emerging South and the Developing South constitute the "broad-sense" Global South, which basically corresponds to the definition of the South in the existing literature, except that *de facto* advanced countries (e.g., the Asian Tigers) are excluded.

Some previous studies have been conscious of the fact that those fast-growing emerging countries or richer developing countries have dominated the growth of South-South trade (e.g., Kowalski and Shepherd, 2006; UNCTAD, 2008; Dutt, 2012). However, those *de facto* developed countries (e.g., the Asian Tigers) have still tended to be classified under emerging countries or richer developing countries. For one thing, this is a conceptual inappropriateness of country grouping. For another thing, it is thus unclear whether and to what extent the exaggeration of South-South trade is contributed by *de facto* developed countries or emerging countries. This chapter, instead, defines these countries under developed countries, say the Global North. In this chapter, South-South trade is defined in various ways based on different definitions of the Global South. The particular interest is given to trade between countries in the Developing South, which is defined as the poorer half of the broad-sense Global South. Moreover, this chapter also considers South-South trade in different product categories (e.g., primary commodities and manufactures). This treatment is important, as those *de facto* developed countries and emerging countries, which lead to the rapid growth of South-South trade highlighted in the literature, tend to be big players in manufactures but not primary commodities.

The contrast between the traditionally-defined South-South trade and the alternatively-defined South-South trade sharply points out how the inappropriate

[7] In this thesis, the Emerging South and the Developing South are synonymous with emerging countries and developing countries, respectively. In order to better demonstrate South-South trade under different definitions, this chapter uses the terms of "the Emerging South" and "the Developing South". The following chapters, instead, use the terms of "emerging countries" and "developing countries".

inclusion of some *de facto* advanced and emerging countries in South-South trade statistics generates an "illusion" of a fast-growing South-South trade, especially in manufactured trade. In this sense, there is an illusion of not only the size and growth of South-South trade but also the technological and manufacturing capabilities of those real developing countries. Furthermore, this chapter highlights the marginalisation of the Developing South and the dominance of China in the broad-sense South-South trade, which is defined as trade within the broad-sense Global South.

Having drawn a holistic picture of the size and growth of South-South trade, another concern falls in the composition of exports from the Developing South and its changes in the recent two decades. This chapter shows that the composition of the Developing South's exports varies across different destinations. Their exports to the Emerging South are dominated by fuels and have a minor share of manufactures, which may indicate limited developmental effects of this export direction. Exports to the North and exports within the Developing South have relatively high share of manufactures, especially the latter. Other Developing Economies (ODEs) in the UNIDO terminology, which are defined as the better-off half of the developing world, perform significantly better than Least Developed Countries (LDCs) in terms of the diversification and technological level of manufactured exports[8]. Finally, this chapter demonstrates an asymmetrical trade potential between the Developing South and the rest of the world, namely, developed and emerging countries. The Developing South's exports concentrate on primary commodities and low-end manufactures with limited complementarity with the demand structure of the rest of the world, whereas developed and emerging countries export diversified manufactures, which have high complementarity with the demand structure of the Developing South. In other words, the needs of developing countries for the rest of the world are larger than the needs of the rest of the world for developing countries.

[8] Details of the UNIDO country grouping are introduced in Section 2.2.2.

This echoes the unbalanced North-South trade pattern suggested by classical and radical development economics.

This chapter is organised as follows. Section 2.2 introduces the UNIDO country grouping and presents the "South-South trade illusion" by analysing South-South trade based on different definitions. Section 2.3 analyses the composition of the Developing South's exports to different destinations. Section 2.4 deals with trade potential of the Developing South with the rest of the world. Finally, Section 2.5 concludes. All trade data in this chapter are from the UNCTAD database.

2.2. The Illusion of South-South Trade

The great size and rapid growth of exports from the Global South in general and South-South exports in particular have been widely highlighted in the literature. Accordingly, South-South trade has been seen by many as a path for developing countries' growth and structural transformation (Demir and Dahi, 2011). However, this observation is subject to two problems. First, previous studies tend to include in the group of developing countries some *de facto* advanced countries (e.g., the Asian Tigers and advanced former European socialist countries). This brings about great upward bias to statistics on the Global South's exports. That is to say, the delightful picture of exports from the Global South in general and South-South exports in particular is largely an "illusion". Second, even if those *de facto* advanced countries are excluded, the broad-sense Global South is still not homogeneous. Instead, it consists of groups of countries at different development levels, and some emerging countries (e.g., China) dominate exports of the broad-sense Global South. Thus, trade statistics that do not differentiate between different country groups within the broad-sense Global South are distorted by those emerging countries, especially the big players, and conceal the marginalised position of the real developing countries. This problem leads to another "illusion". This section aims to clarify the "illusion" of

South-South exports by adopting alternative country grouping and to highlight the position of the real developing countries, say, the Developing South.

2.2.1. Conventional Definition of the Global South

The Global South has become a spotlight in the recent trade literature. Shirotori and Molina (2009) report that in 2005 total exports from the Global South amounted to $3.7 trillion, accounting for 33% of the total world exports, and South-South exports took 15% of the total world exports, reaching $1.7 trillion. UNCTAD (2008) reports that in 2006 total exports from the South amounted to $4.3 trillion, accounting for 37% of the total world exports, and South-South exports exceeded $2 trillion, accounting for 17% of the total world exports. By 2012, the share of the Global South in the world exports had increased to 44% (Bernhardt, 2016). These cited numbers deliver an impression of a significant and growing share of the South in the global trade. This "positive" impression of trade achievement of the Global South becomes greater, if we move the attention away from general exports to manufactured exports. Kowalski and Shepherd (2006) point out that manufacturing is the largest sector in South-South trade. The share of manufactures in total South-South merchandise exports increases from 25% in 1965 to more than 60% in 2005, and the Southern share of skill-intensive manufactured exports in the total world skill-intensive manufactured exports grows by even more than 17 times from 2% to 35% from 1978 to 2005 (Dahi and Demir, 2005).

These seemingly delightful figures, however, conceal the huge geographical variation and concentration in the Global South's export performance. WTO (2003) and Dutt (2012) point out that Asia dominates both South-South and South-North exports. In particular, intra-regional trade within Asia contributes to the major part of South-South trade. UNCTAD (2008) classifies the Asian Tigers under developing countries and reports that Southbound exports from China, South Korea, Taiwan, Hong Kong, Singapore, Malaysia, Thailand, Indonesia, and the Philippines accounted for 65% of total South-South exports in 2005. Such concentration is a result of not only these Asian countries' deep integration into the global value chain, but, more importantly, also their (relatively) high development level, especially the *de facto* advanced Asian Tigers. Just as what Kowalski and Shepherd (2006) argue, middle-income countries (e.g., developing Asian countries) dominate South-South trade, and low-income countries are only at a minor position, in terms of both size and growth.

The concentration of South-South trade in Asian countries and the marginalised position of those real developing countries make it necessary to rethink the conventional approach to defining the Global South and South-South trade. Table 2.1 lists country classifications used in some recent South-South trade studies. It is straightforward to see that the current literature tends to adopt a dichotomous vision by simply dividing the world into a Global North and a Global South without further disaggregation. Two major problems then arise: 1). inappropriate classification of some *de facto* advanced countries under Southern countries, and 2). simplified treatment of the broad-sense Global South as a homogeneous whole.

Table 2.1. Country classifications in some recent South-South trade studies

Paper	*The North*	*The South*
Coe, Helpman, and Hoffmaister (1997)	21 OECD countries plus Israel[9]	77 countries (incl. South Korea, Hong Kong, Taiwan, and Singapore)
WTO (2003)	The rest of the world	Latin America, Africa, the Middle East, Asia (excl. Japan) and Oceania (excl. Australia and New Zealand)
UNCTAD (2005)	OECD countries (excl. Mexico, South Korea, and Turkey), non-OECD new EU countries, South-East Europe and former Soviet Republics (incl. Russian Federation)	The rest of the world (incl. South Korea, Hong Kong, Taiwan, and Singapore)

[9] The OECD membership of Israel started from 2010. Thus, in 1997 Israel was not an OECD member.

Dahi (2006)	North America, West Europe, Japan, Israel, Australia, and New Zealand	The rest of the world (incl. South Korea, Singapore, Hong Kong, Russian Federation, Czech Republic, and Hungary)
Kowalski and Shepherd (2006)	High-income countries in the World Bank grouping (incl. South Korea, Hong Kong, Taiwan, and Singapore)	Low- and (upper and lower) middle-income countries in the World Bank grouping (incl. Russian Federation, Czech Republic, Poland, Slovak Republic, and Hungary)
Schiff and Wang (2006)	15 countries in North America, West Europe, and Oceania plus Japan	24 developing countries (incl. South Korea, Hong Kong, and Cyprus)
Akın and Kose (2008)	23 core OECD countries	23 Emerging Southern countries (incl. South Korea, Hong Kong, Singapore, and Israel) 60 Developing Southern countries[10]
Dahi and Demir (2008)	High-income OECD countries	All middle- and low-income countries (incl. Argentina, Brazil, Chile, Colombia, China, Hong Kong, South Korea, and Singapore)[11]
Klinger (2009)	GDP per capita above USD 10, 000 in 2000 (incl. South Korea, Hong Kong, and Singapore)	The rest of the world (incl. Russian Federation, Czech Republic, Slovenia, Hungary, and Poland)
Shirotori and Molina (2009)	Not applicable/specified	Members of the *Group of 77*, China, and other developing countries according to WTO (incl. South Korea, Singapore, Hong Kong, and Taiwan). There are no European countries.
Athukorala (2011)	WTO (2003)/UNCTAD (2005)	WTO (2003)/UNCTAD (2005)
Athukorala and Nasir (2012)	WTO (2003)/UNCTAD (2005)	WTO (2003)/UNCTAD (2005)
Bernhardt (2016)	Proxied by the United States and the Eurozone	Proxied by China, Indonesia, India, South Korea, Argentina, Brazil, Chile, and Peru

Source: Author's elaboration.

[10] The classification of the Emerging South and the Developing South in Akın and Kose (2008) is based on the extent to which a country is integrated into the global economy rather than its development level, which renders it incomparable with the grouping of the Emerging South and the Developing South in this chapter. Thus, their group of Emerging South includes countries at very different development levels (e.g., Singapore and Pakistan). This issue is discussed in detail in Section 2.2.2.

[11] Dahi and Demir (2008) examine the period of 1978 to 2005. This may be the reason that Hong Kong, South Korea, and Singapore are classified under middle-income countries. However, their paper does not give an explanation.

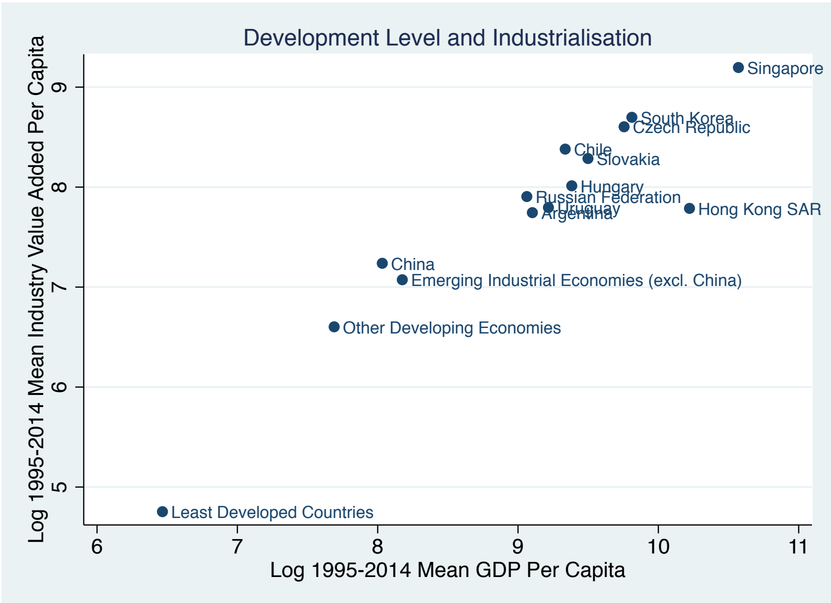
The first problem directly relates to the issue of which countries should be included in South-South trade statistics and which should not. Two groups of countries should definitely not be considered as part of the Global South, regardless of the broad-sense one or the narrow-sense one (i.e., only including the Developing South). The first group refers to some previous developing countries that have already achieved a high development level. The Asian Tigers (i.e., South Korea, Singapore, Hong Kong, and Taiwan) are the typical example[12]. These countries have been usually included in South-South trade studies. A likely reason is historical continuity, as these countries were typical developing countries before the 1970s (the 1960s for Hong Kong). However, at least since the 1990s, they have reached comparable income and human development level with that of traditional developed countries, which is much higher than the level of not only other developing countries but also those newly emerging countries. The second group of countries refers to advanced former European socialist countries (e.g., Russian Federation), which possess advanced scientific and technological level and qualified human capital stock, as the heritage of the socialist period. These countries tend to be defined as transition economies[13] in the literature, but, in some South-South trade studies, (part of) these countries are still included in the Global South. Figure 2.1 compares GDP per capita (development level) and industry value added (industrialisation level) between some *de facto* advanced countries, which are usually included in South-South trade studies (i.e., the Asian Tigers, advanced former European socialist countries, and the

[12] In addition to the Asian Tigers, the development status of the three Southern Cone countries (Argentina, Chile, and Uraguay) is also subject to debate (developed versus developing). However, since the three countries have lower development level and smaller trade size than the Asian Tigers, they are not seen as the most typical representative of the first group of countries.

[13] Normally, transition economies include both advanced European socialist countries (e.g., Czech Republic and Slovakia) and those less advanced ones (e.g., the Soviet Republics in Transcaucasia and Central Asia, Moldova, and Albania). Here, the second group of countries only refers to those advanced ones: Belarus, Bulgaria, Czech Republic, Hungary, Poland, Romania, Russian Federation, Slovakia, Ukraine, the three Baltic countries, and constituent republics of the former Socialist Federal Republic of Yugoslavia (except for Bosnia and Herzegovina).

Southern Cone)[14], and other countries in the broad-sense Global South (China, Emerging Industrial Economies, Other Developing Economies, and Least Developed Countries according to the UNIDO country grouping). *De facto* advanced countries are positioned at a much higher level than other countries in terms of both income and industrialisation. This implies that these *de facto* advanced countries are structurally different from countries in the broad-sense Global South.

Figure 2.1. GDP per capita and industrialisation: *de facto* advanced countries versus developing countries*



Source: Author's calculation based on the WDI database.
*At 2010 constant US Dollars.

The second problem concerns the growing heterogeneity within the broad-sense Global South. Even if those *de facto* advanced countries are excluded, this heterogeneity is still great. In 1995, GDP per capita (constant 2005 price) of China, Emerging Industrial Economies (in the UNIDO grouping), and Least Developed Countries (LDCs) was \$767, \$2165, and \$329, respectively. In 2014, China and Emerging Industrial Economies had GDP per capita of \$3799 and \$3449, whereas

[14] Since data on GDP per capita and industry value added are from the World Development Indicators (WDI) database, Taiwan is not included.

GDP per capita of LDCs was only $616. The gap in GDP per capita has been substantially enlarged over the past two decades, which reflects heterogeneity within the broad-sense Global South in not only living standards and productivity but also a wide range of socio-economic dimensions. This renders conventional South-South trade statistics that are based on a highly aggregate vision on the South inappropriate for the purpose of examining trade issues of those real developing countries. Therefore, as pointed out by Nielsen (2011), a classification system with multiple country groups, rather than a simple dichotomy of the North and the South, is needed to reflect the growingly divergent development achievements across country groups within the broad-sense South.

2.2.2. Industrialisation-Based Definition of the Global South

In response to the two problems aforementioned, this thesis adopts the UNIDO country grouping (UNIDO, 2013) based on a country's industrialisation level. In the UNIDO Constitution, industrialisation is defined as "a dynamic instrument of growth essential to rapid economic and social development" and "a multi-dimensional task". A country's achievements in industrial development cover a wide range of social and economic changes. This clearly shows that industrialisation represents not only the development of manufacturing but also a process of overall socio-economic progress. In this regard, industrialisation level is a suitable indicator to differentiate between country groups for the purpose of examining development issues. Based on its own research, UNIDO uses PPP-adjusted MVA (manufacturing value added) per capita to measure a country's industrialisation level[15]. The thresholds to classify countries are shown in Table 2.2. In the UNIDO grouping, the world is divided into Industrialised Economies (IEs), Emerging Industrial Economies (EIEs), Other Developing Economies (ODEs), and Least Developed

[15] $MVA_{pc}(adjusted) = \frac{GDP(PPP)}{Population} \times \frac{MVA}{GDP}$ (UNIDO, 2013).

Countries (LDCs). IEs largely correspond to the North in the conventional sense, and EIEs, ODEs, and LDCs to the traditionally-defined South. It should be noted that, according to the absolute threshold of MVA per capita, China belongs to EIEs, but in the UNIDO statistics China is separately listed due to its size. As a matter of fact, besides the large size, the rapid growth, relatively great manufacturing capability, and highly comprehensive industrial system also make it reasonable to treat China separately. Otherwise, findings related to EIEs are likely to be distorted by China. This thesis follows this approach. Thus, from now on, EIEs do not include China. Appendix A lists all countries in the UNIDO grouping.

In the UNIDO country grouping, those *de facto* advanced countries, which tend to be inappropriately tagged as "South" in the South-South trade literature (e.g., the Asian Tigers and advanced former European socialist countries), are mostly classified under Industrialised Economies (IEs), namely, the North/Developed Countries[16]. The rest of the world, namely, the broad-sense Global South, is divided into three groups (i.e., EIEs and China, ODEs, and LDCs), which represent three different development levels. Alternatively, the broad-sense South can also be divided into two broader groups: the Emerging South/Emerging Countries (EIEs and China) and the Developing South/Developing Countries (ODEs and LDCs). This dichotomous approach provides a simpler division of the Global South in terms of development level. The Emerging South represents the better-off half of the broad-sense Global South, and the Developing South represents the worse-off half.

[16] An exception is that the Southern Cone countries are classified under Emerging Industrial Economies by UNIDO.

Table 2.2. The UNIDO country grouping[17][18]

Country Groups		*Statistical Thresholds*	*Economies*
North	Industrialised Economies (IEs)	$MVA_{pc}(adjusted) \geq 2500$ or $GDP\ per\ capita\ (PPP) \geq 20000$	57
Emerging South (ES)	Emerging Industrial Economies (EIEs) & China	$1000 \leq MVA_{pc}(adjusted) < 2500$ or $GDP\ per\ capita\ (PPP) \geq 10000$ or share in world $MVA \geq 0.5\%$	33
Developing South (DS)	Other Developing Economies (ODEs)	All others (except LDCs)	82
	Least Developed Countries (LDCs)	Based on the official UN list	46

Source: Author's elaboration based on UNIDO (2013)

Akın and Kose (2008) also divide the Global South into an Emerging South and a Developing South, but their approach and purpose are completely different from the grouping in this thesis. The grouping of Akın and Kose (2008) is based on the extent to which a country integrates itself into the global economy, instead of a country's development level. They point that their Emerging South largely corresponds to the emerging markets listed in the MSCI Emerging Markets Index[19]. It is important to note that the concept of emerging markets, which has been commonly used outside of the academia (e.g., the FTSE list and the MSCI list)[20], completely differs from the concept of Emerging South/Emerging Countries in this thesis. The conceptualisation of emerging markets primarily concerns a country's business and investment environment rather than economic development level, thus generating quite different country list. Table 2.3 shows that the Emerging South in Akın and Kose (2008) includes countries at three different income and development levels,

[17] Some countries are classified under the group of IEs based on their GDP per capita, instead of MVA per capita, because countries with GDP per capita higher than 20000 international dollars may have experienced a decline in manufacturing production (but this does not imply a reduction in industrial capability). The reason to use the share in the world MVA in identifying some EIEs countries is that these countries have reached the level of EIEs in absolute terms, but not in relative terms due to large population size, such as India and Indonesia (UNIDO, 2013).
[18] At 2005 current prices, international dollars in PPP.
[19] MSCI refers to the Morgan Stanley Capital International.
[20] FTSE refers to the Financial Times Stock Exchange.

from those among the richest countries in the world (e.g., Hong Kong and Singapore) to those backward ones (e.g., the Philippines and Pakistan). Such great heterogeneity definitely invalidates their country grouping for the use in examining development issues. Thus, despite the same naming, the terms of "Emerging South" and "Developing South" in this thesis are intrinsically incomparable with those in Akın and Kose (2008).

Table 2.3. Emerging Southern countries by income level in Akın and Kose (2008)

Income Level (World Bank Standard)	***Emerging South (Akın and Kose, 2008)***
High-Income Economies	Chile, Uruguay, Hong Kong SAR, South Korea, Singapore, and Israel
Upper Middle-Income Economies	Argentina, Brazil, China, Colombia, Mexico, Peru, Venezuela, Thailand, Turkey, Jordan, and South Africa
Lower Middle-Income Economies	Indonesia, Philippines, Pakistan, India, Egypt, and Morocco

Source: Author's elaboration based on Akın and Kose (2008).

2.2.3. South-South Trade under Conventional Definition and Industrialisation-Based Definition

Figure 2.2 compares values of the broad-sense South-South exports in eight product categories [21] under the conventional definition of the South and under the industrialisation-based definition. The conventionally-defined South corresponds to the South in mainstream South-South trade studies. Since there is not a "unified" definition of the South in the literature, the term "conventional definition" is used to generalise several country groupings used in the literature, rather than representing any particular country grouping. Here, it is proxied by *Developing Economies* (incl.

[21] The eight product categories consist of three levels: the first level is "All Products"; the second level is divided into "Non-Fuel Commodities", "Fuels", and "All Manufactures"; and the third level refers to four subgroups by technological level under "All Manufactures", which are "Labour- and Resource-Intensive Manufactures", "Low Skill- and Technology-Intensive Manufactures", "Medium Skill- and Technology-Intensive Manufactures", and "High Skill- and Technology-Intensive Manufactures".

the Asian Tigers) plus (narrowly-defined) *Transition Economies*[22] in the UNCTAD grouping system. The industrialisation-based definition of the broad-sense Global South includes *Emerging Industrial Economies* (EIEs)[23], *China*, *Other Developing Economies* (ODEs), and *Least Developed Countries* (LDCs) in the UNIDO country grouping. The Asian Tigers and Russian Federation are classified under *Industrialised Economies* rather than Southern countries, which is the major difference between the conventional definition and the industrialisation-based definition. This seemingly minor difference in grouping makes substantial difference to South-South trade statistics.

For all the eight product categories, South-South export values under the conventional definition of the South are far larger than those under the industrialisation-based definition. In 2014, total South-South exports under the conventional definition are $5351 billion after deflation[24], while this number decreases to only $2242 billion under the industrialisation-based definition. There is a great difference of $3109 billion ($5351 billion−$2242 billion). This difference is mostly accounted for by the Asian Tigers, which specialise in skill- and technology-intensive manufactured exports and, to a much lesser degree, Russian Federation[25]. In terms of sectoral distribution, this difference is largely driven by manufactured

[22] In the UNCTAD database, *Transition Economies* only refer to those former European socialist countries that have not completed the so-called "transition process" (e.g., Russian Federation). In contrast, Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia are defined as *Developed Economies*.

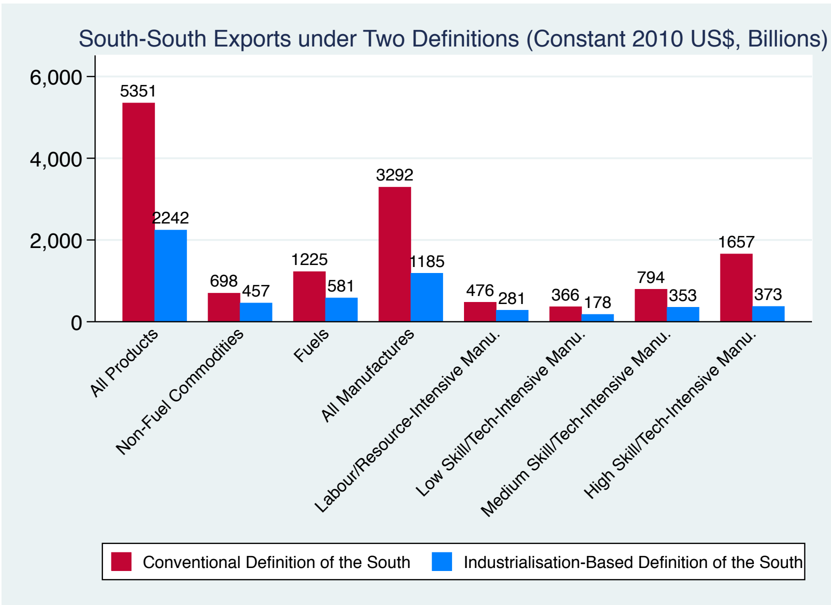
[23] Bulgaria, Belarus, Croatia, Latvia, Macedonia, Poland, Romania, Serbia, and Ukraine are classified under EIEs in the UNIDO grouping, instead of IEs. Thus, under the industrialisation-based definition, their exports are included in exports of the broad-sense Global South. However, due to their relatively small export values, this does not generate a major upward bias to export values of the broad-sense Global South.

[24] All export values are deflated by corresponding price indexes from the World Bank (base year=2010). Total exports (all products) are deflated by the world GDP deflator. Manufactured exports (various technological levels and types) are deflated by the manufactures unit value index (*MUV*). Fuel exports are deflated by the energy price index. Exports in Non-Fuel Commodities are deflated by the non-energy commodity price index.

[25] As seen from footnote 23 and 24, Russian Federation is the only advanced former European socialist country that is classified under *Industrialised Economies* in the UNIDO country grouping, but under *Transition Economies* in the UNCTAD country grouping. That is to say, in Figure 2.2, the inflation effect of the second type of countries (advanced former European socialist countries) on South-South exports is reflected only through Russian Federation.

exports, which shrink from $3292 billion to only $1185 billion under the industrialisation-based definition. Within manufacturing, exports in high skill- and technology-intensive manufactures have the largest contribution to this difference. The value of this product category contracts from $1657 billion to only $373 billion under the industrialisation-based definition. If manufactures are classified by type, instead of by technological level, then exports in machinery and transportation equipment ($1724 billion versus $373 billion, not shown in Figure 2.2) account for the largest part of the difference. In contrast, the difference between exports in non-fuel primary commodities under the conventional definition and under the industrialisation-based definition is quite small ($698 billion versus $457 billion). This is easy to understand, as the Asian Tiger hardly export non-fuel commodities.

Figure 2.2. South-South exports under two definitions in 2014*[26][27]



[26] Total exports refer to the category of "All Allocated Products (SITC 0 through 8+961+971)" in the UNCTAD database; non-fuel commodities refer to "Primary Commodities, excluding Fuels (SITC 0+1+2+4+68)" in the UNCTAD database; fuels refer to "Fuels (SITC 3)" in the UNCTAD database; and all manufactures refer to "Manufactured Goods (SITC 5 through 8 less 667 and 68)" in the UNCTAD database. The sum of non-fuel commodities, fuels, and all manufactures is smaller than the value of all allocated products, because products of SITC 667 (pearls and precious stones), 961 (coin), and 971 (non-monetary gold) are not covered by the above three product categories but are included in "All Allocated Products". All data refer to merchandise trade.

[27] The sum of manufactured exports at the four skill and technological levels under conventional definition is 3293 billion, instead of 3292 billion, due to rounding.

Source: Author's elaboration based on the UNCTAD database
*In billion of constant 2010 US Dollars

The great difference between South-South trade under the two definitions clearly shows the inflation impact on South-South trade due to the inappropriate inclusion of *de facto* advanced countries. This impact works basically through *de facto* advanced countries' strong presence in skill- and technology-intensive manufactured exports. If these countries are not excluded, then the Global South's trade performance and production capability in skill- and technology-intensive manufactures will be heavily overestimated. In this sense, the conventional approach towards South-South trade generates an illusion of not only trade performance of the Global South but also their technological and manufacturing capabilities.

2.2.4. South-South Trade at Three Levels

Section 2.2.3 has discussed the first source of the "illusion" of South-South trade, which is produced by inappropriate inclusion of *de facto* advanced countries in South-South trade statistics. This section deals with the second source of the "illusion", which is due to the great heterogeneity within the broad-sense Global South. In a broad sense, South-South exports are exports among all countries in the broad-sense Global South (the Emerging South and the Developing South). This is defined as "*Broad-Sense South-South Exports*". Given the differential development levels within the broad-sense South and the emphasis of this thesis on the Developing South, it is of importance to disentangle exports within the Developing South (DS) from the broad-sense South-South exports. This export flow is then defined as *DS-DS Exports*. Moreover, in order to exclude the bias due to the lion's share of China in the broad-sense South-South exports, "*Non-China South-South Exports*" are singled out by removing China-related parts (China's exports to other countries and other countries' exports to China) from "*Broad-Sense South-South*

Exports". In this way, South-South exports can be analysed at three levels, which is illustrated in Figure 2.3.

Figure 2.3. South-South exports at three levels

	EIEs	**China**	**DS**
EIEs	Δ	×	Δ
China	×		×
DS	Δ	×	Δ

Source: Author's elaboration

Country groups in the row are exporting countries, and those in the column are importing countries. The cell at the centre is empty, because (mainland) China does not export to itself. The summation of all the eight cells (crosses and triangles) represents "*Broad-Sense South-South Exports*". The summation of the four triangles at the four corner cells represents "*Non-China South-South Exports*". In particular, the triangle at the bottom right cell represents "*DS-DS Exports*", which are exports within the Developing South. The four crosses are China-related South-South exports.

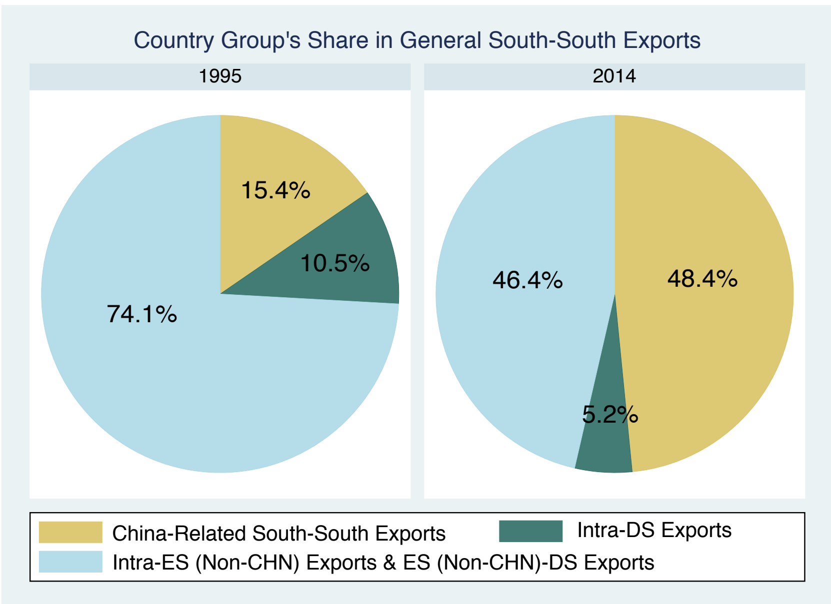
Appendix B shows the values of South-South exports at the three levels in 1995 and 2014 for eight product categories[28] and the corresponding annual growth rates derived from exponential trend function. The shares of *Non-China South-South Exports* and *DS-DS Exports* in *Broad-Sense South-South Exports* for each product category in 1995 and 2014 are also reported. Two observations should be highlighted. First, *Broad-Sense South-South Exports* have significantly higher growth rate than *Non-China South-South Exports* and *DS-DS Exports* for all product categories. Second,

[28] The eight categories include all products, non-fuel primary commodities, fuels, all manufactures, labour/resource-intensive manufactures, low skill/technology-intensive manufactures, medium skill/technology-intensive manufactures, and high skill/technology-intensive manufactures.

the shares of *Non-China South-South Exports* and *DS-DS Exports* in *Broad-Sense South-South Exports* substantially drop from 1995 to 2014. While, in 1995, *Non-China South-South Exports* accounted for around 80% of *Broad-Sense South-South Exports* for all product categories, by 2014 the share had decreased to around 40%. The share of *DS-DS Exports* decreases from around 10% or less in 1995 to negligible percentages in 2014.

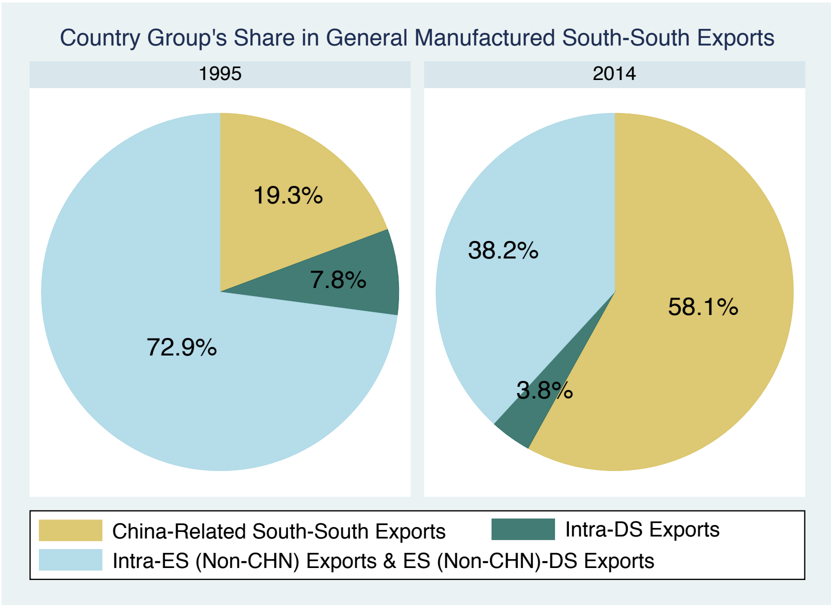
Figure 2.4 and Figure 2.5 visualise changes in the distribution of country-group share for overall exports and manufactured exports, respectively. The share of China-related part in *Broad-Sense South-South Exports* increases from 15.4% in 1995 to 48.4% in 2014. The increase is even greater for manufactured exports, from 19.3% to 58.1%. By contrast, the share of *DS-DS Exports* in *Broad-Sense South-South Exports* decreases from 10.5% to 5.2%. The situation is similar for DS-DS manufactured exports, decreasing from 7.8% to 3.8%.

Figure 2.4. Shares of country groups in broad-sense South-South exports



Source: Author's elaboration based on the UNCTAD database.

Figure 2.5. Shares of country groups in broad-sense South-South exports in manufactures



Source: Author's elaboration based on the UNCTAD database.

The aforementioned facts clearly demonstrate the second source of "illusion" of South-South trade. After excluding those *de facto* advanced countries from South-South export statistics, China takes over the position of the biggest player, especially in manufactured exports. If China is excluded, the growth of South-South exports becomes much less impressive. In particular, exports within the Developing South have been marginalised to a negligible position. In this regard, economic cooperation within the Developing South has not sufficiently developed, just as what was observed by Gunnar Myrdal in 1956. However, despite substantial reduction in shares, the absolute values of *Non-China South-South Exports* and *DS-DS Exports* have considerably increased, which is shown in Appendix C.

In summary, it can be concluded that China dominates both the size and growth of the broad-sense South-South exports. By contrast, other countries, especially the poorest countries in the world, have been marginalised. In this sense, including China in South-South trade statistics generates a strong inflation effect. However, in absolute terms, the Emerging South and, to a lesser extent, the Developing South have experienced great growth in export values.

2.2.5. South-South Trade in a Multi-Tier World

Having clarified the two sources of "illusion" with respect to South-South trade, it is of interest to show the dynamics and position of each country group in the overall global trade. Appendix C presents eight export matrices for the aforementioned eight product categories. Country groups in the row are exporting countries, and country groups in the column are importing countries. Each cell in the export matrices contains three numbers. The number at the top is the value of exports in a particular product category from country group in the row to country group in the column in 1995. The number at the middle gives the corresponding export value in 2014. The number at the bottom is the annual growth rate of the corresponding export flow between 1995 and 2014. For example, in Table C1, the third cell from the top left records the value of exports in all products from IEs (row country group) to EIEs (column country group) in 1995 and 2014 and the growth rate. Annual growth rate is derived from exponential trend function, namely, the coefficient b in $y_t = ae^{bt}$. This follows the method of the UNCTAD[29]. Exponential trend function takes into consideration all observations from the beginning year to the ending year. This method is better than the commonly-used compound annual growth rate (CAGR), which only considers the starting year and the ending year. All export values are deflated by price indexes. Total exports are deflated by the world GDP deflator (the World Bank). Manufactured exports (various technological levels and types) are deflated by the manufacturing unit value index (MUV, the World Bank). Fuel exports are deflated by the energy price index (the World Bank). Exports in non-fuel primary commodities are deflated by the non-energy commodity price index (the World Bank). Base year of these price indexes is 2010.

---

[29] http://unctadstat.unctad.org/EN/FAQ.html

Industrialised Economies (IEs), namely, the Global North, are the largest source of imports for all country groups (IEs *per se*, EIEs, China, ODEs, and LDCs) in all product categories, even in fuels[30], non-fuel primary commodities, and labour-intensive manufactures. IEs are also the largest destination for exports from other country groups in all product categories. However, the growth rates of exports from IEs tend to be much lower than the growth rates of exports from other country groups, and each country group's exports to IEs grow more slowly than their exports to other destinations. Intra-IEs exports are considerably greater than IEs' exports to other country groups in all product categories. In other words, North-North trade is the single largest part in the global trade. This is consistent with the stylised fact highlighted in the intra-industry trade literature.

Amongst all country groups, China has registered the highest export growth rates in almost all product categories, except fuels. The annual growth rates in all sub-groups of manufactures are spectacular, ranging from 15% to 20%. China's manufactured exports were much less than those from EIEs countries in 1995, whereas by 2014 China had outnumbered EIEs countries in manufactured exports at all technological levels, especially labour- and resource-intensive manufactures and high skill- and technology-intensive manufactures. Interestingly, with exceptions of labour- and resource-intensive manufactured exports and low skill- and technology-intensive manufactured exports, all country groups' exports to China register higher growth rates than their exports to other destinations. By contrast, each country group's exports to IEs tend to grow more slowly than their exports to other destinations. In this regard, China has become the most dynamic part in the global trade, and IEs are the largest but the least dynamic one.

The export growth rates of EIEs, ODEs, and LDCs fall between the growth rates of IEs and of China. LDCs have quite limited export values in all product categories.

[30] Bahrain, Kuwait, Qatar, and the United Arabic Emirates are classified under IEs by UNIDO.

ODEs' exports are much more than LDCs', but are still at quite a low level. More importantly, given that the majority of ODEs' and LDCs' exports are in non-fuel primary commodities and fuels, their manufactured exports are even at a lower level. Amongst the limited manufactured exports from ODEs and LDCs, the majority go to IEs. Considering that manufacturing is the core driver of economic growth and the importance of manufactured exports has been demonstrated by those late industrialisers, the low manufactured exports from the Developing South are a bad signal for their development prospect. However, a consolation is that ODEs' and LDCs' manufactured exports at various technological levels grow faster (around 10%) than their exports in non-fuel primary commodities and fuels (around 5%).

2.3. Composition of Developing Countries' Exports

From the quantity side, Section 2.2 demonstrates two sources of "illusion" of South-South trade and highlights the dominance of China and the marginalisation of the Developing South in the broad-sense South-South trade. This section moves the focus to the quality side by analysing the composition of the Developing South's exports to various destinations and its change between 1995 and 2014. Section 2.3.1 deals with the Developing South's exports to IEs and the Emerging South, and Section 2.3.2 deals with exports within the Developing South.

2.3.1. Composition of Developing Countries' Exports to Developed and Emerging Countries

Table 2.4 shows the share of each product category in total exports from ODEs and LDCs to IEs, respectively. In 1995, non-fuel primary commodities, fuels, and manufactures had similar shares. By 2014, the share of non-fuel primary commodities had declined to 18.7% for ODEs and 18.2% for LDCs. It should be noted that the reduction in export share has accompanied increase in absolute export values, as shown in Table C2. By 2014, the share of fuels had amounted to 42.1% for ODEs, accounting for the largest part in their total exports to IEs, and to 36.4% for LDCs. The shares of manufactures in total exports from ODEs and LDCs to IEs increase from 28.2% and 24.9% in 1995 to 34.9% and 40.1% in 2014, respectively. In 2014, manufactures even took the largest share in LDCs' exports to IEs. However, manufactured exports from LDCs to IEs have always concentrated on labour- and resource-intensive manufactures (36.1% of LDCs' total exports to IEs in 2014), mostly textile, garment, and footwear. Other manufactures have negligible shares. In 2014, textile, garment, and footwear accounted for 35.8% of LDCs' total exports to IEs, accounting for 89.3% of LDCs' total manufactured exports to IEs. The situation in 1995 was the same. One explanation for the dominant share of textile, garment, and footwear is preferred trade agreement between some LDCs countries and developed countries, such as the African Growth and Opportunity Act (AGOA), but a more fundamental reason is that LDCs countries barely have manufacturing capabilities outside of labour- and resource-intensive manufacturing.

ODEs' manufactured exports to IEs are more diversified. The share of high skill- and technology-intensive manufactures almost doubles from 6.1% in 1995 to 11.8% in 2014, and the share of medium skill- and technology-intensive manufactures increases from 2.7% to 5.6%. In particular, within the general category of manufactures, the share of machinery and equipment soars from 5.0% to 13%. In contrast, the share of labour- and resource-intensive manufactured exports slightly declines from 17.6% in 1995 to 15.4% in 2014. This category of exports is dominated by textile, garment, and footwear. It is easy to see that ODEs’ manufactured exports to IEs have experienced an improvement in both technological level and diversification. This may preliminarily shed lights on the progress in manufacturing capability and even structural transformation of ODEs. However, LDCs’ manufactured exports have always stuck at the low end. Despite a significant growth in the share of manufactured exports, the specialisation pattern has not been improved, still concentrating on labour- and resource-intensive manufactures.

Table 2.4. Composition of LDCs' and ODEs' exports to IEs[31]

Product Category (Percentage)	1995		2014	
	ODEs	LDCs	ODEs	LDCs
Non-Fuel Primary Commodities	30.3	37.2	18.7	18.2
Fuels	38.0	26.1	42.1	36.4
All Manufactures	28.2	24.9	34.9	40.1
Labour/Resource-Manu.	17.6	21.5	15.4	36.1
Low Skill/Tech-Manu.	1.8	0.9	2.2	1.0
Medium Skill/Tech-Manu.	2.7	0.9	5.6	0.7
High Skill/Tech-Manu.	6.1	1.6	11.8	2.3
Machinery & Equipment	5.0	1.5	13.0	1.6
Textile, Garment & Footwear	16.0	21.0	12.8	35.8

Source: Author's calculation based on the UNCTAD database.

The composition of exports from ODEs and LDCs to EIEs is quite different from that of their exports to IEs, as shown in Table 2.5. In 1995, fuels accounted for 42.7% and 15.0% in ODEs' and LDCs' total exports to EIEs, while by 2014 the share of fuels had increased to 57.2% for ODEs and 53.2% for LDCs, much larger than the share of their fuel exports to IEs (42.1% for ODEs and 36.4% for LDCs in 2014). By 2014, the share of non-fuel primary commodities had declined from 32.7% and 71.3% to 17.5% and 24.6% for ODEs and LDCs, respectively. It should be noted again that reduced export share has accompanied increase in export value, as shown in Table C2 in Appendix C. The share of manufactured exports maintains at a low level during the 20 years (around 24% for ODEs and around 15% for LDCs), in comparison with their manufactured exports to IEs (34.9% for ODEs and 40.1% for LDCs in 2014). While ODEs' manufactured exports to EIEs concentrate on medium and high skill- and

[31] Total exports refer to the category of "All Allocated Products (SITC 0 through 8+961+971)" in the UNCTAD database; non-fuel commodities refer to "Primary Commodities, excluding Fuels (SITC 0+1+2+4+68)" in UNCTAD database; fuels refer to "Fuels (SITC 3)" in UNCTAD; and all manufactures refer to "Manufactured Goods (SITC 5 through 8 less 667 and 68)" in UNCTAD database. The sum of the shares of non-fuel commodities, fuels, and all manufactures in total exports is smaller than 100%. This is because that the product categories of SITC 667 (pearls and precious stones), 961 (coin) and 971 (non-monetary gold) are not covered by the above three general categories, but they are included in "All Allocated Products".

technology-intensive manufactures, LDCs' manufactured exports to EIEs have increasingly specialised in labour- and resource-intensive manufactures.

Table 2.5. Composition of LDCs' and ODEs' exports to EIEs

Product Category (Percentage)	1995		2014	
	ODEs	LDCs	ODEs	LDCs
Non-Fuel Primary Commodities	32.7	71.3	17.5	24.6
Fuels	42.7	15.0	57.2	53.2
All Manufactures	24.1	13.4	23.3	16.2
Labour/Resource-Manu.	8.2	4.3	5.8	10.0
Low Skill/Tech-Manu.	2.7	1.5	3.1	2.2
Medium Skill/Tech-Manu.	3.9	0.9	4.1	1.4
High Skill/Tech-Manu.	9.3	6.7	10.3	2.5
Machinery & Equipment	4.8	1.5	7.4	2.8
Textile, Garment & Footwear	5.8	3.4	4.1	9.6

Source: Author's calculation based on the UNCTAD database.

The composition of exports from ODEs and LDCs to China, as shown in Table 2.6, is basically similar to that of their exports to EIEs. Importantly, ODEs' and LDCs' exports to China show even a lower share of manufactures. Between 1995 and 2014, the share of manufactures increases from 11.0% to 19.1% in ODEs' exports to China, but it decreases from 4.6% to 2.5% in LDCs' total exports to China. More than half of ODEs' manufactured exports to China are high skill- and technology-intensive manufactures, whereas more than half of LDCs' manufactured exports to China are labour- and resource-intensive manufactures.

Table 2.6. Composition of LDCs' and ODEs' exports to China

Product Category (Percentage)	1995		2014	
	ODEs	LDCs	ODEs	LDCs
Non-Fuel Primary Commodities	68.3	26.8	24.8	29.6
Fuels	20.7	64.8	56.0	64.8
All Manufactures	11.0	4.6	19.1	2.5
Labour/Resource-Manu.	2.3	2.5	4.6	1.3
Low Skill/Tech-Manu.	1.7	0.05	0.5	0.4
Medium Skill/Tech-Manu.	0.6	0.4	1.8	0.3
High Skill/Tech-Manu.	6.3	1.6	12.2	0.5
Machinery & Equipment	0.8	0.45	6.7	0.2
Textile, Garment & Footwear	1.9	1.6	4.3	1.2

Source: Author's calculation based on the UNCTAD database.

In summary, the Developing South's exports to the Emerging South (EIEs and China) concentrate on primary commodities, especially fuels, and manufactures take a minor share. In contrast, manufactures have an increasing and large share in the Developing South's exports to the North. By 2014, manufactures and fuels had become two dominant parts in the Developing South's exports to the North. In the recent decades, it has been widely argued that developing countries have experienced a major shift in their export structure to a manufacture-dominant pattern (e.g., Singer and Sarkar, 1991). This section shows that this shift has been clearly reflected in developing countries' exports to developed countries, but developing countries' exports to emerging countries seem to duplicate the earlier North-South trade pattern in which countries in the South (the periphery) export primary commodities to countries in the North (the centre). Between 1995 and 2014, however, the Developing South's exports to the North and the Emerging South share common trends of the decline in non-fuel primary commodities and the rapid increase in fuels. Moreover, ODEs' manufactured exports are more diversified than LDCs', with a higher share of medium and high skill- and technology-intensive manufactures and a lower share of labour- and resources-intensive manufactures.

2.3.2. Composition of Exports between Developing Countries

The composition of exports within the Developing South has largely remained unchanged between 1995 and 2014, with non-fuel primary commodities and manufactures being dominant. A sharp difference in comparison with the composition of their exports to the North and the Emerging South is the low share of fuels. As shown in Table 2.7 and Table 2.8, fuels took 11.1% and 16.8% in LDCs' total exports to ODEs in 1995 and 2014, and the shares of fuels in ODEs' exports to LDCs are 24.1% and 22.9%. The corresponding shares are 8.8% and 14.6% in intra-LDCs exports. Only in intra-ODEs exports, fuels have relatively high share (30.4% and 34.0% in 1995 and 2014).

The share of manufactured exports in total exports within the Developing South is comparable with the share in their exports to the North (around 40%), except in the case of LDC's exports to ODEs. ODEs' manufactured exports to other Developing Southern countries are basically as diverse as their exports to the North and the Emerging South. High skill- and technology-intensive manufactures take a significant share. LDCs' manufactured exports to other Developing Southern countries are obviously more diverse than their manufactured exports to the North and the Emerging South. Labour- and resource-intensive manufactures are still important, but not in an absolutely dominant position. Instead, medium and high skill- and technology-intensive manufactures have much larger shares. High skill- and technology-intensive manufactures even have the largest share in intra-LDCs manufactured exports (13.3% in 1995 and 12.3% in 2014 in total intra-LDCs exports). Textile, garment, and footwear only take a small share (2.1% in total intra-LDCs exports in 2014) in total labour- and resource-intensive manufactured exports within LDCs (11.7% in total intra-LDCs exports in 2014). This pattern is consistent with the observation in the South-South trade literature that South-South trade tends to be more diverse and more sophisticated than South-North trade. Provided that diverse and sophisticated exports imply greater developmental effect, it may be tentatively argued that exports to other Southern countries have the greatest developmental effect, followed by exports to the North. By contrast, exports to the Emerging South, given its minor share of manufactures, are least development-enhancing, if not development-impeding.

Table 2.7. Composition of LDCs' and ODEs' exports to ODEs

Product Category (Percentage)	1995		2014	
	ODEs	LDCs	ODEs	LDCs
Non-Fuel Primary Commodities	31.9	63.4	27.1	57.6
Fuels	30.4	11.1	34.0	16.8
All Manufactures	36.6	18.4	37.5	22.4
Labour/Resource-Manu.	13.4	9.6	8.8	8.8
Low Skill/Tech-Manu.	4.7	1.3	5.7	3.8
Medium Skill/Tech-Manu.	6.6	2.7	9.0	4.8

High Skill/Tech-Manu.	12.0	4.8	13.9	5.0
Machinery & Equipment	5.7	3.1	10.6	6.6
Textile, Garment & Footwear	8.5	8.4	4.4	6.8

Source: Author's calculation based on the UNCTAD database.

Table 2.8. Composition of LDCs' and ODEs' exports to LDCs

Product Category	1995		2014	
(Percentage)	ODEs	LDCs	ODEs	LDCs
Non-Fuel Primary Commodities	26.5	56.8	30.0	49.8
Fuels	24.1	8.8	22.9	14.6
All Manufactures	49.3	34.3	47.2	35.6
Labour/Resource-Manu.	15.8	11.0	15.4	11.7
Low Skill/Tech-Manu.	12.1	3.0	8.9	5.0
Medium Skill/Tech-Manu.	7.4	7.1	8.6	6.6
High Skill/Tech-Manu.	13.9	13.3	14.3	12.3
Machinery & Equipment	6.2	6.3	8.2	6.1
Textile, Garment & Footwear	8.5	5.7	8.2	2.1

Source: Author's calculation based on the UNCTAD database.

2.4. Trade Potential of Developing Countries

Having presented the quantity and the quality aspect of the Developing South's exports at various levels, this section deals with trade potential of the Developing South. As the first step, Trade Complementarity Index (TCI) is used to measure the match between exports (supply) from the Developing South and imports (demand) by the rest of the world. Second, Export Intensity Index (EII) is adopted to shed lights on the degree to which trade potential of the Developing South with the rest of the world has been actually exploited.

2.4.1. Trade Complementarity of Developing Countries

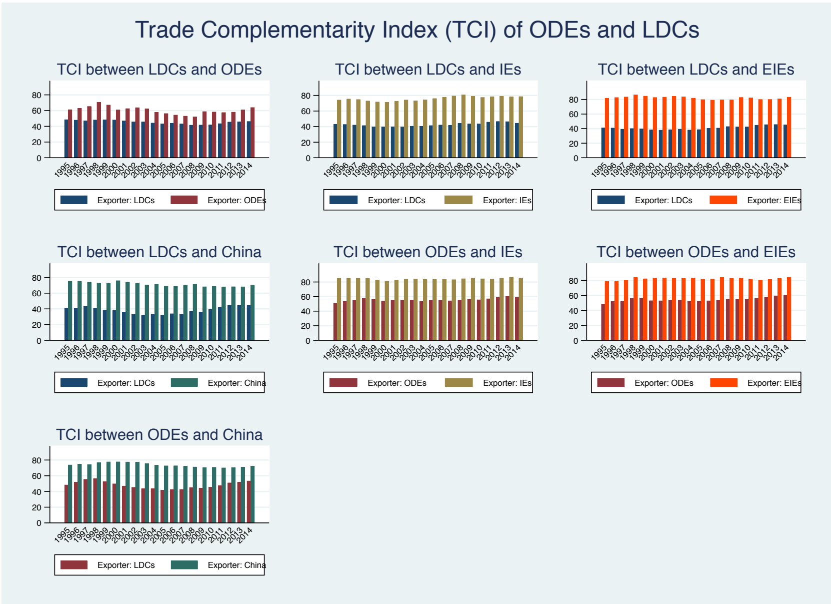
Trade Complementarity Index (TCI) measures the extent to which a country's export (supply) structure matches another country's import (demand) structure. A higher value implies greater export potential of the exporting country with respect to the importing country. Trade complementarity of country *i* (exporting country) with country *j* (importing country) is defined as:

$$TCI_{ij} = 100\times\left[1-\sum_{k}\left(\frac{|m_{jk}-x_{ik}|}{2}\right)\right]$$

where m_{jk} is the share of good *k* in total imports of country *j* from the world, and x_{ik} is the share of good *k* in country *i*'s total exports to the world. The value of *TCI* ranges from 0 to 100. A value of zero means that country *j* does not import any goods that are exported by country *i*. In other words, country *i* does not supply any goods that country *j* demands. A *TCI* value of 100 means full match between country *j*'s import (demand) and country *i*'s export (supply). It should be noted that higher *TCI* does not necessarily imply that country *j* imports more goods from country *i*, because country *j* may import from other countries.

Figure 2.6 shows *TCI* of ODEs and LDCs with other country groups. The most striking finding is that IEs', EIEs', and China's *TCI* with ODEs and LDCs (around 80) is significantly higher than ODEs' and LDCs' *TCI* with IEs, EIEs, and China (between 40 and 50). This implies that the match between the supply of IEs, EIEs, and China and the demand of ODEs and LDCs is much higher than the match between the supply of ODEs and LDCs and the demand of IEs, EIEs, and China. In other words, the extent to which the North and the Emerging South need the Developing South is lower than the extent to which the Developing South needs the North and the Emerging South. Thereby, it can be argued that the North and the Emerging South have higher export potential with the Developing South than the reverse direction. The deeper reason for this mismatch between the Developing South's supply and the demand of the rest of the world may fall within the Developing South's economic structure. The Developing South's exports concentrate on less elastic primary commodities and low-end manufactures, which have limited growth in demand. In contrast, the North and the Emerging South have diverse exports across a wide range of manufactures for which the Developing South may have irreplaceable demand. This is consistent with the argument of the unbalanced North-South relationship in classical development economics. As the mismatch is a structural problem, the only solution seems to be structural transformation, especially export diversification and upgrading. Unfortunately, trade complementarity between the Developing South and the rest of the world maintains basically unchanged from 1995 to 2014. This phenomenon implies that during this period the Developing South did not make their production structure more compatible with demand from the rest of the world, which further makes the trade prospect of the Developing South less promising.

Figure 2.6. Trade complementarity of ODEs and LDCs



Source: Author's calculation based on the UNCTAD database.

2.4.2. Export Intensity of Developing Countries

The extent to which trade complementarity between two countries has been actually exploited can be measured by Export Intensity Index (EII), which shows whether trade value between two countries is larger or smaller than would be expected based on their importance in the world trade. Export intensity of country i (exporting country) with respect to country j (importing country) is defined as:

$$EII_{ij} = \frac{x_{ij}/X_i}{x_{wj}/X_w}$$

where x_{ij} is the value of exports from country i to country j, X_i is country i's total export value, x_{wj} is the value of total exports from the rest of the world to country j, and X_w is total world export value. This index is the ratio of the share of exports going to country j in country i's total exports (x_{ij}/X_i) to the share of exports going to country j in the world total exports (x_{wj}/X_w). The value of this index ranges from 0 to infinity. One is the threshold level. A value above one implies that the actual value of exports from country i to country j is larger than the expected level, given the importance of country j (importing country) in the total world exports (x_{wj}/X_w).

If country i's Trade Complementarity Index with country j is high and its Export Intensity Index with country j is higher than one, then trade potential of country i with country j has been well exploited. In comparison, if a combination of high trade complementarity and low export intensity is observed, then trade potential has not been sufficiently utilised. In this case, there could be space for potential trade expansion. However, another possibility is the combination of low trade complementarity and low export intensity. In this case, there is hardly trade potential between the two countries for exploitation.

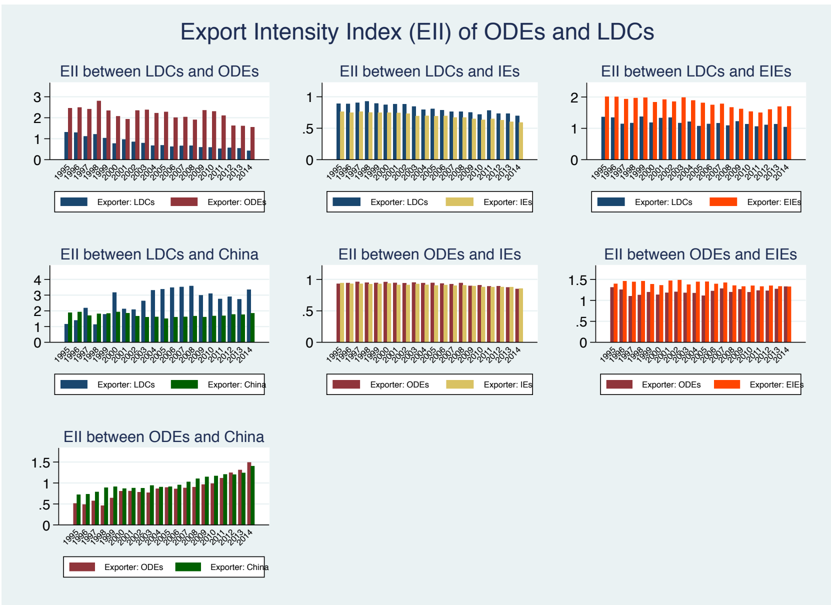
Figure 2.7 shows Export Intensity Index of ODEs and LDCs with other country groups. LDCs' export intensity with ODEs has been smaller than one since 2000, and it has tended to decrease over years. This phenomenon implies that since 2000 exports from LDCs to ODEs have been lower than would be expected based on ODEs' importance in the world trade, and the gap between the actual export value and the expected export value increases. This lower-than-expected export intensity seems to be consistent with the low trade complementarity of LDCs with ODEs (around 40). In comparison, ODEs' export intensity with LDCs, despite a decreasing trend, has always been larger than one and is even larger than two in some years.

Given that ODEs' trade complementarity with LDCs is relatively high (around 60), it can be argued that ODEs' trade complementarity with LDCs has been relatively well exploited.

Bilateral export intensity between ODEs and IEs has always been slightly below one (around 0.9) from 1995 to 2014, whereas bilateral trade between ODEs and EIEs has always been slightly higher than expected. Interestingly, despite the low trade complementarity with China, ODEs' export intensity with China shows a continuous increase from 0.51 in 1995 to almost 1.5 in 2014. The threshold of one has been surpassed since 2011. The relatively low trade complementarity of ODEs with China reflects that ODEs' exports to China concentrate on limited product categories, mostly primary commodities. However, this concentration has not impeded their exports to China. Instead, the increasing export intensity indicates the growth in ODEs' exports to China. China's fast-growing import demand for primary commodities, especially fuels and minerals, from ODEs may be the driver behind this paradoxical combination of steadily low trade complementarity but increasing export intensity. This phenomenon demonstrates a situation that great demand-side force may partly overcome weak trade complementarity on the supply side. However, is such a growing export intensity with China a good news? This is an empirical question, because different forces coexist. Chapter 3 will provide a further discussion and examination on this issue.

Bilateral trade between LDCs and IEs has always been lower than would be expected. However, export intensity between LDCs and EIEs has always been above one, despite the low trade complementarity of LDCs with EIEs (around 40). LDCs' export intensity with China has increased significantly over the past two decades, amounting to more than three for the recent ten years. Since 2000, LDCs' export intensity with China has been much higher than China's export intensity with LDCs. This situation seems to be against expectation, because LDCs' trade complementarity with China is approximately half of China's trade complementarity with LDCs. The most likely explanation is China's growing demand for primary commodities from LDCs, just as the aforementioned case of ODEs' paradoxical trade complementarity and export intensity with China. Strong forces on the demand side reverse the weakness on the supply side. ODEs and LDCs also have low trade complementarity with IEs, the same as that with China. However, unlike their high and increasing export intensity with China, their export intensity with IEs has always been below one without a positive trend. A likely reason is that IEs' demand for primary commodities from the Developing South is stable, in contrast to China's fast-growing demand.

Figure 2.7. Export intensity of ODEs and LDCs



Source: Author's calculation based on UNCTAD database.

2.5. Conclusion

The great size and rapid growth of exports from the Global South in general and South-South exports in particular have been highlighted in the recent literature, and South-South trade has been seen as a promising approach towards development.

However, this chapter demonstrates that the spectacular trade achievement of the Global South recorded in the literature is largely an "illusion". The first source of this "illusion" is the inappropriate inclusion of some *de facto* advanced countries (e.g., the Asian Tigers and advanced former European socialist countries) in South-South trade statistics. By comparing South-South exports under conventional definition of the South and industrialisation-based definition, this chapter shows that including these countries in the Global South leads to a great upward bias (more than doubling) to South-South trade values. This upward bias is largely driven by exports in manufactures, in particular high skill- and technology-intensive manufactures, from the Asian Tigers. If these countries are not excluded, the Global South's trade performance and production capabilities in medium- and high-end manufactures will be heavily overestimated. In this regard, the conventional approach to defining the Global South generates an illusion of not only the size and growth of South-South trade but also the technological and manufacturing capabilities of the Global South. The second source of the "illusion" is the great divergence in development level and trade performance across different country groups within the broad-sense Global South. In response to this problem, this chapter divides the broad-sense Global South into the Emerging South (including China) and the Developing South. Accordingly, South-South exports are treated at three levels as broad-sense South-South exports, non-China South-South exports, and intra-Developing South exports. Data show that China dominates the size and growth of the broad-sense South-South exports. If China is excluded, the size and growth of South-South trade significantly decrease. On the other hand, the Developing South, which is the poorest part of the world, has been marginalised with declining and quite limited trade share. However, it should be noted that the declining share has still accompanied increase in absolute trade values. Thus, the marginalisation of the Developing South should be interpreted in relative terms.

This chapter is also concerned with the quality side of the Developing South's export performance. The Developing South's exports to different destinations have quite different compositions. Their exports to the North have been dominated by fuels and manufactures, and their exports to other Developing Southern countries show comparably high share of manufactures. On the other hand, their exports to the Emerging South are dominated by fuels, and manufactures take a minor share, especially in the case of exports to China. From 1995 to 2014, ODEs' manufactured exports experienced an improvement in both technological level and diversification, while LDCs' manufactured exports stick at the low end. This may preliminarily reflect the progress in manufacturing capabilities and structural transformation for ODEs and the stagnation for LDCs. Given that more sophisticated and more diversified exports are associated with greater developmental effects (Hausmann, Hwang and Rodrik, 2007; Parteka and Tamberi, 2013; Felipe, Kumar and Abdon, 2014), exports to the Emerging South seem to be less development-enhancing than intra-Developing South exports and exports to the North.

Another problem facing the Developing South is the limited trade potential with the rest of the world, due to the mismatch between the product structure of their exports and the structure of demand by the rest of the world. Trade complementarity analysis shows that trade potential of the Developing South with the North and the Emerging South is much lower than that of the reverse. In other words, the Developing South's concentrated export structure in primary commodities and low-end manufactures restricts further development of their exports to the rest of the world, except to China. They act as suppliers of those low income-elasticity products, and miss the opportunity from the growing demand for diversified and differentiated medium- and high-end manufactures by the rest of the world. In contrast, the high complementarity between the Developing South's import structure and the rest of the world's export structure implies that the Developing South may have irreplaceable needs to import manufactures from the rest of the world, namely, those advanced countries. This echoes the bleak picture of the unbalanced North-South relationship suggested by classical and radical development economics. The need of the Developing South for the rest of the world is greater than the need of the rest of the world for the Developing South. What is more unfortunate is that, between 1995 and 2014, the Developing South generally did not make their production structure more compatible with the demand from the rest of the world. Finally, within the Developing South, ODEs show high trade complementarity and export intensity with LDCs, whereas LDCs' trade complementarity and export intensity with ODEs are quite low. Therefore, LDCs, the least developed part of the world, are not only marginalised in the general global trade, but they also have a risk of being marginalised in intra-Developing South trade. In order to mitigate this risk, structural transformation is necessary.

References

Akın, Ç., & Kose, M. A. (2008). Changing nature of North–South linkages: Stylized facts and explanations. *Journal of Asian Economics*, *19*(1), 1-28.

Athukorala, P. C. (2011). South-South trade: An Asian perspective. Asian Development Bank Economics Working Paper Series, (265).

Athukorala, P. C., & Nasir, S. (2012). Global production sharing and south-south trade. *Indian Growth and Development Review*, *5*(2), 173-202.

Bernhardt, T. (2016). South-South trade and South-North trade: which contributes more to development in Asia and South America? Insights from estimating income elasticities of import demand. *CEPAL Review*.

Coe, D. T., Helpman, E., & Hoffmaister, A. (1997). North-south R&D spillovers (No. w5048). National Bureau of Economic Research.

Dahi, O. S. (2006). *Economic Development and South-South Trade* (Doctoral dissertation, University of Notre Dame).

Dahi, O. S., & Demir, F. (2008). South-South trade in manufactures: Current performance and obstacles for growth. *Review of Radical Political Economics*, *40*(3), 266-275.

Demir, F., & Dahi, O. S. (2011). Asymmetric effects of financial development on South–South and South–North trade: Panel data evidence from emerging markets. *Journal of Development Economics*, *94*(1), 139-149.

Dutt, A. K. (2012). South-South issues from a North-South perspective. Geneva: UNCTAD Discussion Paper.

Felipe, J., Kumar, U., & Abdon, A. (2014). How rich countries became rich and why poor countries remain poor: It's the economic structure… duh!. *Japan and the World Economy*, *29*,

46-58.
Hausmann, R., Hwang, J., & Rodrik, D. (2007). What you export matters. *Journal of Economic Growth*, *12*(1), 1-25.
Klinger, B. (2009). Is South-South trade a testing ground for structural transformation?. *UN Policy Issues in International Trade and Commodities Study*, (40).
Kowalski, P., & Shepherd, B. (2006). South-South trade in goods. OECD Trade Policy Papers, No. 40, OECD Publishing.
Myrdal, G. (1956). *An international economy; problems and prospects*. London: Routledge and Kegan Paul Press.
Nielsen, L. (2011). Classifications of Countries Based on Their Level of Development: How it is Done and How It Could be Done [Electronic resource]. IMF Working Paper.
Parteka, A., & Tamberi, M. (2013). What determines export diversification in the development process? Empirical assessment. *The World Economy*, *36*(6), 807-826.
Sarkar, P., & Singer, H. W. (1991). Manufactured exports of developing countries and their terms of trade since 1965. *World development*, *19*(4), 333-340.
Schiff, M., & Wang, Y. (2006). North South and South South trade related technology diffusion: an industry-level analysis of direct and indirect effects. *Canadian Journal of Economics/Revue canadienne d'économique*, *39*(3), 831-844.
Shirotori, M., & Molina, A. C. (2009). *South-south Trade: The Reality Check*. UN.
UNCTAD (2005). Trade and Development Report 2005. Geneva: United Nations
UNCTAD (2008). South-South Trade in Asia: The Role of Regional Trade Agreements. Geneva: United Nations.
UNIDO (2013). Country grouping in UNIDO statistics. Vienna: United Nations.
WTO (2003). Selected Features of South South Trade Development in the 1990-2001 Period, in World Trade Report 2003. Geneva: WTO.

Appendix A. The UNIDO Country Grouping

Table A1. Country list of the UNIDO grouping

Industrialised Economies (IEs)	***Emerging Industrial Economies (EIEs)***	***Other Developing Economies (ODEs)***	***Least Developed Countries (LDCs)***
Austria	Brazil	Albania	Afghanistan
Belgium	China	Algeria	Angola
Czech Republic	Colombia	Anguilla	Bangladesh
Denmark	Costa Rica	Antigua and Barbuda	Benin
Estonia	India	Armenia	Bhutan
Finland	Indonesia	Azerbaijan	Burkina Faso
France	Kazakhstan	Bahamas	Burundi
Germany	Mauritius	Barbados	Cambodia
Hungary	Mexico	Belize	Cape Verde
Ireland	Oman	Bolivia	Central African Republic
New Zealand	Saudi Arabia	Bosnia and Herzegovina	Chad
Italy	Serbia	Botswana	Comoros
Lithuania	South Africa	Cameroon	Democratic Rep of the
Luxembourg	Suriname	Congo	Congo

Malta Netherlands Portugal Slovakia Slovenia Spain Sweden United Kingdom Iceland Cyprus Greece Liechtenstein Norway Switzerland Russian Federation Belarus Ukraine Latvia Bulgaria Poland Romania Croatia Switzerland China (Hong Kong SAR) China (Macao SAR) China (Taiwan Province) Japan Malaysia Republic of Korea (South Korea) Singapore Brunei Darussalam Bahrain Kuwait Qatar United Arab Emirates Bermuda Canada Greenland United States of America Aruba Australia British Virgin Islands Curaçao French Guiana French Polynesia Guam New Caledonia Israel Puerto Rico United States Virgin Islands Argentina Chile Uruguay	Thailand TFYR Macedonia Tunisia Turkey Venezuela	Cook Islands Côte d'Ivoire Cuba D.P.R. Korea (North Korea)* Dominica Dominican Republic Ecuador Egypt El Salvador Fiji Gabon Georgia Ghana Grenada Guadeloupe Guatemala Guyana Honduras Iran Iraq Jamaica Jordan Kenya Kyrgyzstan Lebanon Libya Marshall Islands Martinique Micronesia Mongolia Montenegro Montserrat Morocco Namibia Nicaragua Nigeria Pakistan Palau Palestine Panama Papua New Guinea Paraguay Peru Philippines Republic of Moldova Réunion Saint Kitts and Nevis Saint Lucia Saint Vincent and the Grenadines Seychelles Sri Lanka Swaziland Syrian Arab Republic Tajikistan Tonga	Djibouti Eritrea Equatorial Guinea Ethiopia Gambia Guinea Guinea-Bissau Haiti Kiribati Lao People's Dem Rep Lesotho Liberia Madagascar Malawi Maldives Mali Mauritania Mozambique Myanmar Nepal Niger Mozambique Myanmar Nepal Niger Rwanda Sao Tome and Principe Senegal Sierra Leone Solomon Islands Somalia South Sudan Sudan Samoa Timor-Leste Togo United Republic of Tanzania Vanuatu Yemen Zambia

		Trinidad and Tobago Turkmenistan Uzbekistan Vietnam Zimbabwe	

Source: UNIDO (2013)

Appendix B. Values and Growth of South-South Exports at Three Levels

Table B1. Values and growth of South-South exports in all products

All Products	1995	2014	Annual Growth Rate by Exponential Function
Broad-Sense South-South Exports	289.4	1958.8	12.6%
Non-China South-South Exports (percentage in Broad-Sense South-South exports)	244.8 (84.6%)	1010 (51.6%)	9.7%
DS-DS Exports (percentage in Broad-Sense South-South exports)	30.3 (10.5%)	101.1 (5.2%)	8.8%

Source: Author's Calculation based on the UNCTAD database.

Table B2. Values and growth of South-South exports in non-fuel primary commodities

Non-Fuel Commodities	1995	2014	Annual Growth Rate by Exponential Function
Broad-Sense South-South Exports	94.3	471.4	8.8%
Non-China South-South Exports (percentage in Broad-Sense South-South exports)	81.4 (86.3%)	286 (60.7%)	6.6%
DS-DS Exports (percentage in Broad-Sense South-South exports)	11.6 (12.3%)	37.4 (7.9%)	6.5%

Source: Author's Calculation based on the UNCTAD database.

Table B3. Values and growth of South-South exports in fuels

Fuels	1995	2014	Annual Growth Rate by Exponential Function
Broad-Sense South-South Exports	156.8	491	6.4%
Non-China South-South Exports (percentage in Broad-Sense South-South exports)	143.5 (91.5%)	309.5 (63%)	4.3%
DS-DS Exports (percentage in Broad-Sense South-South exports)	21.9 (14%)	28.5 (5.8%)	1.0%

Source: Author's Calculation based on the UNCTAD database.

Table B4. Values and growth of South-South exports in all manufactures

All Manufactures	1995	2014	Annual Growth Rate by Exponential Function
Broad-Sense South-South Exports	101.5	1114.8	14.2%
Non-China South-South Exports (percentage in Broad-Sense South-South exports)	81.9 (80.7%)	467.6 (41.9%)	10.6%
DS-DS Exports (percentage in Broad-Sense South-South exports)	7.9 (7.8%)	41.9 (3.8%)	10.8%

Source: Author's Calculation based on the UNCTAD database.

Table B5. Values and growth of South-South exports in labour/resource-intensive manufactures

Labour and Resource-intensive Manufactures	1995	2014	Annual Growth Rate by Exponential Function
Broad-Sense South-South Exports	28.9	264.7	12.9%
Non-China South-South Exports (percentage in Broad-Sense South-South exports)	22.3 (77.2%)	90.2 (34.1%)	8.3%
DS-DS Exports (percentage in Broad-Sense South-South exports)	2.9 (10%)	11.3 (4.3%)	9.2%

Source: Author's Calculation based on the UNCTAD Database

Table B6. Values and growth of South-South exports in low skill/technology-intensive manufactures

Low Skill and Technology-intensive Manufactures	1995	2014	Annual Growth Rate by Exponential Function
Broad-Sense South-South Exports	18.7	167.6	13.8%
Non-China South-South Exports (percentage in Broad-Sense South-South exports)	14.6 (78.1%)	72.4 (43.2%)	10.9%
DS-DS Exports (percentage in Broad-Sense South-South exports)	1.2 (6.4%)	6.7 (4%)	12.7%

Source: Author's Calculation based on the UNCTAD database.

Table B7. Values and growth of South-South exports in medium skill/technology-intensive manufactures

Medium Skill and Technology-intensive Manufactures	1995	2014	Annual Growth Rate by Exponential Function
Broad-Sense South-South Exports	24.6	331.8	15.4%
Non-China South-South Exports	20.4	150.4	11.9%

(percentage in Broad-Sense South-South exports)	(82.9%)	(45.3%)	
DS-DS Exports (percentage in Broad-Sense South-South exports)	1.4 (5.7%)	9.2 (2.8%)	12.1%

Source: Author's Calculation based on the UNCTAD database.

Table B8. Values and growth of South-South exports in high skill/technology-intensive manufactures

High Skill and Technology-intensive Manufactures	1995	2014	Annual Growth Rate by Exponential Function
Broad-Sense South-South Exports	29.4	350.7	14.5%
Non-China South-South Exports (percentage in Broad-Sense South-South exports)	24.5 (83.3%)	154.6 (44.1%)	10.8%
DS-DS Exports (percentage in Broad-Sense South-South exports)	2.5 (8.5%)	14.6 (4.2%)	10.7%

Source: Author's Calculation based on the UNCTAD database.

Appendix C. Values and Growth of Exports by Country Group and Product Group

Table C1. Values and growth of the world exports in all products

All Products		IEs	EIEs	China	ODEs	LDCs	World
IEs	1995	4992.9	641.8	201.5	352.8	38.3	6227.4
	2014	7134.6	1533.1	1067.1	679.1	96.1	10510.1
	growth rate	2.6%	6.0%	11.1%	5.3%	6.7%	3.8%
EIEs	1995	603.4	96.3	13.2	66.4	12.8	792.2
	2014	1593.5	391	207.8	251.6	66.1	2510
	growth rate	6.5%	9.7%	18.2%	9.2%	10.6%	7.7%
China	1995	200	13.3		9.8	3.4	226.6
	2014	1472.5	296.9		216.6	58.4	2044.4
	growth rate	12.5%	19.9%		18.7%	17.5%	13.8%
ODEs	1995	181.9	33.7	3.7	21.3	4.9	245.4
	2014	488.7	172.1	115.1	66.2	20.7	862.7
	growth rate	6.5%	10.9%	20.5%	8.3%	10.4%	8.1%
LDCs	1995	25.7	5.2	1.2	2.9	1.3	36.3
	2014	83.8	28.1	53.9	5.7	8.5	180.1
	growth rate	8.2%	12.1%	22.6%	7.4%	12.5%	10.8%
World	1995	6003.9	790.3	219.6	453.2	60.8	7527.8
	2014	10773.1	2421.3	1443.9	1219.1	249.8	16107.3
	growth rate	4.0%	7.6%	12.5%	7.1%	9.4%	5.2%

Source: Author's Calculation based on the UNCTAD Database

Table C2. Values and growth of the world exports in non-fuel primary commodities

Non-Fuel Commodity	IEs	EIEs	China	ODEs	LDCs	World
IEs 1995 2014 growth rate	729.4 1038 0.9%	81.9 209.4 4.4%	29.8 182.7 10.9%	69.9 115.1 2.4%	8.4 19.2 3.5%	919.5 1564.3 2.1%
EIEs 1995 2014 growth rate	163.8 335.4 3.5%	30 100.2 6.5%	6.5 102 17.1%	20.3 81.1 7.1%	3.6 23.5 9.7%	224.1 642.2 5.6%
China 1995 2014 growth rate	26.6 76.1 4.7%	1.6 15.5 12.3%		1.5 12.9 10.5%	0.3 2.5 10.5%	30 107 6.0%
ODEs 1995 2014 growth rate	60 107.5 1.9%	12 35.6 5.1%	2.7 33.7 14.0%	7.4 21.1 5.9%	1.4 7.3 8.7%	83.4 205.3 4.0%
LDCs 1995 2014 growth rate	10.4 18 2.2%	4 8.2 4.2%	0.4 18.8 22.3%	2 3.9 4.7%	0.8 5 9.9%	17.6 53.9 5.5%
World 1995 2014 growth rate	990.2 1575.1 1.6%	129.4 368.8 5.2%	39.3 337.3 12.9%	101 234.1 4.3%	14.6 57.5 6.8%	1274.6 2572.7 3.1%

Source: Author's Calculation based on the UNCTAD database.

Table C3. Values and growth of the world exports in fuels

Fuels	IEs	EIEs	China	ODEs	LDCs	World
IEs 1995 2014 growth rate	661.3 1073.4 2.2%	96.7 193.9 5.1%	13.4 67 9.3%	69.3 180.2 5.7%	3.4 19 9.1%	844.2 1533.5 3.2%
EIEs 1995 2014 growth rate	316.9 405.5 1.6%	45 116.9 5.2%	6.2 74.2 14.0%	32.2 43.7 1.8%	3.2 10.7 6.9%	403.5 651 2.8%
China 1995 2014 growth rate	19.1 18 -1.0%	1.7 3.5 3.4%		1.2 6.6 9.5%	0.1 1 12.7%	22.1 29.1 0.98%
ODEs 1995 2014 growth rate	187.3 199 1.2%	39.1 95.3 5.4%	2.1 62.3 17.3%	17.6 21.7 0.43%	3.2 4.6 2.8%	249.1 382.9 2.7%
LDCs 1995 2014 growth rate	18.2 29.5 3.9%	2.1 14.5 10.8%	2.1 33.8 14.9%	0.86 0.93 1.9%	0.3 1.2 6.2%	23.6 79.9 7.5%
World 1995 2014 growth rate	1202.7 1725.3 1.9%	184.5 424 5.3%	23.8 237.3 12.7%	121.2 253.2 4.2%	10.2 36.5 7.1%	1542.5 2676.4 3.1%

Source: Author's Calculation based on the UNCTAD database.

Table C4. Values and growth of the world exports in all manufactures

All Manu.	IEs	EIEs	China	ODEs	LDCs	World
IEs 1995 2014 growth rate	2860 5328.6 3.1%	371.8 1164.9 6.4%	120.3 841.2 11.7%	186.6 418.8 5.0%	20.8 64.6 7.0%	3559.6 7818.1 4.2%
EIEs 1995 2014 growth rate	228.4 911 7.1%	36.2 197.5 10.4%	3.5 47.8 15.4%	25.6 142.9 10.4%	5.9 37.2 10.8%	299.5 1336.4 8.1%
China 1995 2014 growth rate	119.4 1492.6 14.6%	8 301.6 22.1%		5.7 213.9 20.8%	2.2 58.8 19.2%	135.3 2066.9 15.8%
ODEs 1995 2014 growth rate	36.6 183.5 6.3%	5.8 43.2 11.6%	0.3 23.7 23.4%	5.5 26.7 10.4%	1.7 10.5 11.7%	49.9 287.6 8.0%
LDCs 1995 2014 growth rate	4.6 36.2 9.6%	0.5 4.9 13.0%	0.04 1.5 17.4%	0.4 1.4 9.4%	0.3 3.3 14.6%	5.8 47.2 10.3%
World 1995 2014 growth rate	3248.9 7951.9 4.6%	422.2 1712 8.1%	124.1 914.2 12.0%	223.8 803.7 7.6%	30.9 174.3 10.3%	4050 11556.2 5.7%

Source: Author's Calculation based on the UNCTAD database.

Table C5. Values and growth of the world exports in labour/resource-intensive manufactures

Labour/Resource Manu.	IEs	EIEs	China	ODEs	LDCs	World
IEs 1995 2014 growth rate	413 515.4 0.8%	46.5 98.1 3.5%	22.9 35.4 1.7%	28.9 44.3 2.5%	3.2 7.2 3.3%	514.6 700.3 1.3%
EIEs 1995 2014 growth rate	79 162.3 3.1%	8.7 30.5 7.5%	0.7 5.9 10.4%	6.7 26.8 7.9%	1.9 7.7 8.1%	97.1 233.2 4.2%
China 1995 2014 growth rate	53.5 328.8 10.3%	2.8 70.8 19.1%		2 68.3 20.1%	1 22.9 18.0%	59.3 490.9 12.0%
ODEs 1995 2014 growth rate	22.8 80.7 5.2%	2 10.8 10.2%	0.1 5.8 21.8%	2 6.3 8.1%	0.5 3.4 11.5%	27.4 107 6.3%
LDCs 1995 2014 growth rate	3.9 32.5 9.7%	0.2 3 16.3%	0.02 0.7 14.6%	0.2 0.5 7.2%	0.1 1.1 13.6%	4.4 37.9 10.1%
World 1995 2014 growth rate	572.3 1119.8 3.2%	60.2 213.3 6.8%	23.7 47.8 2.9%	39.8 146.3 7.5%	6.7 42.3 9.9%	702.8 1569.4 4.0%

Source: Author's Calculation based on the UNCTAD database.

Table C6. Values and growth of the world exports in low skill/technology-intensive manufactures

Low Skill Manu.	IEs	EIEs	China	ODEs	LDCs	World
IEs 1995	248.7	34.5	12.9	28.2	7.1	331.4
2014	511.8	124	34.9	62.3	12.1	745
growth rate	4.5%	8.2%	7.4%	6.4%	5.1%	5.3%
EIEs 1995	26.8	6.4	1.1	5.2	1.2	40.6
2014	106.8	26.9	3.4	25	7.3	169.4
growth rate	8.5%	10.0%	7.0%	11.1%	10.5%	9.2%
China 1995	14.7	1.6		0.9	0.4	17.6
2014	136.5	41.6		38.5	11	227.6
growth rate	14.0%	21.5%		21.1%	20.9%	15.9%
ODEs 1995	2.4	0.7	0.04	0.7	0.4	4.2
2014	11.5	5.7	0.6	4.1	2	23.9
growth rate	8.6%	13.3%	18.6%	12.5%	11.6%	10.7%
LDCs 1995	0.2	0.1	0.0004	0.03	0.03	0.3
2014	0.9	0.7	0.2	0.2	0.5	2.5
growth rate	6.0%	13.7%	32.3%	17.2%	18.7%	11.8%
World 1995	292.8	43.1	14	35.1	9.2	394.2
2014	767.6	199	39.1	130	32.8	1168.5
growth rate	6.0%	9.8%	7.5%	9.1%	9.0%	6.9%

Source: Author's Calculation based on the UNCTAD database.

Table C7. Values and growth of the world exports in medium skill/technology-intensive manufactures

Medium Skill Manu.	IEs	EIEs	China	ODEs	LDCs	World
IEs 1995	1051.6	159	38.6	58.9	6.2	1314.2
2014	2003.6	478.8	279.7	154.7	26.4	2943.2
growth rate	3.1%	6.4%	12.5%	6.2%	8.5%	4.3%
EIEs 1995	63	10.3	0.5	6.1	1.6	81.6
2014	360.3	77	9.7	44.2	11.8	503.1
growth rate	8.6%	11.9%	18.3%	11.8%	12.0%	9.5%
China 1995	22.1	1.6		1.5	0.5	25.8
2014	352.6	89.9		63.3	16.1	521.9
growth rate	15.3%	24.4%		22.2%	19.4%	16.9%
ODEs 1995	3.4	0.9	0.02	1	0.3	5.6
2014	29.3	7.6	2.2	6.4	1.9	47.5
growth rate	10.3%	12.3%	24.3%	12.0%	12.5%	11.2%
LDCs 1995	0.2	0.03	0.004	0.1	0.1	0.3
2014	0.7	0.4	0.2	0.3	0.6	2.2
growth rate	7.4%	13.2%	22.7%	8.9%	14.7%	10.6%
World 1995	1140.3	171.9	39.1	67.5	8.7	1427.6
2014	2746.5	653.7	291.9	268.9	56.9	4017.9
growth rate	4.4%	7.8%	12.7%	8.4%	11.0%	5.5%

Source: Author's Calculation based on the UNCTAD database.

Table C8. Values and growth of the world exports in high skill/technology-intensive manufactures

High Skill Manu.	IEs	EIEs	China	ODEs	LDCs	World
IEs 1995 2014 growth rate	1146.7 2297.9 3.4%	131.8 464 6.9%	46 491.3 13.9%	70.6 157.5 4.0%	4.2 18.9 8.6%	1399.4 3429.5 4.7%
EIEs 1995 2014 growth rate	59.5 281.5 8.0%	10.7 63 10.7%	1.2 28.8 19.1%	7.6 46.9 10.4%	1.2 10.3 12.4%	80.2 430.5 9.0%
China 1995 2014 growth rate	29 674.6 18.2%	2 99.3 23.3%		1.2 43.9 20.1%	0.3 8.8 20.2%	32.6 826.6 18.7%
ODEs 1995 2014 growth rate	7.9 62 6.2%	2.2 19.1 11.7%	0.2 15.1 24.4%	1.8 9.9 10.5%	0.5 3.2 11.5%	12.6 109.2 8.4%
LDCs 1995 2014 growth rate	0.3 2 11.6%	0.2 0.8 6.8%	0.01 0.3 22.4%	0.1 0.3 7.0%	0.1 1.1 13.9%	0.8 4.6 10.6%
World 1995 2014 growth rate	1243.4 3318 5.0%	147 646 8.3%	47.3 535.5 14.2%	81.4 258.4 6.1%	6.3 42.4 10.9%	1525.5 4800.4 6.1%

Source: Author's Calculation based on the UNCTAD database.

Chapter 3. Determinants of Developing Countries' Export Upgrading: The Role of China and Productive Investment[32]

3.1. Introduction

By the 1970s, industrialisation had been at the core of development economics (Raffer & Singer, 2001; Ocampo & Ros, 2011). The Prebisch-Singer thesis and Thirlwall's law focus on the difference in income elasticity of demand between primary commodities and manufactures, pointing out the risk of specialising in primary commodities. Hirschman's unbalanced growth model and Kaldor's growth laws point out the special properties of manufacturing. After the neoclassical paradigm shift in development economics between the 1970s and the 1990s, which is represented by production homogeneity[33], trade regime neutrality, and allocative efficiency, industrialisation has been re-emphasised by many economists over the recent two decades. Particularly, the sophistication of a country's export basket has often been discussed in the recent literature as a signal of industrial development and a driver of economic growth (Rodrik, 2006; Hausmann, Hwang, & Rodrik, 2007; Hidalgo & Hausmann, 2009; Felipe, Kumar, Abdon, & Bacate *et al.*, 2012; Spatafora, Anand, & Mishra, 2012). If a country's export basket has a higher share of technologically and productively more sophisticated or more value-added products, say "rich-country" goods (Hausmann *et al.*, 2007), then this country is believed to have higher export sophistication. This has led to a change in the growth literature that the growth-enhancing effect of export is conditional on its product composition.

---

[32] This chapter has been co-authored with Dr Dic Lo (the second author) of the Department of Economics, SOAS University of London. Dr Dic Lo has contributed to part of Section 3.2.3 and part of Section 3.6, regarding the discussion on the distinction between local political-economic problems and institutions and the relationship between productive investment and local political-economic problems. I have contributed to the rest of this chapter.

[33] Production homogeneity refers to the view that all production activities/sectors are alike and generate the same effects on growth and development. The adoption of such view in trade theories leads to an argument that international trade is simply the exchange of labour hours without qualitative attributes such as skills and technology, which undermines the need of industrialisation and production upgrading (Reinert, 2006).

That is to say, exporting potato chips is seen as economically different from exporting micro-chips. Accordingly, upgrading export basket through increasing its sophistication has been considered as a core issue by many governments and international agencies (Harding & Javorcik, 2011; Zhu & Fu, 2013).

Therefore, understanding what factors determine the sophistication of a country's export basket is of great importance and relevance. Interestingly, efforts to examine determinants of export sophistication have also been urged by sociologists of the school of world-system theory. In their terminology, the question is expressed as examining the determinants of a country's upward mobility in the world system or the international division of labour (Mahutga & Smith, 2011). Since the seminal work on export sophistication by Hausmann *et al*. (2007), a small number of studies have examined the determinants of countries' export sophistication, showing the positive effects of income level, human capital, investment, and FDI (Cabral & Veiga, 2010; Kemeny, 2010; Weldemicael, 2012; Spatafora *et al*., 2012; Zhu & Fu, 2013). However, explorations into the determinants of export sophistication are still insufficient, especially for developing countries, and need to be methodologically improved (Zhu & Fu, 2013).

Developing countries encounter more difficulties in upgrading their export basket due to constraints of resource and capability (Harding & Javorcik, 2011). Hausmann and Rodrik (2003) and Hausmann *et al*. (2007) demonstrate entrepreneurs' underinvestment in new production activities in developing countries as a result of uncertainty and externalities. Thereby, they suggest developing countries to use appropriate policy to protect entrepreneurship and stimulate investment. Accumulating productive investment is especially important for developing countries, because they have to inaugurate industrialisation at a low level of capital per worker (Szirmai, 2012). Lo (2016) further argues that the level of productive investment reflects particular political-economic embeddedness and that it is the insufficient productive investment that leads to developing countries' poor manufacturing performance. This echoes the argument that industrialisation is a process driven by motivations and interests of various political and social agents (Kiely, 1998). These agents' conceptualisation and realisation of their roles in industrialisation are embedded in particular endemic political-economic context, reflecting on the level of productive investment. Therefore, productive investment should be understood as not only an economic determinant but also a socio-political determinant of export upgrading.

A factor that has tended to be neglected in the export sophistication literature is the impact of China on developing countries. Since the late 1990s, China has become an increasingly important trade partner for developing countries. As a major buyer of primary commodities and a major supplier of manufactures, how China has influenced developing countries' industrial development has been a highly contentious topic. Existing studies tend to examine this influence by looking at how China's export supply and import demand have impacted on prices and supply in both the global market and developing countries' local market. This can be read as the direct impact of China on developing countries[34]. Many studies suggest that China has crowded out developing countries' manufacturing and re-primarised their economic structure. Lall and Weiss (2005) and Jenkins (2010) even argue that China's trade relationship with developing countries has reproduced the old centre-periphery relationship. However, existing studies tend to neglect an indirect channel through which the monetary gains from trade with China may influence developing countries' capital accumulation and industrial production[35]. China's great import demand benefits many developing countries by the improvement in their income

[34] It should be noted that the direct channel and the indirect channel defined in this chapter are irrelevant to the direct impact (on home market) and the indirect impact (on third market) of China on developing countries defined by Kaplinsky (2009).
[35] Meyersson, i Miquel, and Qian (2008) show that natural resource exports to China increase Sub-Saharan African countries' investment. However, their study simply concerns developing countries' exports to China rather than changes in their terms of trade *vis-à-vis* China as a result of bilateral trade flows.

terms of trade *vis-à-vis* China, indicating absolute gains accruing to these countries as potential productive investment for export upgrading. Moreover, existing studies' emphasis on China's direct impact on developing countries through changes in prices and supply leads to a consequence that these studies tend to focus on the quantitative side of the story such as changes in the market share of developing countries' manufactures, but much less attentions have been paid to the qualitative side of the story, say how China has influenced the sophistication of developing countries' export basket.

Therefore, this chapter aims to connect the literature on export sophistication and the literature on China's impact on developing countries, bringing the "China" factor to the former and bringing export sophistication to the latter. We examine the determinants of developing countries' export upgrading measured by export sophistication from 1995 to 2014. In addition to general contributors (e.g., geography, human capital, investment, institutions, and FDI inflow), a special interest lies in the hypothesis that developing countries' growing trade with China may serve as a source of productive investment for their export upgrading. The empirical analyses rely on disaggregated export data from the BACI database at the HS 6-digit level for 62 developing countries. Emerging countries and developing countries that specialise in mineral fuels are excluded[36][37]. Moreover, we use dynamic panel estimation based on System GMM to address the path dependence of export upgrading and endogeneity.

We find that accumulating productive investment, improving education, and promoting openness can stimulate export upgrading. Moreover, absolute gains from

[36] We define emerging countries based on the UNIDO country classification (UNIDO, 2013). Countries such as Brazil, Colombia, Kazakhstan, India, South Africa, and Venezuela are classified under this category.
[37] Because we measure export sophistication by the EXPY indicator (Hausmann *et al.*, 2007), the sophistication level of developing countries that specialise in mineral fuels is a special case, which does not reflect their productive and technological capabilities. Footnote 11 discusses this issue.

trade with China, reflecting on improvement in income terms of trade *vis-à-vis* China, also promote developing countries' export upgrading. Importantly, mediation analysis shows that this export-upgrading effect takes effect largely through the enhancing effect of trade with China on developing countries' productive investment. In this regard, China as a source of productive investment is a positive factor for developing countries' industrial development. Meanwhile, we find a slight export-downgrading impact of China's exports, mainly manufactures, on developing countries that specialise in manufactures, but no evidence for re-primarisation has been found. Our findings provide a new perspective to understand how China has influenced developing countries' industrialisation. In contrast to the prevalent argument of crowding-out and re-primarisation, we suggest that, for developing countries, China serves more as a stimulator of capital accumulation than a competitor in manufacturing market or a predator of natural resources. Accordingly, the priority for developing countries is the appropriate use of gains from trade for productive purpose. To this end, we highlight the importance of developmentally-oriented political and social agents (e.g., the state and entrepreneurs).

This chapter is organised as follows. Section 3.2 discusses theoretical framework of export upgrading and its determinants as well as the impact of China. Section 3.3 discusses the measure of export upgrading by export sophistication, and introduces data and country sample. Section 3.4 presents descriptive evidence of developing countries' export sophistication. Section 3.5 discusses empirical strategy for the estimation of the determinants of export upgrading and presents results. Section 6 concludes this chapter.

3.2. Analytical Framework of Export Upgrading

3.2.1. Export Upgrading and Development

What underlies export upgrading is the transformation of a country's specialisation pattern towards more sophisticated products, namely, manufactures. In this regard, export upgrading, which can be measured by export sophistication, is intrinsically associated with industrialisation. Although export sophistication *per se* is a relatively young concept, its theoretical underpinnings can be traced back to the industrialisation-centred classical development economics prior to the 1980s. In the late 1940s and the early 1950s, the Prebisch-Singer hypothesis (Prebisch, 1950; Singer, 1950) uncovers the unequal exchange between developing countries at the periphery as suppliers of inelastic primary commodities and developed countries at the centre as suppliers of elastic manufactures[38]. The positive trend of terms of trade for developed countries and the negative one for developing countries lead the latter to export more but gain less, which obstacles their development. Moreover, in developed countries, technological progress, basically in modern sectors, leads to higher wage, whereas in developing countries technological progress, mostly in traditional sectors, results in lower exporting prices of primary commodities and relatively lower wage. This factor acts as another channel through which specialising in primary commodities results in deteriorating terms of trade. Economists following the Prebisch-Singer hypothesis thus urge to industrialise developing countries.

In the late 1950s, Albert Hirschman's unbalanced growth model (Hirschman, 1958) regards manufacturing as the driving force of economic growth through its great backward and forward linkages with the rest of the economy. A given activity of

[38] At later stage, Hans Singer and others revisited the Prebisch-Singer hypothesis by considering the growing share of manufactures in exports from developing countries (e.g., Singer, 1975; Sarkar and Singer, 1991). They find that the declining terms of trade in the original Prebisch-Singer hypothesis still holds true.

manufacturing production stimulates other production activities in both the two directions by purchasing outputs of upstream sectors as inputs and providing outputs to downstream sectors as inputs, while agriculture, which lies in the primitive production stage, tends not to be linked with other production activities. This is the so-called "production linkage" through input and output in the physical terms. Another form of linkage, which has become increasingly important, is "technological linkage". It is particularly concerned with spillovers of knowledge and technology from manufacturing to other sectors, because manufacturing is the major source of technological progress and innovation. In the 1960s, Nicholas Kaldor's growth laws (Kaldor, 1966 and 1967) point out the positive association of manufacturing growth with overall economic growth and productivity growth. The faster the growth of manufacturing is, the faster is the growth of the overall economy, manufacturing productivity, and the overall productivity. In the 1970s, Thirlwall's law (Thirlwall, 1979) relates developing countries' sluggish growth and the growing North-South divide to the income elasticity of demand for their exports and imports. The core argument is that a country's growth rate relative to that of the rest of the world depends on the ratio of the rest of the world's income elasticity of demand for this country's exports, e_{rw}, to this country's income elasticity of demand for its imports from the rest of the world, e_a. Davidson (1990) suggests that, in the global free trade market, developing countries export primary commodities with low e_{rw} while import manufactures with high e_a from developed countries. Consequently, developing countries' growth rate is certainly slower than the rest of the world ($\frac{e_{rw}}{e_a} < 1$), and the North-South divide has a tendency to be increasingly widened. Therefore, it is relevant for developing countries to upgrade their export structure in order to achieve faster economic growth (Thirlwall, 2011).

It is straightforward to see that classical development economics holds a sectoral approach towards development. That is to say, development is driven by those dynamic sectors, such as manufacturing (Thirlwall, 2003). The sectoral composition of growth pattern, rather than simply growth rate, matters (Singer, 1998). In the late 1970s and the 1980s, however, development economics experienced a paradigm shift in its theoretical basis, leading to a shift in research subject and methodology. The essential role of industrialisation and industrial policy in development process and the sectoral approach were abandoned. Instead, the new neoclassical paradigm holds a vision of "commodity blindness" on development (Amsden, 1987), which ignores the difference between dynamic sectors (e.g., manufacturing) and static sectors (e.g., agriculture and mining). Neoclassical economics puts allocative efficiency of resources and endowments at the core of gains from trade, instead of technical efficiency through learning by doing and spillovers. This is a "conspicuous silence" on technical efficiency (Nayyar, 1997). The maximisation of gains from trade is, in the neoclassical perspective, realised via the optimisation of the distribution of resources and endowments on a global scale. As a result, comparative advantages have been enshrined again as the "natural" path towards development. Accordingly, in the policy-making sphere, "trade regime neutrality" serves as the pillar of the policy proposal of outward-looking strategy by international agencies (Lo, 2004). According to the "trade regime neutrality", developing countries simply need to follow the predetermined world labour division and export primary commodities and low-end manufactures, without the need of state intervention and industrial policy.

Over the recent two decades, however, the pro-manufacturing vision on development has experienced a revival (Andreoni, 2013; Andreoni and Gregory, 2013). The transformation of production structure from low value-added production into high value-added production is regarded as the precondition of economic development (Spatafora *et al*., 2012; Fortunato and Razo, 2014). In particular, technological level of export basket has been growingly seen as a signal of the transformation of the overall production structure. Hausmann *et al*. (2007) suggest that a country will become what it exports. Different export structures have different developmental effects: specialising in sectors or products that embody more human capital and technology has a larger positive effect on technological progress and economic growth (Lall, 2000; Rodrik, 2006). A key finding of Hausmann *et al*. (2007) is that higher export sophistication, which is a proxy for the technological and productive level of a country's export specialisation, is a robust predictor of higher subsequent economic growth. As a telling example, Hausmann (2006) demonstrates that China's export sophistication is disproportionately higher than its income level and China has experienced spectacular high growth rate. By contrast, low-end specialisation will block economic growth, because of the vicious spiral between trade specialisation and growth (Amable, 2000). Thus, a primary reason of being poor is low and narrow specialisation pattern (Felipe, Kumar, and Abdon, 2014), and it is the difference in technology or, more specifically speaking, the capability to produce more sophisticated products that generates the difference in countries' growth performance and income level (Gerschenkron, 1962; Saviotti and Frenken, 2008; Felipe *et al*., 2012). This argument deviates from the conventional "fundamentals" approach towards the determinants of export structure, which argues that a country's comparative advantages in endowment determine what it should export.

The pro-manufacturing vision also involves the issue of state intervention. For developing countries or late comers, market force may not be beneficial to the development of sophisticated and dynamic sectors. In fact, conforming to comparative advantages and pursuing allocative efficiency tend to lead to a technologically and structurally inferior specialisation pattern for developing countries in contrast to the pattern induced by state intervention, which is just opposite to the neoliberal assumption that market force will produce similar specialisation pattern as state intervention can (Amsden, 1994; Kiely, 1998). This is due to the uneven distribution of productivity, technology, and power between developed and developing countries. Thus, government policy has a positive role to play in upgrading export structure (Hausmann *et al*., 2007). Theoretically, this echoes the appeal for state intervention in classical development economics. Some particular sectors feature greater Marshallian externalities with increasing returns and strong learning effect than others. Promoting such sectors in the way of protection or subsidy is welfare-enhancing (Nunn and Trefler, 2004; Lehmann and O'Rourke, 2008; Harrison and Rodríguez-Clare, 2010). Practically, the pro-industrial policy vision in the export sophistication literature echoes the industrial protectionism implemented by South Korea and Taiwan during their early industrialisation stage (Raffer and Singer, 2001). Put the issue under a broader context, developing countries need to strategically integrate themselves into the global economy by utilising imported technology and capital goods to upgrade their export structure, rather than simply following trade regime neutrality by specialising based on comparative advantages (Lo, 2012).

3.2.2. Determinants of Export Upgrading

Traditional international trade theories use a "fundamentals" view of the world to explain a country's export composition based on its fundamentals or, alternatively speaking, endowments (Hausmann *et al*., 2007). In the early supply-side trade theories, such as the Ricardian model and the Heckscher-Ohlin model, fundamentals refer to comparative advantages in productivity or abundance of endowment. A country should produce and export products that intensively use its most abundant or efficient production factors. Accordingly, countries with abundant natural resources are expected to export primary commodities, and those with abundant labour resources are expected to export labour-intensive products. The concept of fundamentals can also be extended to institutions, human capital, physical capital, and technology (Hausmann *et al*., 2007). For instance, countries with advanced technology and human capital, such as developed countries, should export technology- and skill-intensive products. Importantly, unlike natural and labour resources, technology and skill are not completely predetermined. Instead, they can be endogenously created or imported through international trade and FDI (Grossman and Helpman, 1991; Schiff and Wang, 2006; Wang and Wei, 2008; Harding and Javorcik, 2011). Imported foreign knowledge and technology have key roles to play in promoting income growth and productivity (Coe and Helpman, 1995; Lee, 1995). New international trade theories, represented by the Linder model and the Krugman model, provide a third strand of explanation for a country's export composition, which is based on preference (e.g., consumers' love of variety) and production (e.g., economies of scale). However, it should be noted that new international trade theories are established on a premise of trade between similar countries. In this sense, these theories explain export composition conditional on the relationship between trade partners rather than conditional on a country's endowment and capabilities. This renders them less relevant to the discussion of this chapter.

The fundamentals-based international trade theories leave limited, if any, space for policy-directed export upgrading. In other words, changes in export specialisation are largely the passive outcome of changes in endowment (Hausmann and Klinger, 2006). An exception may be the endogenous creation of knowledge and technology, which, however, applies more to developed countries than developing countries. In this regard, the "fundamentals" approach is intrinsically associated with the neoclassical "trade regime neutrality" and "commodity blindness", which ignores differential developmental effects of different sectors. In contrast, classical development economics and classical development theories follow the sectoral approach towards development, arguing that political and social agents, especially the state, can select particular dynamic sectors to stimulate industrialisation and development through, for example, industrial policy. This implies that a country can defy, rather than follow, its predetermined fundamentals and that defying the predetermined fundamentals and ascending the ladder of product sophistication are beneficial to structural transformation. For example, Lectard and Rougier (2018) find that developing countries that deviate from their comparative advantages, say, those whose capital content in exports is higher than overall capital endowment of the economy as a whole, tend to export more sophisticated products. What fall in the core of "defying comparative advantages" are motivations of and commitments to industrialisation by political and social agents, such as the state and entrepreneurs. In particular, productive investment, amongst others (e.g., R&D and education), is central to the realisation of these agents' roles in industrialisation and structural transformation, which will be discussed in Section 3.2.3.

Similar arguments can also be found in the capability theory of production, which treats a country's export structure as the reflection or outcome of its productive capabilities (Andreoni, 2011). Production activities can be conceptualised as a network of interrelated tasks through which materials are transformed into outputs according to particular capabilities with the constraints of scale and time (Andreoni, 2010). Accordingly, productive capabilities, which are the major driver of structural transformation, can be defined as skills, knowledge, and experience embedded in agents and organisations that are needed by firms to perform various productive tasks and to undertake technological and organisational improvement (Andreoni, 2011). This definition is at the micro/firm level, but can be generalised to the macro/country level. According to Andreoni (2011), productive capabilities reflect on both static and dynamic efficiency. The former refers to skills, knowledge, and experience required to perform particular productive tasks and a set of related activities, while the latter refers to technological capabilities needed to fulfil technological and organisational changes (e.g., R&D). Importantly, the realisation of the static efficiency is conditional upon a certain material basis (e.g., means of production), which is defined as production capacity. Investing in means of production enhances production capacity. In turn, enhanced production capacity transforms tangible and intangible productive capabilities into real productive outputs. This echoes the emphasis of Lo (2016) on the centrality of productive investment in manufacturing performance. Following this logic, Andreoni (2011) suggests that both "knowledge ingredient" (e.g., human capital, R&D, FDI inflow, and imports in capital goods) and production capacity (e.g., means of production) are determinants of productive capabilities, which reflect on a country's export structure. That is to say, a country's productive capabilities are a collective reflection of its static and dynamic capabilities and production capacity. Therefore, insufficiency in the building of productive capabilities and/or the investment in production capacity impedes the upgrading of a country's production and export structure.

The determinants of developing countries' export sophistication can be derived from traditional fundamentals-based international trade theories on the one hand, and classical development economics, the recent export sophistication literature, and the capability theory of production on the other. The first set of determinants refers to fundamentals, which can be divided into uncontrollable factors and controllable factors. The former includes a country's geography and endowment, and the latter refers to human capital, institutions, trade, and FDI inflow. China's impact is considered as part of the impact of trade and will be discussed in Section 3.2.4. The second kind of determinant refers to productive investment, which reflects political and social agents' motivations of and commitments to industrialisation. It will be discussed in Section 3.2.3.

Geography has been widely found in the literature to affect export performance. Access to sea may be one of the most important geographical variables for trade. Radelet and Sachs (1998) find that landlocked location reduces export quantity. Another geographical attribute is distance. Anderson and van Wincoop (2004) find that distance reduces bilateral trade. Weldemicael (2012) finds that distance from major markets reduces export sophistication. Parteka and Tamberi (2008) and Regolo

(2013) demonstrates that larger bilateral distance reduces export diversification. Access to sea and remoteness can also be seen as proxy for trade costs. It is reasonable to argue that higher trade costs weaken a country's competitiveness in target markets and then reduce its export sophistication. Because developing countries are generally less competitive in sophisticated products, the impact of geography should be greater for them.

Natural resources have been found to negatively affect a country's socio-economic performance, the so-called "curse of natural resources" (Sachs and Warner, 1995; Sachs and Warner, 1997; Sachs and Warner, 2001). In particular, abundant natural resources are likely to be associated with low motivation of production diversification and upgrading. Some econometric evidence, however, rejects the "curse of natural resources" and even shows positive effects of natural resources on economic growth (e.g., Manzano and Rigobón, 2001; Lederman and Maloney, 2007). In the export sophistication literature, Hausmann *et al*. (2007), Cabral and Veiga (2010), and Zhu and Fu (2013) use land per capita as a proxy for the abundance of natural resources and find negative impact. Cabral and Veiga (2010) also use the dummy of net oil exporting countries as an additional measure of natural resources and find insignificant impact.

Human capital has been found to be an important contributor to export sophistication. In endogenous growth theory, human capital is a major source of knowledge creation and economic growth (Lucas, 1988; Romer 1990; Howitt and Aghion, 1992). Schott (2008) suggests that abundant human capital ensures developed countries' sophisticated export composition. Parteka and Tamberi (2008) argue that greater human capital is associated with more dynamic and heterogeneous economic environment, thus stimulating production diversification. Similarly, in the self-discovery model by Hausmann and Rodrik (2003) and Hausmann *et al*. (2007), human capital expands the portfolio of "discoverable goods" and promotes new production activities. In addition to human capital, trade represents another channel of knowledge creation (Grossman and Helpman, 1991; Coe and Helpman, 1995; Coe, Helpman, and Hoffmaister, 1997). Importing capital goods helps the importing country to directly access R&D made in the exporting country (Harrison and Rodríguez-Clare, 2010). Bell (2007) terms this channel as "international transaction-embedded" learning process and argues that international transactions are the only realistic way for developing countries to acquire foreign technology. Recent studies have gradually shifted the focus away from trade to FDI as a source of foreign knowledge. Weldemicael (2012) distinguishes between direct and indirect effects of FDI on export sophistication. The former refers to sophisticated exports by firms with FDI background, which tend to be more productive and more integrated into the global value chain. The latter refers to the spillover effect of FDI with respect to the rest of the economy through production linkages. Finally, institutions have been increasingly considered as a covariant in international trade studies, and better institutions are seen as a comparative advantage (Levchenko, 2007). Some goods are more institutionally dependent than others. They are the so-called "institution-intensive" goods. Such goods tend to feature multiple production stages, complex sourcing from different input suppliers, and higher technological contents. It can be argued that more sophisticated products require better institutions, and thus institutions are in theory a determinant of how sophisticated a country's export basket can be.

3.2.3. The Role of Productive Investment

Another determinant of export upgrading is productive investment. By definition, productive investment falls within the category of physical capital. In traditional trade theories, physical capital is defined as part of a country's endowments or fundamentals. However, this chapter conceptually treats productive investment as a proxy for a country's efforts to invest in industrial production rather than a predetermined endowment. Higher commitment to industrialisation is expected to stimulate productive investment. This echoes the positive role of political and social agents, especially the state, in promoting industrialisation suggested in classical development economics and classical development theories. Lo (2016) demonstrates the great difference in productive investment between China and developing countries, suggesting that it is this difference in productive investment that leads to the great difference in manufacturing performance between China and developing countries. This viewpoint is in line with the argument in the seminal work of *Monopoly Capital* (Baran and Sweezy, 1966) that social surplus indicates the extent to which a country can accomplish its goal of growth and development and that investment is a core component of social surplus.

Since the level of productive investment largely reflects the motivations and interests of political and social agents, which are embedded in given political-economic context, the insufficiency of productive investment is a reflection of endemic political-economic problems. Lo (2016) shows that, at the aggregate level, developing countries have experienced positive trends of terms of trade in the recent two decades, which implies gains from trade, but their manufactured exports have not performed well. Accordingly, he argues that developing countries' failure in translating gains from beneficial terms of trade into productive investment is the deep cause of their poor manufacturing performance and this failure can be ascribed to their "broader political-economic problems".

Importantly, the term of "broader political-economic problems" (Lo, 2016) is not equivalent to the mainstream terminology of institutions. Aside from its political dimensions (e.g., accountability, democracy, political stability, and freedom), institutions in the mainstream terms tend to be interpreted as governmental efficiency and effectiveness, regulatory quality, control of corruption, rule of law, and enforcement of contract (Kaufmann, Kraay, and Mastruzzi, 2011), which reflects the quality of the role played by the authorities in guaranteeing the functioning of the market and in promoting private sectors. The World Bank's 2002 *World Development Report* was even entitled *Building Institutions for Markets*. In this regard, institutions in the mainstream terms, as an indication of a country's market friendliness, are not necessarily relevant to motivations of political and social agents, especially political and economic elites, to promote industrialisation, partly because pro-industrialisation measures may not always be market-friendly. For instance, industrial policy encourages the government to select and promote particular sectors, which clearly deviates from market-friendly institutions. More generally speaking, developmental state best exemplifies political and social agents' motivations and commitments. Leftwich (1995) summarises some stylised facts of developmental state that obviously "violate" the so-called "good institutions": concentrated and strong political power of the central government that can shape and pursue particular development goals and can direct and organise the economy, developmentally-oriented elites, relatively weak civil society, and relatively weak civil rights. However, it must be noted that relatively weak civil rights or civil society are not the sufficient condition for developmental state, because they may lead to predator/rentier state as well (Kiely, 1998). Instead, development state may be implicitly seen as the sufficient condition for relatively weak civil rights or civil society. Kiely (1998) reviews the literature on the state-society relationship, highlighting the key point that the state should develop and maintain effective control of and intervention in the economy, especially in an autonomous way, and appropriately manage and coordinate interests of different social groups (Seddon and Belton-Jones, 1995).

Rather, both institutions in the mainstream terms and political and social agents' industrialisation motivations are largely determined by particular endemic political-economic embeddedness. Kiely (1998) argues that industrialisation is a social process, because it is ultimately socially determined. That said, the process of industrialisation and the innovation of technology along with industrialisation are rooted in specific social-political context and reflect the interests and motivations of particular groups of agents (Kitching, 1982; Kiely, 1998). This implies that the examination of the determinants of industrialisation should take into account, in addition to generic contributors (e.g., technology and human capital), those context-specific factors that influence the conceptualisation and realisation of the government's and other social agents' roles in promoting industrialisation and development. These factors can be generalised as "broader political-economic problems" (Lo, 2016), which are embedded in local political, economic, and social context. The "broader political-economic problems" determine social agents' motivations of industrialisation via, at least, their influence on productive investment. Because it is difficult to quantitatively measure these context-embedded factors, productive investment is a good proxy for the "broader political-economic problems" or, alternatively speaking, political-economic embeddedness. Moreover, productive investment is in fact also a proxy for industrial policy or, more generally speaking, policies of promoting production upgrading. Lectard and Rougier (2018) points out that such policies often target at the sectoral or even firm level, which is difficult to measure, but they reflect on the country-level capital intensity of production.

3.2.4. China and Developing Countries' Export Upgrading

China's factor is another concern for developing countries' exports upgrading. Over the recent two decades, China has become an increasingly important trade partner for developing countries. The influence of China on developing countries has raised widespread concerns. Table 3.1 shows the fast growth of China's share in exports and imports of various groups of developing countries in 1995 and 2014. Only developing countries specialising in manufactures (MANUs)[39] still have quite low share of China in their export basket (5.7% in 2014). The first channel through which trade with China influences developing countries lies in the composition of China's exports and imports. Despite great productive capabilities in medium and high technology-intensive manufactures, China still has advantages in labour-intensive manufactures (Baliamoune-Lutz, 2011). Therefore, China's manufactured exports may crowd out or displace developing countries' manufacturers in both their home markets and third markets. This "crowding-out" impact has been widely found for Sub-Saharan Africa and Latin America (e.g., Kaplinsky, McCormick, and Morris, 2007; Moreira, 2007; Kaplinsky and Morris, 2008; Power, 2008; Freund and Ozden, 2009; Giovannetti and Sanfilippo, 2009; Fu, Zhang, and Kaplinsky, 2012). For another thing, China's commodity boom and the subsequent upward trend in primary commodity prices may act as a "push" factor to lead some developing countries to increasingly specialise in primary commodities and then experience export downgrading. The export-side and the import-side factors of trade with China thus produce a consequence of the so-called "re-primarisation".

Table 3.1. China's share in developing countries' trade: 1995 versus 2014 (%)

Developing Countries	**China's Share in Exports**		**China's Share in Imports**	
By Export Specialisation	1995	2014	1995	2014
AGRIs	2.6	11.8	3.9	15.8
MINEs	5.2	23.1	5.6	19.2
FUELs	2.9	20.5	2.1	17.6
MANUs	0.8	5.7	2.8	14

Source: Author's calculation based on the BACI database.

Another channel takes place through developing countries' absolute gains from trade with China as a source of productive investment. Capital accumulation, which is partly dependent on terms of trade, is crucial to economic development (Somel, 2005). China's rapidly-growing demand for primary commodities and supply of

[39] AGRIs, MINEs, FUELs, and MANUs refer to major exporting countries of agricultural products, non-fuel minerals, mineral fuels, and manufactures, respectively. All groups refer to the case of developing countries. Classification details are shown in Section 3.2.

cheap manufactures lead to rising export prices and volumes but decreasing import prices for many developing countries specialising in primary commodities. As a result, these countries' income terms of trade (ITOT) *vis-à-vis* China will improve[40]. For developing countries specialising in manufactures, the trends of their income terms of trade *vis-à-vis* China remain an empirical question. Time series analysis in Table 3.2 shows that developing countries specialising in manufactures (MANUs) have experienced positive trends in their income terms of trade *vis-à-vis* China, but to a lesser extent than the positive trends for other groups of developing countries, especially those specialising in mineral fuels (FUELs). This clearly shows that even developing countries specialising in manufacture, which may directly compete with China, have absolute gains from their trade with China.

Table 3.2. Trends of ITOT of developing countries *vis-à-vis* China: 1995-2014

Country Group	r (TS)	$Adj\ R^2$	DW Statistics
AGRIs	0.18*** (0.17***, 0.21***)	0.83 (0.92, 0.62)	0.69 (1.94, 2.15)
MINEs	0.17*** (0.17***, 0.18***)	0.94 (0.96, 0.83)	1.1 (1.81, 1.72)
FUELs	0.21*** (0.21***, 0.19***)	0.92 (0.86, 0.82)	1.27 (1.76, 1.9)
MANUs	0.13*** (0.13***, 0.11***)	0.84 (0.97, 0.33)	0.6 (1.71, 1.66)

Note: Trend rate is estimated by fitting the trend equation: Log(*ITOT*)=*a*+*rt*+*u*, where *t* is the time (year) variable and *r* is the trend rate. *** p<0.01, ** p<0.05, * p<0.1. *ITOT* is defined as net barter terms of trade (*NBTOT*) multiplying export volume. In the case of 1st-order autocorrelation, trend rate, R^2, and transformed Durbin-Watson statistics under Prais-Winsten estimation and Cochrane-Orcutt estimation are shown respectively in brackets. 5% significance level is used for Durbin-Watson critical value (1.411).

However, as suggested by Paus (2009), whether revenues from primary commodity exports are appropriately used is more important than simply gaining them. She argues that the use of revenues depends on how the government conceptualises its role in development, which echoes the "broader political-economic problems" (Lo, 2016) and the importance of political agents (Kiely, 1998). Gallagher and Porzecanski (2009) question Latin America's ability to direct rents from commodity boom, especially China's boom, to stimulate development, showing negative evidence in spite of "good institutions". Gottschalk and Prates (2006) suggest developing

[40] Income terms of trade is defined as net barter terms of trade multiplied by export volume index. Net barter terms of trade reflects a country's relative gains from trade. Income terms of trade reflects a country's absolute gains from trade.

countries to capture the current exceptional commodity boom and direct commodity revenues to investment in tradable sectors and infrastructure construction. The failure in translating resource rents into production activities may lead developing countries to miss the opportunity of production diversification and then risk their "re-primarisation" (Cypher, 2007). Another concern is foreign ownership. FDI inflows going to many developing countries, especially SSA countries and South American countries, tend to concentrate in natural resource sectors (CEPAL, 2012; World Bank, 2014; Chen, Geiger, and Fu, 2015). Gottschalk and Prates (2006) suggest that foreign ownership in these sectors and inappropriate regulations on profit remittance and distribution may impede the transfer of natural resource revenues to domestic investment.

3.3. Measurement, Data, and Country Sample

3.3.1. Measuring Export Sophistication

Hausmann *et al*. (2007) develop an indicator of "EXPY" to reflect a country's export sophistication, which is measured by the associated income level of all products in this country's export basket. According to Andreoni (2011), EXPY is a trade-based indirect measure of country-level productive capabilities. In particular, a country's export sophistication is a proxy for its frontier of productivity, because firm heterogeneity model argues that only the most productive firms are able to export (Melitz, 2003). The EXPY index and other similar indices following the same rationale are different from conventional product taxonomies that are based on prior assumptions of the technological intensity of a sector (e.g., manufacturing is more sophisticated than agriculture), because they are outcome-based indicators that classify technological level based on empirical calculation (Lall, Weiss, and Zhang, 2006; Klinger, 2009). The underlying rationale is that a particular product embodies a certain level of technology, human capital, management, and other production-related factors, and these embodied factors can be reflected by the income level of countries that export this product. In other words, the sophistication of a given product is a function of productive capabilities that are required by the production of this product (Andreoni, 2011). Provided that there is no trade intervention, products mainly exported by rich countries tend to embody high level of technology, human capital, and management[41], because it is these characteristics that enable high-wage producers from rich countries to have competitiveness in these products (Lall *et al*., 2006). Generally speaking, the higher is the mean income level of exporting countries of a given product, the higher is the sophistication of this product. In this sense, a country's productive capabilities can be revealed by the sophistication of its export basket. A country is said to have higher export sophistication, if its export basket contains a higher share of products with higher sophistication, namely rich-country goods. That is to say, its export basket is more similar to that of a typical rich country. Prior to Hausmann *et al*. (2007), Michaely (1984) proposes an index of "income level of exports" and Lall *et al*. (2006) develop an index of "sophistication of exports". However, these two indices are much less used in the literature, in comparison to the EXPY by Hausmann *et al*. (2007). They follow a similar approach as that of Hausmann *et al*. (2007) to quantify the sophistication of a country's export basket by the associated income level of its exported products[42].

Importantly, the index of export sophistication should not be read simply as a

[41] A striking exception is mineral fuel, especially petroleum and natural gas. These products have relatively high associated income level (PRODY), because some rich but not developed countries (e.g., the Gulf countries) take a major share in the world exports in mineral fuels. However, as a capital-intensive extractive sector, mineral fuel sector does not have high spillover effect or linkages with the rest of the economy. If a country specialises in mineral fuels, it may have numerically high export sophistication. However, such spuriously high export sophistication does not indicate high technological and manufacturing capabilities for the economy as a whole.

[42] Lall *et al*. (2006) use each country's share in the world export of a particular product, rather than their RCA in this product, as the weight in the formula of product sophistication. This will overestimate the role of a large country that does not actually have RCA in this product and underestimate the role of a small country that has RCA.

reflection of a country's technological level. A developing country's abilities to produce and export (relatively) sophisticated products implies that it has mastered both the "hardware" (e.g., technology and facilities) and the "software" (e.g., management) that are required by these products (Page, 2012). As aforementioned, what is revealed by the sophistication of a country's export basket is this country's overall productive capabilities (Andreoni, 2011). In other words, EXPY, as an outcome-based indicator, captures the overall capabilities required for the production of a given export basket. Development can be therefore seen as a process of transformation to produce goods that are associated with higher income level, which is a process of accumulating new productive capabilities.

An advantage of this approach is that it measures product characteristics based on the characteristics of exporters (exporting countries) reflected by export data rather than the characteristics of "parent" industries reflected by industry data on factor content or technology intensity, such as R&D and number of patents (Lall *et al*., 2006). Trade data feature a high level of disaggregation (e.g., 6-digit level or even more) and great availability for a wide range of countries, while industry data (e.g., R&D) are much less available, especially for developing countries, and are collected at a high level of aggregation (e.g., 2-digit level or even country level). Classification based on aggregate industry data tends to conceal heterogeneity in actual technological level across products within a given product category and cannot give unique measurement of sophistication for each particular product. In contrast, disaggregated trade data can largely avoid such misclassification by differentiating between different products under the same product category at a more disaggregated level (Lall *et al*., 2006; Hausmann and Klinger, 2007).

Moreover, industry data only partially reflect a country's productive capabilities, mostly the technological aspect. According to the capability theory of production (Andreoni, 2010 and 2011), productive capabilities have four interrelated and complementary dimensions, namely, static capabilities (e.g., skills, knowledge, and experience), dynamic/technological capabilities (e.g., R&D), production capacity (e.g., means of production), and capability enablers (e.g., infrastructure)[43]. Technological capabilities, as reflected by industry data, are just one of the four components. Without a certain level of production capacity and capability enablers, neither static nor dynamic capabilities, say, the knowledge ingredients, can be fully realised. In particular, the relevance of the technological aspect of productive capabilities may be relatively weak for developing countries. Andreoni (2011) distinguishes between two types of functional activities: productive activities and technical change activities. The former refers to undertaking productive tasks based on existing technological, technical, and organisational conditions, requiring static productive capabilities (e.g., skills, knowledge, and experience). In comparison, the latter refers to undertaking changes and innovations with respect to existing conditions, requiring dynamic/technological capabilities (e.g., R&D). It is easy to see that static capabilities, production capacity, and capability enablers are more important and relevant to developing countries than dynamic capabilities, because developing countries largely involve themselves in standardised production with limited product and process innovations. Unlike technological capabilities, static capabilities, production capacity, and capability enablers tend not to reflect on industry data.

In fact, even if the interest is confined to the technological side of production or product, classifications with regard to factor content/technological intensity based on industry data are still poor indicators of embodied technology and knowledge of products. This is because that such classifications do not reflect the contribution of knowledge-intensive intangibles (e.g., coordination and marketing) and technology and skill embodied in production process rather than in R&D process, which have

[43] Static and dynamic capabilities (knowledge ingredients) and production capacity constitute capability determinants (Andreoni, 2011).

been increasingly important (Kaplinsky and Santos-Paulino, 2005)[44]. Another problem of conventional indicators based on industry data is that the variables which are used to construct these indicators (e.g., R&D) are actually proxies for the determinants of products' intensity of technology and know-how or, more generally speaking, producers' productive capabilities rather than proxies for productive capabilities *per se*, because those variables reflect the technological and knowledge basis for producing given products but whether and how the role of the technological and knowledge basis can be realised in real production depend on intangibles (e.g., policy and decision-making), production capacity, and infrastructures (Andreoni, 2011). This accords with Lall *et al*. (2006) that technology as a determinant of export sophistication should include not only tangible technology and innovation (e.g., R&D) but also the "production capabilities" to effectively use the tangible technology and innovation. In this sense, the outcome-based index of export sophistication is a better proxy for products' intensity of technology and know-how or, more generally speaking, producers' productive capabilities, in comparison with the input-based indicators constructed based on industry data[45]. In brief, the arbitrarity of conventional product taxonomies based on industry data makes it more like an art rather than a science (Lall *et al*., 2006). In contrast, export data provide a relatively rigorous proxy for products' embodied technology and knowledge, in addition to other production-related factors (e.g., production capacity).

As pointed out by Lall *et al*. (2006), the index of export sophistication, as an outcome-based or "catch-all" indicator, is like an "amalgam" of a wide range of factors rather

[44] This accords with the argument by Andreoni (2011) that the technological/dynamic aspect (i.e., technological capabilities) of an entity's productive capabilities, such as R&D, is just one of the capabilities required for technological and organisational changes. In addition to technological capabilities, a wide range of capabilities on the static side (e.g., skill, experience, and knowledge) and production capacity are also necessary.

[45] Andreoni (2011) highlights the importance of analytical and theoretical grounding in designing indicators of productive capabilities, with the consideration of both input and outcome variables. However, for developing countries, such composite approach tends not to be feasible due to the unavailability of data.

than a pure "technological measure", which makes it unclear to what extent the level of sophistication can be ascribed to technological factors rather than other factors that are irrelevant to technology. The authors summarise the economic characteristics that reflect on the sophistication of a given product: technology, marketing, logistics and proximity to market, fragmentability of production process, information and familiarity with respect to the outsourced countries, natural resources, infrastructure, and value chain organisation. In addition to economic factors, some policy factors also affect the location of production, such as trade restriction and trade agreement. Clarifying the influence of these non-technological factors on export sophistication has to rely on case-by-case studies with specific background information. However, as implicitly suggested by the authors, amongst others, technology in a broad sense (e.g., not only R&D but also technology used in production process) is the major factor. More importantly, ascending the ladder of product sophistication implies that a country has obtained higher overall capabilities required by more sophisticated products. This is a process of accumulating and developing productive capabilities.

Another proxy for the technological level of a product is unit price. For instance, Kaplinsky and Santos-Paulino (2005) distinguish between innovative and non-innovative products by the trends of unit prices, which is based on a kind of Schumpeterian assumption that increasing unit prices reflect high barriers to entry and growing innovations and that decreasing unit prices reflect low barriers to entry. However, as recognised by the authors and by Lall *et al*. (2006), for one thing, decreasing unit prices may be a result of cost-reducing innovation or different paces of innovation across products. If costs fall by a larger margin than prices, then declining unit prices do not necessarily reduce profits. For another thing, many factors other than innovation may affect unit prices, such as non-technological barriers to entry, policy distortions, and demand-side changes. Thus, it is unclear the extent to which the trends of unit prices can be attributed to innovations. Moreover, for products that are exported by both developed and developing countries, it is unclear to what extent developed countries' unit prices are driven by their market power, mark-up, and labour costs and to what extent differences in unit prices are contributed by differences in technology rather than in technique. For developing countries, mastering the technology required to produce a relatively sophisticated product should be more important than whether they can produce it with more refined technique or produce a high-quality variety. This renders unit price an inappropriate indicator to measure the technological level of developing countries' exports.

Following the rationale that higher similarity with rich countries' export basket means higher export sophistication, the construction of the index of EXPY is done in two steps, leading product-level sophistication to country-level sophistication. First, each traded product is given a certain level of income, which reflects the sophistication of this product. This is termed as PRODY. The PRODY of product *k* in year *t* is defined as:

$$PRODY_{k,t} = \sum_{i} \left\{ \frac{\left(x_{i,t}^{k} / X_{i,t} \right)}{\sum_{i} \left(x_{i,t}^{k} / X_{i,t} \right)} Y_{i,t} \right\}$$

where $Y_{i,t}$ equals GDP per capita of country *i* in year *t*, $x_{i,t}^{k}$ equals the export value of product *k* by country *i* in year *t*, and $X_{i,t}$ is the total export value of country *i* in year *t*. The numerator is the share of product *k* in total exports of country *i*, and the denominator is the sum of this share across all countries exporting product *k*. The weight of GDP per capita is simply each country's revealed comparative advantage (RCA) in this product, which captures the network structure of countries' specialisation. Therefore, PRODY is the mean GDP per capita of all exporting countries, weighted by each country's RCA. It should be noted that the RCA that is used as the weight in the PRODY formula is different from the classical RCA by

Balassa (1965), because the RCA in the PRODY formula has been normalised to make the sum of the weights equal to one.

Then, product-level sophistication is transformed to country-level sophistication, say EXPY, based on the importance of each product in the country's total exports. The EXPY of country *i* in year *t* is calculated as:

$$EXPY_{i,t} = \sum_{k} \left\{ \frac{x_{i,t}^{k}}{X_{i,t}} \right\} PRODY_k$$

A country's EXPY is the average of PRODY values of all its exported products, weighted by the share of each product in this country's export basket. Importantly, each product's annual PRODY values ($PRODY_{k,t}$) during a given period are averaged to generate a single static PRODY of this product ($PRODY_k$, instead of $PRODY_{k,t}$). A country's annual EXPY is calculated based on the static PRODY values, which give each product a constant associated income level. The fixed value of PRODY ensures that any change in EXPY is due to change in this country's export structure, instead of change in GDP per capita of other exporting countries.

There are three major criticisms of the measure of product sophistication "PRODY". The first criticism concerns the use of income information in calculating the sophistication level of a product, which generates a circularity that "rich countries export rich-country products" (Hidalgo, 2009; Hidalgo and Hausmann, 2009). Their solution, the so-called "Method of Reflections", is to separate income information (each country's GDP per capita) from the network information (each country's revealed comparative advantage in a particular product) in the PRODY formula. Then, they propose a pure network-based measure of the sophistication level of a product by its ubiquity, termed as "Product Complexity Index" (PCI). The circularity problem mainly matters for studies on the impact of EXPY on economic growth. However, this chapter examines the determinants of EXPY of developing countries, which are relatively homogenous in terms of income level. Moreover, both PRODY and EXPY are highly correlated with their network equivalents, namely, PCI and Economic Complexity Index (ECI), which indicates that the network structure of countries' revealed comparative advantages dominantly explains the variance in PRODY and EXPY (Hidalgo, 2009). Thus, the circularity problem tends not to matter in this chapter, and PRODY and EXPY are sufficient and qualified for the purpose of this chapter.

The second criticism is raised by the consideration of within-product quality differentiation. Schott (2004) distinguishes between cross-product sophistication and within-product sophistication. The former refers to differences in sophistication (e.g., embodied technology) between different product categories and is exactly what PRODY measures, while the latter reflects differences in quality within a given product category and is not considered by PRODY. For instance, both Italy and Bangladesh export skirt, but the price of Italy's skirt is substantially higher than that of Bangladesh's skirt. Such differences in quality (unit value) are great even at 10-digit disaggregation level (Xu, 2007). Ignoring this within-product differentiation may overestimate the value of export sophistication of poor countries whose product quality/unit value tends to be low and underestimate that of rich countries, because product quality or unit value is associated with income level (Schott, 2004). The solution is to adjust the formula of PRODY by multiplying it with a unit value multiplier, which is calculated based on all exporting countries' unit values of a particular product (Xu, 2007; Minondo, 2010; Xu, 2010). However, since unit value often contains extreme values or outliers, it is difficult to select an appropriate extent to which unit value truly reflects product quality. Minondo (2010) proposes to define quality grade based on the percentile of unit value, which is quite arbitrary. Xu (2007 and 2010) proposes a regression-based method to select the quality multiplier, but his method is still subject to arbitrary judgement and requires sectoral R&D data, which are unavailable for many developing countries[46].

[46] Xu (2007) suggests that there is no theoretically "correct" choice of the quality multiplier. He

In addition to the difficulty in selecting an optimal magnitude of adjustment with respect to unit value, there are some more important and fundamental arguments that point to the meaninglessness of adjusting quality differentiation for a study focusing on developing countries. First, as aforementioned, it is difficult to judge the extent to which the difference in unit price is due to market power and mark-up possessed by producers from rich countries and higher labour costs in these countries, and to what extent the difference is due to difference in production technology. As argued by Henn *et al*. (2017), unit price is driven by many factors. Changes on the supply and the demand side, non-technological barriers to entry, policy distortions, and cost-reducing innovations may also affect unit prices, which are irrelevant to the real sophistication of a product (Lall *et al*., 2006). Second, it is difficult to judge to what extent the difference in unit price is due to difference in production technology rather than production technique. The premise here is that production technology matters more for the developmental effect of a particular production process than production technique. For developing countries, the fact that they can produce a relatively sophisticated product is more important than whether they can produce it with more refined technique or produce a variety with higher quality. Although the level of a developing country's production technique in producing a particular (relatively) sophisticated product is not as high as that in developed countries, its ability to produce and export this product implies that it has at least reached the minimum level of technology and management required by this product. Moreover, disaggregated export data (e.g., HS 6-digit level in this chapter) can reduce the differential in the embodied level of technology and management between different products within a product category. Third, because all countries concerned by this chapter are developing countries with relatively similar

proposes to regress various adjusted EXPY values on sectoral R&D expenditure and then select the optimal adjusted EXPY value that best reflects R&D. This method is not suitable to developing countries, due to, amongst other reasons, unavailability of data on sectoral R&D expenditure.

development level, the within-product heterogeneity should not be large. The major difference in unit price occurs between developed and developing countries, but this chapter does not compare export sophistication between developed and developing countries. Finally, this chapter uses EXPY as a vector for dynamic comparison of a given country's export sophistication across years, instead of as a scalar for horizontal comparison between countries at a given time point.

The third criticism may be seen as an extension of the second one. Participation in global value chain (GVC) allows some developing countries to assemble technologically sophisticated intermediate inputs from developed countries and then export final products. This trade in task/production fragmentation masks the true sophistication level of these countries' export basket. Instead, it reflects the sophistication level of the producing countries of those intermediate inputs (Ma and van Assche, 2011). Such bias cannot be solved by export data. Van Assche and Gangnes (2010) use production data, rather than export data, to calculate the index of product and country sophistication, following the methodology of Hausmann *et al*. (2007). They use this method to measure the sophistication of China's electronics production, which is well-known for its deep involvement in trade in task. However, this kind of approach does not fit this chapter, because it requires data on production process rather than product *per se*, which are hardly available at a cross-country level, needless to say for developing countries (Lall *et al*., 2006). Actually, using export data rather than industry data (i.e., on technological intensity, instead of production process) can, to some extent, mitigate the impact of production fragmentability on the estimation of the technological level of products. Using industry data on technological intensity (e.g., R&D) leads to a discrepancy between the location of R&D (e.g., in outsourcing developed countries) and the location of production (e.g., in outsourced developing countries), which generates spuriously high export sophistication of the outsourced developing countries. Instead, using export data (e.g., the EXPY index) takes into account the income level of other outsourced developing countries and can, to some extent, identify the fragmentation of production process along the value chain, which differentiates between where the R&D is carried out and where the real production is carried out. For instance, as demonstrated by Lall *et al*. (2006), a combination of high technological intensity and low sophistication indicates that such products are designed and developed in high-income countries but produced in (relatively) low-income countries. Moreover, trade in task in medium and high technology-intensive products is more relevant to emerging countries rather than developing countries. The latter, rather than the former, is the focus of this chapter. In the country sample of this chapter, only a few countries (e.g., the Philippines and Vietnam) actively participate in technology-intensive trade in task. Thus, the bias due to trade in task is not a major problem in this chapter.

3.3.2. Data

The calculation of PRODY and EXPY requires data on countries' annual export values in each product category and GDP per capita. Export data are from the BACI database at the 1992-version Harmonised System (HS 92) 6-digit disaggregation level from 1995 to 2014. BACI database adopts an original and unique statistical method to reconcile export and import data reported by around 150 countries in the UN COMTRADE database and expands data coverage to more than 200 countries (Gaulier and Zignago, 2010). The number of reporting countries varies from the minimum of 212 in 1995 and 1996 to the maximum of 221 in 2013 and 2014. Export values are reported in current US Dollars. Data on GDP per capita (PPP, in 2011 constant International Dollars) are from the World Development Indicators (WDI) database.

Hausmann *et al*. (2007) emphasise that PRODY should be calculated based on a consistent sample of countries, because non-reporting situation may be correlated with the income level of a country. Moreover, the country coverage for calculating PRODY should be as large as possible, in order to include more countries that export a particular product. For the period of 1995 to 2014, although more than 200 countries have export data in the BACI database, only 165 countries have full data on GDP per capita (PPP) in the WDI database. Thus, each product's PRODY in each year from 1995 to 2014 is calculated based on these 165 countries. Then, each product's annual PRODY values during the 20 years are averaged into a single static PRODY, which is used for constructing each country's annual EXPY. Previous studies tend to calculate the static PRODY based on a short period, for example 1999-2001 (Hausmann *et al*., 2007), 2003-2005 (Felipe, Kumar, and Abdon, 2010), and 2005-2009 (Spatafora *et al*., 2012). Because the BACI database provides a sufficiently large country coverage for the whole period under study, PRODY here is calculated based on a 20-year period.

3.3.3. Country Sample and Classification

Developing Countries are defined as Other Developing Economies (ODEs) and Least Developed Countries (LDCs) in the UNIDO country grouping (UNIDO, 2013). The 2013 UNIDO country grouping divides the world into four tiers: Industrialised Economies (IEs), Emerging Industrial Economies (EIEs) and China, Other Developing Economies (ODEs), and Least Developed Countries (LDCs). The classification criterion is manufacturing value added per capita (MVA per capita)[47]. IEs correspond to developed countries, and EIEs and China correspond to emerging countries. Moreover, developing countries are further classified into major exporting countries of agricultural products (AGRIs), major exporting countries of manufactures (MANUs), major exporting countries of non-fuel minerals (MINEs), and major exporting countries of mineral fuels (FUELs). A country is defined as

[47] $MVA_{pc} = \frac{GDP\ (PPP)}{Population} \times \frac{MVA}{GDP}$

major exporter of a particular product category if this product category accounts for on average no less than 40% in this country's total exports in 1995, 2005, and 2014. Agricultural products are defined as products of SITC 0+1+2+4-27-28[48]; non-fuel minerals are defined as products of SITC 27+28+667+68+971; mineral fuels are defined as products of SITC 3[49]; and manufactures are defined as products of SITC 5+6+7+8-667-68. A country may be a major exporter of two product categories. For instance, Moldova is major exporting country of both agricultural products and manufactures. Among the total of 101 developing countries in the sample, only five countries do not have any product categories that account for no less than 40% of total exports (i.e., Bolivia[50], Kyrgyzstan, Papua New Guinea, Saint Lucia, and Togo). These five countries are kept in the database, but they are not covered by the dummy variable on export specialisation. Appendix B lists countries in each group of export specialisation.

The original groups of Other Developing Economies (ODEs) and Least Developed Countries (LDCs) have totally 128 countries, but 27 countries are dropped in the following analyses, for the reasons of centrally planned economies (Cuba and D.P.R. Korea), long-term (civil) war and/or the lack of an effective central government (Afghanistan, Somalia, and Palestine), territorial alteration and/or newly-established countries between 1995 and 2014 (Sudan, South Sudan, and Timor Leste),

---

[48] Agricultural products are defined in a broad-sense way. In addition to conventional agricultural products, this category also includes hide and skin (SITC 21), crude rubber (SITC 23), wood product (SITC 24), pulp (SITC 25), and textile fibre (SITC 26).

[49] The sub-group of SITC 35 under SITC 3 refers to electric current, which is not mineral fuel, but in the database there is no developing country that exports electric current. Thus, the inclusion of SITC 35 in SITC 3 does not distort the result.

[50] Bolivia is an important exporting country of non-fuel minerals, especially trace element minerals (e.g., silver, zinc, bismuth, antimony, and tungsten), and an important exporting country of natural gas. However, the share of mineral fuels in Bolivia's total exports did not outnumber 40% until 2005. In 1995, the share was only 12.3%, and the share was 51.1% in 2014. This is because the major reserve of natural gas in Bolivia had not been discovered until 1997. For another thing, the share of non-fuel minerals in total exports declined from 46.9% in 1995 to 19.5% in 2005. By 2014, the share had rebounded to 30.2%. As a result, the 1995-2014 average of neither the share of mineral fuels nor the share of non-fuel minerals outnumbers the threshold of 40%. Thus, Bolivia is not classified under either major exporting countries of mineral fuels or those of non-fuel minerals.

non-sovereign entity (e.g., Marshall Islands), associate states of another country (e.g., Palau), countries with population less than 50,000 (e.g., Saint Kitts and Nevis), and countries without export data in the BACI database (Namibia, Swaziland, and Lesotho). This results in a sample of 101 developing countries. Furthermore, since major exporting countries of mineral fuels (FUELs) have special pattern of export sophistication, they are dropped in the econometric analysis in Section 3.5 and in part of the descriptive analysis in Section 3.4. Mineral fuels have relatively high associated income level (PRODY), because some rich but not developed countries (e.g., the Gulf countries) take a major share in the world exports in mineral fuels. However, as a capital-intensive extractive sector, mineral fuel sector does not have high spillover effect or linkages with the rest of the economy. If a country specialises in mineral fuels, it may have numerically high export sophistication. However, such spuriously high export sophistication does not indicate high technological and manufacturing capabilities for the economy as a whole. These fuel-abundant countries enter the calculation of other countries' EXPY, because they enter the calculation of the PRODY index. However, this does not matter, because fuels do not take major share in other countries' export basket. Following Page (2012), countries with population less than one million are dropped in the econometric analysis, but are included in the descriptive analysis. Most of these countries are small island economies with special economic and export structure. This treatment results in a panel database of 62 developing countries for econometric analysis.

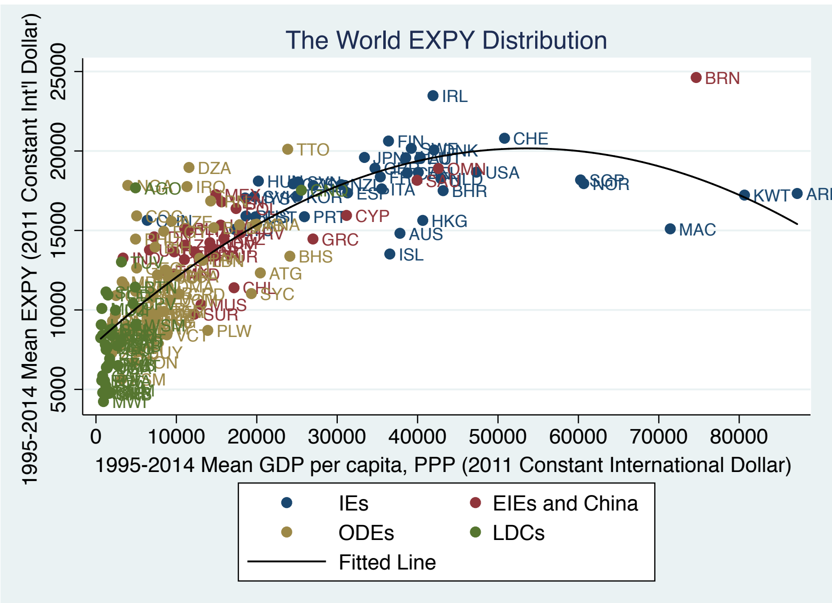
3.4. Developing Countries' Export Sophistication: Descriptive Evidence

3.4.1. Developing Countries' Export Sophistication in a Global Comparison

What is the position of developing countries in the global map of export sophistication? Figure 3.1 shows that Other Developing Economies (ODEs) are positioned at the lower half of both of the global GDP per capita distribution and the

EXPY distribution, and Least Developed Countries (LDCs) are mostly positioned at the bottom. By contrast, developed and emerging countries are positioned at the upper half. Importantly, there is a high correlation between GDP per capita and EXPY. If a country is richer, it tends to have more sophisticated exports. The slope of the quadratic fitted curve is steeper at low income level and becomes flat at higher income level. This reflects that low-income countries' export sophistication increases in income growth at a faster speed than high-income countries. At the far right part of the graph, there are three special countries (region): Kuwait, the United Arabic Emirates, and Macau. They have quite high income level without comparably high export sophistication. Brunei is another special case. It is a country specialising in mineral fuels, but it has much higher export sophistication than other fuel exporters. This is because that methanol, which has higher PRODY than many other fuel products and precious metals, dominates Brunei's export basket. Some countries are outliers in the group of developing countries (e.g., Algeria, Angola, Equatorial Guinea, Nigeria, Congo, and Gabon), because they have relatively high EXPY and GDP per capita. These countries are basically major exporters of petroleum.

Figure 3.1. Developing countries in the world: EXPY against GDP per capita

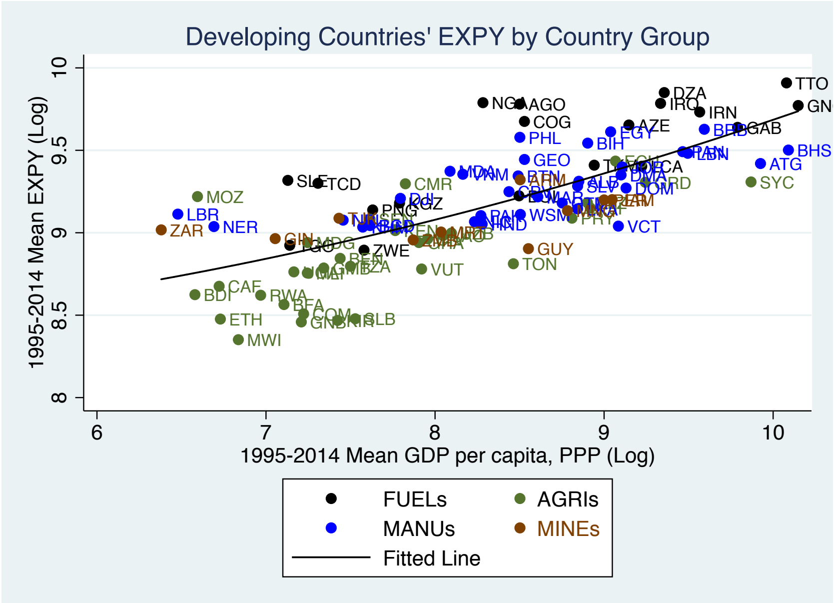


Source: Author's calculation based on the BACI database.

3.4.2. Heterogeneity of Export Sophistication within Developing Countries

Figure 3.2 presents developing countries' export sophistication by country group with respect to export specialisation. The ranking of GDP per capita and that of export sophistication are highly correlated. Major exporting countries of mineral fuels are positioned at the top in both GDP per capita and export sophistication, followed by countries specialising in manufactures and in non-fuel minerals. Countries specialising in agricultural products are at the bottom. The perfect fitted line of the logarithms of EXPY and GDP per capita shows the correlation between export sophistication and income level. According to Yang and Yao (2008), this fitted line represents countries' predicted comparative advantages conditional on income level. Countries located above this line show a catch-up in income growth and may eventually converge to a higher income level, because they positively deviate from their comparative advantages and ascend the ladder of export sophistication. By contrast, countries located below this line lag behind in income growth. These countries' export sophistication is below the level predicted by their comparative advantages and they may experience export degeneration. In Figure 3.2, almost all major exporting countries of mineral fuels are located above the comparative advantage line. However, this should be treated cautiously, because mineral fuels are special products, as discussed previously. Around half of major exporting countries of manufactures lie above the line, whereas the majority of major exporting countries of agricultural products and non-fuel minerals lie below the line. This pattern implies negative catch-up potential for countries specialising in non-fuel primary commodities. Meanwhile, since these countries' predicted comparative advantage lies above their real export sophistication, there is available space for export upgrading and industrial policy may be needed.

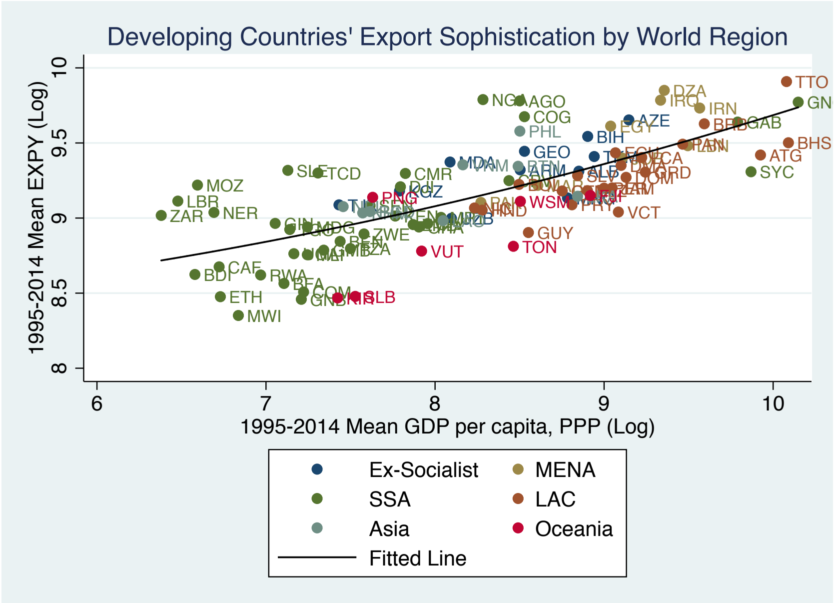
Figure 3.2. Developing countries by country group: EXPY against GDP per capita



Source: Author's calculation based on the BACI database.

Figure 3.3 shows the relationship between EXPY and GDP per capita by country group with respect to world region: Ex-Socialist (ex-European socialist countries and ex-Soviet Republics that fall in the group of ODEs, plus Mongolia), MENA (ODEs and LDCs countries in Middle East and North Africa plus Iran and Pakistan), SSA (ODEs and LDCs countries in Sub-Saharan Africa), LAC (ODEs and LDCs countries in Latin America and the Caribbean), Asia (ODEs and LDCs countries in Southeast Asia and South Asia), and Oceania. SSA countries are basically positioned at the lower half in terms of GDP per capita and EXPY. Ex-Socialist, MENA, and LAC countries are at the upper half. Petroleum exporters in MENA and SSA show extraordinarily high EXPY and, to a lesser extent, GDP per capita. In terms of catch-up, the majority of LAC and Oceanian countries lie below the comparative advantage line, while the majority of Ex-Socialist, MENA, and Asian countries lie above the line. Approximately half of SSA countries lie below the line and half above the line. Given SSA's regional variation, more disaggregated investigation at the sub-continental level may be necessary, which is beyond the scope of this chapter.

Figure 3.3. Developing countries by world region: EXPY against GDP per capita



Source: Author's calculation based on the BACI database.

3.5. Methodology and Results

3.5.1. The Empirical Model of Export Upgrading

Based on the review of various strands of (trade) theories, the determinants of developing countries' export upgrading can be generally modelled as:

$$EXPY_{i,t} = \beta EXPY_{i,t-1} + Geography_i'\delta + \tau Specialisation_i + \theta Population_{i,t} + \varphi Human\ Capital_{i,t} + \rho Institutions_{i,t} + \omega Productive\ Investment_{i,t} + \lambda FDI_{i,t} + Trade_{i,t}'\eta + \mu_i + \gamma_t + \varepsilon_{i,t}$$

μ_i refers to unobservable country-specific fixed effects, γ_t stands for year-specific fixed effects, and $\varepsilon_{i,t}$ refers to idiosyncratic errors. $EXPY_{i,t-1}$ refers to the lagged export sophistication by one year. EXPY has also been treated with a lag structure by Kemeny (2010), Iwamoto and Nabeshima (2012), Weldemicael (2012), and Lectard and Rougier (2018). A country's past export sophistication is likely to impact on its current export sophistication. Moreover, as demonstrated by Hausmann and

Rodrik (2003) and Hausmann *et al*. (2007), export upgrading is a path-dependent process, because externalities restrict entrepreneurship for new production activities, especially in developing countries. Using lagged dependent variable as regressor renders the model to be a dynamic one and involves some important econometric issues, which are discussed in Section 5.2. Appendix B gives descriptive statistics and data source of the variables for the 62-country panel.

$Geography_i'$ is a vector of geographical variables: access to sea (*Landlock*) and remoteness (*Remoteness*). Remoteness is defined, following Wei (1999), as a country's mean distance to all other countries weighted by each country's share in the total world trade[51]. $Specialisation_i$ refers to a country's export specialisation dummy, say major exporting country of agricultural products (*AGRIs*), non-fuel minerals (*MINEs*), or manufactures (*MANUs*). This variable is also a proxy for a country's natural resource endowment[52]. Since there are several countries that do not belong to any of the three specialisation groups, including three country dummies does not generate the "dummy trap". $Population_{i,t}$ controls for country size and labour endowment. In the cost discovery model by Hausmann and Rodrik (2003) and Hausmann *et al*. (2007), labour endowment is negatively correlated with wage costs and stimulates new production activities.

$Human\ Capital_{i,t}$ measures a country's human capital level, which is proxied by its mean years of schooling. $Institutions_{i,t}$ represents institutional quality in the mainstream terms, which is proxied by the average of three variables from the Worldwide Governance Indicators database (i.e., rule of law, control of corruption, and regulatory quality). These three variables reflect the degree of a country's market

---

[51] $Remoteness_{i,t} = \sum_{j \neq i} w_{j,t} \times ln[Distance(i,j)]$, $w_{j,t} = {Trade_{j,t}} / {\sum_{k \neq j} Trade_{k,t}}$. *Distance* refers to the one between the most populous cities of two countries.

[52] Previous studies tend to use land per capita to measure natural resource endowment. However, land abundance may not be necessarily correlated with the abundance of natural resources and does not reflect the real dependence of an economy on natural resources.

friendliness and the government's role in guaranteeing the functioning of the market. $Productive\ Investment_{i,t}$ measures productive investment proxied by gross capital formation per worker. Gross capital formation has been widely used as a proxy for capital accumulation (e.g., Lee and Huang, 2002; Lee, 2005; Soytas and Sari, 2006; Narayan and Smyth, 2008). The quantity of capital, in addition to the quality, is a major determinant of labour productivity and economic development (Somel, 2005; Lavopa and Szirmai, 2012).

$FDI_{i,t}$ measures FDI inflow as a share in GDP, which is a proxy for the inflow of external knowledge and technology. $Trade'_{i,t}$ is a vector of trade variables, including a country's trade openness (*Residual Openness*), the share of imports in medium-technology manufactures in total imports (*Manu. Imports*) as a proxy for imported technology and means of production, the share of China in total exports and imports (*Exports to CHN* and *Imports from CHN*), and income terms of trade *vis-à-vis* China (*Income TOT*) as a proxy for absolute gains from trade with China. Different combinations of these variables, rather than all of them, are used in different model specifications. *Residual Openness* is derived, following Wei (1999), as the residual between a country's observed trade share in GDP and the fitted share based on geography, population, language, and income[53]. The fitted share is the so-called "natural openness" (Frankel and Romer, 1999). According to Wei (1999), the "residual openness" includes the effect of trade policy on trade share, and thus can be used as a proxy for trade policy. Here, due to the "catch-all" feature of the "residual openness", trade policy is defined in a broad-sense way, including a wide range of

[53] To derive the "residual openness" of country *i* in year *t*, the following equation is estimated:

$$Trade_{i,t}/GDP_{i,t} = \beta_1 Remoteness_{i,t} + \beta_2 ln(Population_{i,t}) + \beta_3 ln(GDP\ p.c._{i,t}) + \beta_4 Eng_i + \beta_5 FRN_i + \beta_6 SPN_i + \beta_7 Island_i + \beta_8 Landlock_i + \varepsilon_i + \mu_{i,t},$$ where $Remoteness_{i,t}$ is the same as in footnote 49.

ENG_i, FRN_i, and SPN_i specifies whether country *i*'s official language is English, French or Spanish. $Island_i$ and $Landlock_i$ are dummies for island countries and landlocked countries, respectively. This model extends the original model of Wei (1999) by adding GDP per capita to the equation and using panel data. As pointed by Clemens and Williamson (2011), income is the major contributor of trade growth. The regression results are available upon request.

policies that may influence trade. However, the "catch-all" feature makes the "residual openness" to be like a black box, because it is not clear to what extent it is contributed by the broad-sense trade policy rather than some unknown/unspecified time-variant factors. This drawback should be borne in mind.

Following Kemeny (2010), Weldemicael (2012), and Zhu and Fu (2013), *FDI Inflow* is treated as an endogenous variable. However, the mechanism underlying this endogeneity is unlikely to be reverse causality as argued by Zhu and Fu (2013). Rather, the mechanism explained by Weldemicael (2012) is more realistic: factors that promote export upgrading may attract more FDI inflow as well, such as sound investment climate. However, it is difficult to find exogenous variables that are sufficiently correlated with FDI inflow but do not impact on export sophistication unless through FDI. Zhu and Fu (2013) use latitude and longitude to instrument FDI inflow and Weldemicael (2012) instruments FDI inflow by international capital control. However, these two variables are actually direct determinants of export sophistication. This difficulty in finding external instruments is bypassed by using System GMM with internal instruments.

Following Cabral and Veiga (2010), Spatafora *et al*. (2012), and Weldemicael (2012), human capital is not treated as endogenous variable. First, it is unlikely that in short term export sophistication can influence human capital. Changes in export composition indeed affect the incentive and possibility to invest in education through Stolper-Samuelson effect or income effect. However, this influence takes effect with a lag. Galor and Mountford (2008) and Blanchard and Olney (2017) find positive impacts of exports on mean years of schooling with a lag of five or ten years, which excludes the possibility of an instantaneous or contemporaneous effect of trade on human capital. Second, unlike FDI inflow, human capital is largely influenced by some fundamental socio-economic factors, and thus tends not to share common determinants with export sophistication.

Finally, following Zhu and Fu (2013), GDP per capita, which measures income and development level, is not considered as an explanatory variable. This is because GDP per capita is an outcome variable as a result of a set of socio-economic factors (e.g., human capital, FDI inflow, trade, institutions, and investment) rather than an input variable. In other words, GDP per capita *per se* does not have explanatory power. Thus, if GDP per capita is included in the model, then its effect on export sophistication is a spurious one, serving as a proxy for the effects of other variables.

3.5.2. Empirical Strategy of Dynamic Linear Model

Introducing lagged export sophistication as explanatory variable invalidates standard static panel regression, due to the "dynamic panel bias" (Nickell, 1981). After eliminating the country-specific fixed effects by first differencing, the first-differenced lagged dependent variable ($\Delta\ EXPY_{i,t-1} \equiv EXPY_{i,t-1} - EXPY_{i,t-2}$) is still correlated with the first-differenced idiosyncratic error term ($\Delta\ \varepsilon_{i,t} \equiv \varepsilon_{i,t} - \varepsilon_{i,t-1}$), because $EXPY_{i,t-1}$ is correlated with $\varepsilon_{i,t-1}$. This raises the endogeneity problem, and static estimation will generate biased and inconsistent results. The bias is subject to an order of ${}^{1}/_{T}$ and tends to disappear if the time dimension approaches infinity (Baltagi, 2008). Asteriou and Hall (2011) suggest that adding exogenous regressors can reduce the bias, provided that the time dimension *T* is large. However, as shown by Judson and Owen (1999), the bias only decreases from 50% of the true value to 20%, which is still a significant level, if the time dimension substantially increases from 5 to 30. Given that the database of this chapter has only 20 time points/years, this bias is believed to be a problem.

This "dynamic panel bias" can be solved by System GMM estimation, which has been used in export sophistication studies by Kemeny (2010), Weldemicael (2012), Zhu and Fu (2013), and Lectard and Rougier (2018). System GMM (Arellano and

Bover, 1995; Blundell and Bond, 1998) is an augmented version of the earlier Difference GMM (Arellano and Bond, 1991). In order to address the "dynamic panel bias", Arellano and Bond (1991) eliminate individual-specific fixed effects by first differencing and then suggest to use the lagged dependent variable from the time point *t-2* onward (in our case, $EXPY_{i,t-2}$, $EXPY_{i,t-3}$,......) as instruments for the lagged first differenced dependent variable ($\Delta EXPY_{i,t-1}$) in the first differenced equation. The second and the subsequent higher-order lagged dependent variables ($EXPY_{i,t-2}$, $EXPY_{i,t-3}$,......) meet the requirement of a valid instrument variable because they are correlated with $\Delta EXPY_{i,t-1} \equiv EXPY_{i,t-1} - EXPY_{i,t-2}$ and uncorrelated with $\Delta \varepsilon_{i,t} \equiv \varepsilon_{i,t} - \varepsilon_{i,t-1}$. The lagged dependent variable is seen as a predetermined variable, which is correlated only with past idiosyncratic errors. Other predetermined and endogenous independent variables follow this approach to be instrumented as well.

However, Difference GMM is subject to the weak instrument problem because the lagged level variables tend to be only weakly correlated with the instrumented lagged first-differenced variable, especially if the variable is subject to strong persistence across time (Blundell and Bond, 1998). System GMM (Arellano and Bover, 1995; Blundell and Bond, 1998) solves this problem by introducing the level equation and building an equation system by combining moment conditions for the differenced equation and those for the level equation. In the level equation, lagged first-differenced dependent variables (in our case, $\Delta EXPY_{i,t-1}$, $\Delta EXPY_{i,t-2}$,......) are used as instruments of the lagged level dependent variable ($EXPY_{i,t-1}$), and the treatment for the first-differenced equation is the same as in Difference GMM. The correlation between lagged differenced variables and the level variable is believed to be stronger than that between lagged level variables and the differenced variable. System GMM has been proved by simulation exercises to be more efficient, more precise, more consistent, and less subject to finite-sample and downward bias, in comparison with Difference GMM (Blundell and Bond, 2000; Blundell, Bond, and

Windmeijer, 2001; Bond, Hoefller, and Temple, 2001; Bond, 2002; Windmeijer, 2005).

Roodman (2006) argues that both Difference GMM and System GMM are particularly suitable for small-*T* and large-*N* panel database with dynamic dependent variable, predetermined and/or endogenous independent variables, individual fixed effects, heterogeneity, and serial correlation within individuals across time. As all instruments are generated from the model itself, rather than from outside of the model, lagged level and differenced variables in System GMM are "internal instruments". This has significant empirical importance. One of the major concerns in econometric analysis is the difficulty in finding a valid exogenous variable to instrument the endogenous variable, the so-called "external instrument". A valid instrumental variable should be sufficiently correlated with the endogenous variable, be uncorrelated with the idiosyncratic error term, and impacts on the dependent variable only through its impact on the endogenous variable. However, it is quite difficult to find variables that meet these conditions, especially the last one. The use of lagged variable as "internal instrument" bypasses this difficulty. Actually, the superiority of System GMM is not confined within the alleviation of the difficulty in finding instruments. With Monte Carlo simulations, Kočenda and Poghosyan (2018) demonstrate that GMM-type estimators have better bias properties than traditional instrumental variable regressions and fixed-effects regressions in examining the determinants of export sophistication.

Valid System GMM estimation is established on several conditions. First, in order to obtain consistent estimation on the lagged dependent variable, which is used as regressor, the idiosyncratic error term should have first order serial correlation but not have second order serial correlation. That is to say, the Arellano-Bond test for the first order serial correlation, AR(1), should reject the null hypothesis, while the test for the second order serial correlation, AR(2), should not reject the null. Moreover, Roodman (2006) argues that the absence of cross-individual correlation in the idiosyncratic error term is a critical condition for the Arellano-Bond serial correlation test and robust estimations on coefficients' standard errors. He suggests that time dummy helps to make this condition hold. Thus, year dummy is always used in the following regressions.

The second condition is the exogeneity and validity of instruments. The Hansen overidentification test examines the null hypothesis of the joint validity of instruments, and the Difference-in-Hansen test examines the null hypothesis of the validity of each subset of instruments. Despite being robust to heteroskedasticity and serial correlation (unlike the Sargan test), the Hansen test is not robust to the weak instrument problem that is generated by including too many instruments. This problem, coined as "instrument proliferation", leads to false acceptance of the null hypothesis with the unrealistic *p*-value of 1.000 (Roodman, 2009). This phenomenon is called as under-rejection (Anderson and Sørensen, 1996) or zero rejection frequencies (Bowsher, 2002). Thus, in order to obtain valid result for the Hansen test, as suggested by Roodman (2009), the number of instruments must be lower than the number of groups/cross sections (in our case, the number of countries). Without cautious control, it is easy to break this rule of thumb in System GMM estimation because in System GMM (and actually Difference GMM as well) all lags starting from the first or the second order may in theory be used as instruments[54]. This problem is especially severe under large time dimensions, because the number of instrument is quadratic in time dimension (Roodman, 2006). Given that the number of predetermined and/or endogenous variables is usually determined by theory or experience without discretionary space and the time dimension is fixed, the instrument proliferation problem may be avoided only by restricting the length of lags as instruments or collapsing the instrument set into a single column for all time

[54] In the first-differenced equation, instrument starts from the second lag of (level-form) regressors. In the level equation, instrument starts from the first lag of (difference-form) regressors.

points. The following regressions use the "collapsing" method[55].

Finally, in carrying out System GMM, Windmeijer finite-sample corrected standard errors (Windmeijer, 2005) with two-step estimation are used. Cameron and Trivedi (2010) suggest that two-step System GMM estimation outperforms one-step estimation in asymptotical efficiency. In theory, standard errors generated by two-step estimation are robust to heteroskedasticity and serial correlations in idiosyncratic error term. However, as pointed by Bond *et al*. (2001), finite sample leads to downward-biased estimates on standard errors even under two-step estimation. In order to deal with this discrepancy between theory and practice, Windmeijer (2005) suggests to make finite-sample corrections on the standard errors in two-step estimation.

3.5.3. Results

Two sets of regressions on export sophistication are carried out. The first set concerns the aforementioned direct impact of China through the quantity side of developing countries' exports to and imports from China. This corresponds to the approach in existing studies on China's impact of crowding-out and re-primarisation. China's differential impacts on different groups of developing countries are examined by including interaction terms. Interaction regression is preferred to split-sample regression, because the number of observations in each country group is not large enough to avoid the problem of instrument proliferation. The second set of regressions concerns the indirect impact of China through developing countries' income terms of trade *vis-à-vis* China, examining whether absolute gains from trade with China promote developing countries' export upgrading. Importantly, we use mediation analysis to explore whether the effect of income terms of trade on export

[55] This is realised by using the "*collapse*" option under the Stata command *xtabond2*.

upgrading takes effect through their effect on productive investment.

Baseline regressions are based on data from 1995 to 2014. Because consecutive data on institutional quality from the WGI database are only available from 2002, the two sets of regressions are repeated with the institutional quality variable for a shorter period from 2002 to 2014. As China's trade with developing countries has rapidly grown since the early 2000s, the period of 2002 to 2014 is of great relevance. Actually, the short-period regressions can also serve as a robustness check. Another robustness check is concerned with the potential lagged effects of productive investment, income terms of trade, FDI inflow, and trade policy, by using the lagged forms of these variables. This treatment also further excludes the possibility of reverse causality. The last robustness check concerns the impact of global value chain (GVC). All regressions include year dummies, which control for linear time trend and country-invariant but time-variant common shocks (e.g., the global trade slowdown and the 2007-2008 crisis). Finally, panel unit-root test has shown the stationarity of the data.

Table 3.3 shows the first set of regressions. The System GMM regressions are valid as shown by the AR(1) and AR(2) tests, Hansen test, and Difference-in-Hansen tests (not shown in table for the sake of space). *Lagged EXPY* is statistically significant at the 1% or 5% level in all specifications, indicating the path dependence of developing countries' export upgrading. Neglecting this lagged dependent variable will compound the effect of other variables with the path-dependent effect. The *Landlock* dummy has significantly negative coefficients in all but Column 5. *Population* has positive impact in half of the specifications. *Remoteness* has significant coefficient in half of the specifications, with small but negative impact. *Human Capital* has significant positive effect at the 1% level in all specifications. A one-standard-deviation increase in *Human Capital* (5.4 and 5.7 years of schooling for 1995-2014 and 2002-2014) raises *EXPY* by on average 6.7% for 1995-2014 or 7.5% for

2002-2014. *Productive Investment* is significant at the 1% level in all columns. A one-standard-deviation increase in *Productive Investment* increases *EXPY* by on average 7.4% for 1995-2014 and 9.8% for 2002-2014. An increase in *Residual Openness* by one standard deviation increases *EXPY* by approximately 1.7% for 1995-2014 and 2.7% for 2002-2014. However, considering that the within-country variation of variables significantly varies across countries, the interpretation based on changes in one standard deviation should be treated cautiously. *FDI Inflow* and *Institutions* are not statistically significant in any specifications.

How trade with China has directly impacted on *EXPY*? Columns 1-2 concern developing countries as a whole. *Imports from CHN* is not significant, and *Exports to CHN* has quite small significantly negative effect in Column 1. Columns 3-6 examine whether China's impact varies across country groups by adding interaction terms between *Exports to* (*Imports from*) *CHN* and the export specialisation dummy. *Imports from CHN* increases EXPY of major exporting countries of agricultural products (AGRIs countries), as shown by the relatively large positive coefficients of the interaction term (*AGRIs×ImpCHN*). The coefficients of *Imports from CHN* in Columns 3-4, which represent the impact of *Imports from CHN* on MANUs and MINEs countries, are insignificant, because, as shown in the following, *Imports from CHN* has opposite impacts on these two country groups. *Imports from CHN* reduces EXPY of major exporting countries of manufactures (MANUs countries) but increases it for other countries, because negative coefficients of the interaction term (*MANUs×ImpCHN*, -0.00547 and -0.00530) significantly outnumber the positive coefficients of *Imports from CHN* (0.00296 and 0.00339). *Exports to CHN* only shows possible interaction effect for MANUs countries, with significant large positive coefficients of the interaction term (*MANUs×ExpCHN*) but insignificant small negative coefficients of the main effect. The actual impact of imports from China and exports to China is quite limited. For instance, a one-standard-deviation increase in the share of imports from China reduces MANUs countries' export sophistication by

2.2% for 1995-2014 and 1.7% for 2002-2014. A concern about reverse causality may be raised due to the fact that as a country has increased its export sophistication it may be engaged more in trade in task with China. However, this should not be a problem, because, except Vietnam and the Philippines, other countries in the sample have quite small share of China in their foreign value added in exports.

Table 3.3. System GMM: direct channel of China's influence

DepVar EXPY	(1) 1995-2014	(2) 2002-2014	(3) 1995-2014	(4) 2002-2014	(5) 1995-2014	(6) 2002-2014	(7) 1995-2014	(8) 2002-2014
Lagged EXPY	0.363***	0.262**	0.352***	0.252**	0.337***	0.270**	0.360***	0.258**
	(0.0823)	(0.115)	(0.0852)	(0.115)	(0.0804)	(0.115)	(0.0949)	(0.113)
Landlock	-0.0473*	-0.0932**	-0.0557**	-0.0879**	-0.0467	-0.0749*	-0.0549*	-0.0907**
	(0.0272)	(0.0383)	(0.0277)	(0.0342)	(0.0329)	(0.0407)	(0.0311)	(0.0370)
Population	0.0262*	0.0238	0.0283*	0.0273	0.0329**	0.0298	0.0429***	0.0383*
	(0.0150)	(0.0195)	(0.0157)	(0.0195)	(0.0163)	(0.0235)	(0.0160)	(0.0198)
Remoteness	-0.000340	-0.000461	-0.00048*	-0.00053*	-0.00062**	-0.000325	-0.000414	-0.00060**
	(0.00027)	(0.00030)	(0.00029)	(0.00028)	(0.00031)	(0.00027)	(0.00030)	(0.00030)
Human Capital	0.0218***	0.0253***	0.0213***	0.0247***	0.0257***	0.0253***	0.0259***	0.0287***
	(0.00521)	(0.00695)	(0.00528)	(0.00654)	(0.00492)	(0.00646)	(0.00560)	(0.00718)
Institutions		-0.0221		-0.0368		-0.0213		-0.0297
		(0.0322)		(0.0356)		(0.0344)		(0.0358)
Productive Investment	0.0482***	0.0692***	0.0526***	0.0730***	0.0553***	0.0771***	0.0632***	0.0797***
	(0.0133)	(0.0201)	(0.0147)	(0.0207)	(0.0129)	(0.0197)	(0.0152)	(0.0219)
Residual Openness	0.122**	0.210***	0.133**	0.214***	0.137**	0.222***	0.140***	0.194**
	(0.0491)	(0.0751)	(0.0531)	(0.0763)	(0.0570)	(0.0825)	(0.0525)	(0.0778)
Manu. Imports	0.000233	-0.000317	-0.000980	-0.00151	-0.00151	-0.000380	-0.00381*	-0.00285
	(0.00189)	(0.00243)	(0.00186)	(0.00246)	(0.00189)	(0.00306)	(0.00214)	(0.00278)
Imports from CHN	0.00152	0.00162	-0.00102	-0.000221	0.00296***	0.00339**	0.00170	0.00135
	(0.00142)	(0.00175)	(0.00145)	(0.00153)	(0.00109)	(0.00143)	(0.00143)	(0.00171)
AGRIs×ImpCHN			0.00491***	0.00425*				
			(0.00190)	(0.00245)				
MANUs×ImpCHN					-0.00547**	-0.00530*		
					(0.00268)	(0.00308)		
MINEs×ImpCHN							-0.000871	0.00186
							(0.00205)	(0.00264)
Exports to CHN	-0.00144*	-0.00115	-0.000447	-0.000563	-0.00100	-0.00173	-0.00342*	-0.00388
	(0.00086)	(0.00106)	(0.00077)	(0.00097)	(0.00077)	(0.00114)	(0.00207)	(0.00269)
AGRIs×ExpCHN			-0.00284	-0.00339				
			(0.00221)	(0.00274)				
MANUs×ExpCHN					0.00620*	0.00925*		
					(0.00376)	(0.00553)		
MINEs×ExpCHN							0.00298	0.00324
							(0.00217)	(0.00287)
FDI Inflow	0.000946	-0.000461	0.00118	-0.000194	0.00147	-0.000542	0.00107	0.000147
	(0.00238)	(0.00291)	(0.00216)	(0.00249)	(0.00229)	(0.00347)	(0.00220)	(0.00244)
AGRIs	-0.0631*	-0.0749**	-0.131***	-0.101**				
	(0.0326)	(0.0372)	(0.0392)	(0.0426)				
MANUs	0.0715**	0.0185			0.114***	0.0961**		
	(0.0343)	(0.0416)			(0.0386)	(0.0477)		
MINEs	0.0511	-0.0259					0.0303	-0.0548
	(0.0402)	(0.0453)					(0.0444)	(0.0486)
Constant	5.497***	6.620***	5.960***	6.932***	5.532***	6.248***	5.704***	6.601***
	(0.939)	(1.121)	(1.004)	(1.180)	(0.840)	(1.075)	(1.079)	(1.118)
Observations	1018	687	1018	687	1018	687	1018	687
Groups	59	59	59	59	59	59	59	59
Instruments	37	31	37	31	37	31	37	31
AR(1)	0.00147	0.00271	0.00152	0.00285	0.00131	0.00167	0.00160	0.00277
AR(2)	0.820	0.403	0.882	0.430	0.831	0.426	0.813	0.397
Hansen Test (p)	0.950	0.471	0.945	0.526	0.983	0.424	0.926	0.545
Diff.-in-Hansen	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

Wald chi2 (p)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Two-step System GMM: Windmeijer finite-sample corrected standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

In summary, major exporting countries of manufactures tend to be affected by China in an opposite way in contrast to major exporting countries of agricultural products. The positive influence of imports from China on major exporting countries of agricultural products may indicate the positive effect of imported technology and capital goods or a welfare-enhancing effect of cheap imported manufactures, whereas the negative impact of imports from China (mainly manufactures) on major exporting countries of manufactures indicates a kind of crowding-out. The positive effect of exports to China on major exporting countries of manufactures lends support to the positive role of manufactured exports in export upgrading. Moreover, the insignificant effect of exports to China on developing countries specialising in agricultural products and non-fuel minerals indicates the absence of re-primarisation.

Next, we shift the interest to China's indirect influence through developing countries' monetary gains from trade with China. This entails a two-step causality chain from income terms of trade *vis-à-vis* China (gains from trade) to productive investment (step one) and then from productive investment to export upgrading (step two), in addition to any direct and independent contribution of income terms of trade to export upgrading. In other words, productive investment may act as a mediator that channels (part of) the effect of gains from trade with China to export upgrading.

The concept of mediation effect is borrowed from the psychology literature. Assuming *Income TOT* (income terms of trade *vis-à-vis* China) as the independent variable, *Productive Investment* as the mediator variable, and *EXPY* as the outcome variable, following Baron and Kenny (1986), *Productive Investment* acts as the mediator between *Income TOT* and *EXPY*, if:

(1) its variations are significantly explained by *Income TOT*;

(2) *Income TOT* significantly explains variations of *EXPY*;

(3) after controlling for *Productive Investment*, the effect of *Income TOT* on *EXPY* turns to be insignificant or weaker.

This method has been used by Busse, Erdogan, and Mühlen (2016) in examining the mediation effect of investment in the causality from FDI and trade to economic growth. Three regressions should be implemented for testing this mediation effect: regression (1) of *Productive Investment* on *Income TOT*, regression (2) of *EXPY* on *Income TOT* without controlling for *Productive Investment*, and regression (3) of *EXPY* on *Income TOT* and *Productive Investment* together. For a mediation effect to hold, coefficients of *Income TOT* and *Productive Investment* in regressions (1) and (2) should be significant with expected signs, the coefficient of *Income TOT* in regression (3) should be smaller or insignificant in comparison with that in regression (2), and the coefficient of *Productive Investment* should be significant in regression (3). Table 3.4 shows results for regression (1) of *Productive Investment* on *Income TOT*. Explanatory variables are drawn from the literature on gross capital formation. *Income TOT* has highly significant positive effect on *Productive Investment*, supporting condition (1).

Table 3.4. Mediator test: income terms of trade and productive investment

DepVar Productive Investment	(1) 1995-2014	(2) 1995-2014	(3) 2002-2014	(4) 2002-2014
GDP p.c. Growth Rate	0.00833**	0.00596	0.00872*	0.00697
	(0.00353)	(0.00480)	(0.00463)	(0.00580)
FDI Inflow	0.0175***	0.0141**	0.0154**	0.0140**
	(0.00570)	(0.00597)	(0.00610)	(0.00631)
External Debt	0.000148	-9.46e-06	2.86e-05	3.53e-05
	(0.000257)	(0.000193)	(0.000180)	(0.000186)
Exchange rate	-2.94e-05	-3.79e-05	-3.49e-05	-2.47e-05
	(2.88e-05)	(2.39e-05)	(2.90e-05)	(3.64e-05)
Interest Rate		-0.00171		-0.00268
		(0.00227)		(0.00274)
Income TOT	0.0467***	0.0468***	0.0563***	0.0520**
	(0.0127)	(0.0149)	(0.0189)	(0.0209)
Financial Development*	0.0133***	0.0126***	0.0121***	0.0115***
	(0.00155)	(0.00175)	(0.00186)	(0.00225)
Gross Saving % of GDP	0.0177***	0.0138**	0.0122**	0.0109*
	(0.00575)	(0.00569)	(0.00600)	(0.00606)
Constant	4.908***	5.096***	4.953***	5.093***
	(0.121)	(0.163)	(0.188)	(0.221)
Observations	868	664	610	508
Number of Countries	53	48	53	47

Adjusted R-squared	0.517	0.447	0.410	0.349

Fixed-effects regression: robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.
**Financial Development* is measured by domestic credit to private sector as % of GDP.

Table 3.5 shows regressions (2) and (3). In Columns 1 and 3, *Income TOT* significantly increases *EXPY* at the 1% level. A one-standard-deviation increase in *Income TOT* raises *EXPY* by 3.8% and 5.1% for 1995-2014 and 2002-2014, respectively. Having controlled for *Productive Investment*, *Income TOT* becomes marginally insignificant (*p*-value=0.102) in Column 2 and its significance decreases from the 1% level in Column 3 to the 5% level in Column 4. Accordingly, the coefficients decrease from 0.0113 to 0.00659 and from 0.0179 to 0.0129 for the two periods, respectively. Thus, condition (2) and (3) hold, supporting the mediation effect of *Productive Investment* between *Income TOT* and *EXPY*. Interestingly, the impact of *Income TOT* on export sophistication is stronger during the period of 2002-2014, which coincides with China's commodity boom and its strong performance in manufactured exports. Table 3.6 concerns the potential differential impacts of *Income TOT* across country groups by introducing interaction terms between *Income TOT* and export specialisation dummy. However, no interaction effects are found.

Table 3.5. System GMM (mediation analysis): indirect channel of China's influence

DepVar EXPY	(1) 1995-2014	(2) 1995-2014	(3) 2002-2014	(4) 2002-2014
Lagged EXPY	0.335***	0.344***	0.263**	0.260**
	(0.0788)	(0.0787)	(0.103)	(0.108)
Landlock	-0.0766**	-0.0384	-0.106**	-0.0818*
	(0.0306)	(0.0301)	(0.0451)	(0.0426)
Population	-0.000924	0.0227	-0.0105	0.00907
	(0.0139)	(0.0159)	(0.0184)	(0.0197)
Remoteness	-0.000172	-0.000253	-0.000161	-0.000346
	(0.000312)	(0.000302)	(0.000357)	(0.000319)
Human Capital	0.0291***	0.0234***	0.0310***	0.0256***
	(0.00533)	(0.00487)	(0.00791)	(0.00714)
Institutions			0.0275	-0.0258
			(0.0368)	(0.0340)
Productive Investment		0.0510***		0.0617***
		(0.0113)		(0.0183)
Income TOT	0.0113***	0.00659	0.0179***	0.0129**
	(0.00393)	(0.00404)	(0.00652)	(0.00585)
Residual Openness	0.0662	0.125**	0.0979	0.184**
	(0.0629)	(0.0497)	(0.0769)	(0.0773)
Manu. Imports	0.000875	-0.00106	-0.0000663	-0.00190
	(0.00177)	(0.00181)	(0.00235)	(0.00229)
FDI Inflow	0.00120	0.00161	0.00108	-0.000634
	(0.00205)	(0.00229)	(0.00302)	(0.00282)
AGRIs	-0.0565*	-0.0521	-0.0691*	-0.0719**
	(0.0304)	(0.0321)	(0.0362)	(0.0346)
MANUs	0.123***	0.0720**	0.0904**	0.0266
	(0.0326)	(0.0318)	(0.0423)	(0.0348)

MINEs	0.00423	0.00236	-0.0417	-0.0659
	(0.0353)	(0.0327)	(0.0433)	(0.0412)
Constant	6.031***	5.528***	6.843***	6.633***
	(0.935)	(0.948)	(1.189)	(1.106)
Observations	1003	976	665	654
Groups	57	56	57	56
Instruments	35	36	29	30
AR(1)	0.000715	0.00166	0.00203	0.00255
AR(2)	0.904	0.906	0.481	0.470
Hansen Test (p)	0.956	0.967	0.676	0.633
Diff.-in-Hansen	Pass	Pass	Pass	Pass
Wald chi2 (p)	0.000	0.000	0.000	0.000

Two-step System GMM: Windmeijer finite-sample corrected standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 3.6. System GMM with interactions: indirect channel of China's influence

DepVar	(1)	(2)	(3)	(4)	(5)	(6)
EXPY	1995-2014	2002-2014	1995-2014	2002-2014	1995-2014	2002-2014
Lagged EXPY	0.340***	0.258**	0.342***	0.256**	0.340***	0.273***
	(0.0818)	(0.106)	(0.0824)	(0.110)	(0.0896)	(0.105)
Landlock	-0.0533*	-0.0881**	-0.0315	-0.0756*	-0.0481	-0.0841*
	(0.0307)	(0.0426)	(0.0318)	(0.0453)	(0.0347)	(0.0451)
Population	0.0333**	0.0222	0.0239	0.00775	0.0363**	0.0210
	(0.0154)	(0.0207)	(0.0160)	(0.0219)	(0.0156)	(0.0193)
Remoteness	-0.000428	-0.000456	-0.000233	-0.000239	-0.000411	-0.000399
	(0.000338)	(0.000350)	(0.000301)	(0.000322)	(0.000341)	(0.000334)
Human Capital	0.0235***	0.0254***	0.0258***	0.0283***	0.0268***	0.0286***
	(0.00517)	(0.00663)	(0.00519)	(0.00719)	(0.00516)	(0.00733)
Institutions		-0.0189		-0.0332		-0.0304
		(0.0361)		(0.0371)		(0.0379)
Productive Investment	0.0612***	0.0679***	0.0523***	0.0611***	0.0696***	0.0749***
	(0.0120)	(0.0189)	(0.0108)	(0.0173)	(0.0128)	(0.0203)
Income TOT	0.00117	0.00759	0.00865	0.00738	0.00761	0.0139**
	(0.00471)	(0.00791)	(0.00580)	(0.00922)	(0.00477)	(0.00626)
AGRIs×ITOT	0.00518	0.00120				
	(0.00717)	(0.0124)				
MANUs×ITOT			0.000199	0.0132		
			(0.00727)	(0.0140)		
MINEs×ITOT					-0.0122	-0.0138
					(0.00761)	(0.00899)
Residual Openness	0.149***	0.198***	0.127**	0.176**	0.170***	0.195**
	(0.0539)	(0.0758)	(0.0495)	(0.0771)	(0.0541)	(0.0801)
Manu. Imports	-0.00219	-0.00289	-0.00211	-0.00178	-0.00421**	-0.00409
	(0.00193)	(0.00262)	(0.00185)	(0.00271)	(0.00213)	(0.00273)
FDI Inflow	0.00126	-0.000659	0.00178	-0.000336	0.00128	-0.000645
	(0.00233)	(0.00268)	(0.00225)	(0.00268)	(0.00222)	(0.00257)
AGRIs	-0.126	-0.0768				
	(0.0780)	(0.130)				
MANUs			0.0910	-0.0546		
			(0.0734)	(0.142)		
MINEs					0.132	0.121
					(0.0820)	(0.101)
Constant	5.761***	6.674***	5.441***	6.475***	5.563***	6.329***
	(1.061)	(1.134)	(0.942)	(1.121)	(1.087)	(1.070)
Observations	976	654	976	654	976	654
Groups	56	56	56	56	56	56
Instruments	35	29	35	29	35	29
AR(1)	0.00206	0.00280	0.00160	0.00262	0.00186	0.00210
AR(2)	0.886	0.455	0.903	0.455	0.868	0.458
Hansen Test (p)	0.938	0.639	0.972	0.713	0.928	0.665
Diff.-in-Hansen	Pass	Pass	Pass	Pass	Pass	Pass
Wald chi2 (p)	0.000	0.000	0.000	0.000	0.000	0.000

Two-step System GMM: Windmeijer finite-sample corrected standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 3.7 gives results for the robustness check with lag structure. *FDI Inflow*, *Manu. Imports*, *Residual Openness*, *Productive Investment*, and *Income TOT* are lagged by one year. Results for *Human Capital*, *Productive Investment* and its mediation effect, and *Income TOT* do not show any qualitative differences in comparison with previous regressions. *FDI Inflow* and *Institutions* still do not show statistical significance.

Table 3.7. System GMM with lag structure: indirect channel of China's influence

DepVar EXPY	(1) 1995-2014	(2) 1995-2014	(3) 2002-2014	(4) 2002-2014
Lagged EXPY	0.426***	0.447***	0.346***	0.304***
	(0.0820)	(0.0795)	(0.110)	(0.0714)
Landlock	-0.0274	-0.0445	-0.0221	-0.0791**
	(0.0508)	(0.0308)	(0.0851)	(0.0358)
Population	-0.0571*	0.0140	-0.0844*	0.0126
	(0.0292)	(0.0158)	(0.0432)	(0.0165)
Remoteness	0.000377	-0.000181	0.000166	-0.000327
	(0.000456)	(0.000262)	(0.000590)	(0.000300)
Human Capital	0.0127*	0.0183***	0.0179*	0.0226***
	(0.00749)	(0.00437)	(0.0102)	(0.00535)
Institutions			-0.0281	-0.0227
			(0.0646)	(0.0310)
Lagged Productive Investment		0.0409***		0.0583***
		(0.0111)		(0.0173)
Lagged Income TOT	0.0567**	0.00559	0.0820**	0.00980*
	(0.0243)	(0.00380)	(0.0345)	(0.00545)
Lagged Residual Openness	0.000556	0.100**	-0.0156	0.145**
	(0.0899)	(0.0457)	(0.135)	(0.0699)
Lagged Manu. Imports	-0.00157	-0.0000140	-0.00355	-0.000912
	(0.00328)	(0.00161)	(0.00539)	(0.00214)
Lagged FDI Inflow	0.00163	-0.000202	0.00117	0.000129
	(0.00245)	(0.00177)	(0.00273)	(0.00141)
AGRIs	0.00823	-0.0480	0.0114	-0.0681**
	(0.0634)	(0.0294)	(0.0864)	(0.0327)
MANUs	0.185***	0.0530*	0.208*	0.0181
	(0.0651)	(0.0287)	(0.107)	(0.0342)
MINEs	-0.0403	-0.00702	-0.0924	-0.0546
	(0.0750)	(0.0324)	(0.0986)	(0.0363)
Constant	4.860***	4.698***	6.132***	6.192***
	(1.049)	(0.916)	(1.541)	(0.842)
Observations	973	973	653	653
Number of Groups	56	56	56	56
Number of Instruments	35	36	29	30
AR(1)	0.000513	0.000649	0.00173	0.000505
AR(2)	0.921	0.994	0.652	0.469
Hansen Test (p)	0.307	0.286	0.316	0.614
Diff.-in-Hansen	Pass	Pass	Pass	Pass
Wald chi2 (p)	0.000	0.000	0.000	0.000

Two-step System GMM: Windmeijer finite-sample corrected standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Finally, how has global value chain (GVC) influenced export upgrading? Deeper engagement in GVC induces more trade in task, especially in relatively technology-intensive intermediate goods, which increases export sophistication. However, with a few exceptions such as Vietnam, the Philippines, and Lebanon, the countries in our sample tend not to be active in trade in task. As a further robustness check, all regressions are replicated with adding the GVC variable of the share of foreign value added in exports from the UNCTAD-Eora GVC database, but the results do not show qualitative differences. Moreover, because seven countries that are missing in the UNCTAD-Eora database have to be dropped, we have chosen not to include the GVC variable in the models. Results with the GVC variable are available upon request.

3.6. Conclusion

Historical experience of economic catch-ups, especially the case of late industrialisers, has demonstrated the role of export upgrading as a precondition of development. Thus, it is of importance and relevance to understand the mechanism underlying the upgrading of developing countries' export basket. However, empirical explorations into this issue have been insufficient. Moreover, the rise of China as an increasingly important trade partner for developing countries has made it a new factor influencing developing countries' export upgrading. Given the research gap, this paper examines the determinants of developing countries' export upgrading from 1995 to 2014 with a particular interest in the role of trade with China and productive investment.

This chapter examines the determinants of developing countries' export upgrading, measured by export sophistication, from 1995 to 2014 with a particular interest in the role of trade with China and productive investment. This chapter finds that, amongst general factors, access to sea, human capital, productive investment, and trade openness are the major determinants of developing countries' export upgrading. Landlocked location substantially impedes export upgrading, which implies that some developing countries are doomed to be at a disadvantageous position of industrialisation and structural transformation, a "curse of geography". However, improving human capital, accumulating productive investment, and promoting trade openness definitely stimulate export upgrading. The robust and strong positive effect of productive investment lends support to the hypothesis by Lo (2016) that insufficient productive investment leads to the poor performance of developing countries' manufactured exports. The policy implication is clear. In order to promote export upgrading, developing countries should have strong and accountable political and social agents, especially the state, that can appropriately conceptualise their roles in the development agenda and are able to direct the economy to a path of industrialisation and structural transformation. Their roles may operate via investing in education, accumulating productive investment, translating productive investment into technological and productive upgrading, and promoting trade openness. A special note should be given to the last point. Promoting trade openness is not necessarily related to trade regime neutrality and laissez-faire trade policy. Rather, the experience of the Asian Tigers provides an alternative example of export-led model in which the developmental state plays a decisive role.

Absolute gains from trade with China, reflecting on improvement in income terms of trade *vis-à-vis* China, are found to promote developing countries' export upgrading, which takes effect largely through the role of trade with China as a source of productive investment. This effect is particularly strong and robust in the period of 2002-2014, during which China showed rapidly growing role in the global economy, especially through the commodity boom and the strong performance in manufactured exports. This finding echoes the suggestion of Gottschalk and Prates (2006) that developing countries should grasp the "windfalls" of the current commodity boom and channel revenues from resource exports to productive investment. Moreover, this finding provides a new perspective to understand

China's role in developing countries' industrialisation and development. The conventional arguments of the "crowding-out" effect and the "re-primarisation" effect are concerned with the direct channel through which China's cheap manufactured exports compete with developing countries' counterparts and China's import demand induces developing countries to specialise or re-specialise in primary commodities. However, the literature neglects an indirect channel through which monetary benefits from trade with China accruing to developing countries can serve as a source of productive investment for their export upgrading. This chapter points to the need to distinguish between the direct and the indirect channel of the impact of trade with China on developing countries. Based on the findings, we suggest that, for developing countries, China serves more as a stimulator of capital accumulation than a competitor in manufacturing market or a predator of natural resources.

Finally, the effects of labour endowment, FDI inflow, and institutional quality shown by previous studies are basically rejected. A very likely reason is the use of only developing countries as sample in this chapter. Developing countries tend to feature excessive but low-skilled labour force, and thus larger population or richer labour endowment is not necessarily a cost advantage for the cost discovery process of new production activities as suggested by Hausmann and Rodrik (2003) and Hausmann *et al*. (2007). FDI going to many developing countries concentrates on extractive sectors or, more generally speaking, natural resource sectors, and thus tends not to stimulate export upgrading. The absence of institutional quality in the mainstream terms as a contributor to export upgrading may imply that market-friendly institutional arrangement may not necessarily promote industrial development in developing countries, because state intervention and some market-unfriendly measures are necessary for industrialisation. This echoes the experience of the East Asian model and justifies the developmental state. For another thing, the absence of the effect of institutions indicates that institutional quality in the mainstream sense is like a black box with a vague role. It is unclear how institutions influence productive activities and technological progress, because the influence may take effect through either a better planning of production or a better functioning of the market. These two aspects are even not fully mutually compatible. Moreover, from a sociological perspective, industrialisation is socially-determined process, which reflects the motivations and interests of various political and social agents, such as the state and entrepreneurs. Historical experience has demonstrated that all industrialisations are intrinsically up-to-down and profit- or interest-driven revolutions initiated by elite agents, such as entrepreneurs and politicians (Moore, 1966; Kiely, 1998). In this sense, these agents' motivations and interests may have a more important role to play in the industrialisation process than the so-called "institutional quality". This conforms to the centrality of strong and developmentally-oriented elites in the developmentalist model of industrialisation and development (Leftwich, 1995). Thus, the absence of institutions as a contributor to developing countries' export upgrading may not be read as a surprise.

References

Aghion, P., & Howitt, P. (1990). A model of growth through creative destruction (No. w3223). National Bureau of Economic Research.

Amable, B. (2000). International specialisation and growth. *Structural Change and Economic Dynamics*, 11(4), 413-431.

Amsden, A. H. (1987). The directionality of trade: historical perspective and overview. In Exports of developing countries: how direction affects performance. World Bank Conference South-South versus South-North Trade (No. PROG IV-E71 H388). Banco Mundial, Washington, DC (EUA).

Amsden, A. H. (1994). Why isn't the whole world experimenting with the East Asian model to develop?: Review of the East Asian miracle. *World Development*, *22*(4), 627-633.

Anderson, J. E., & Van Wincoop, E. (2004). Trade costs. *Journal of Economic Literature*, *42*(3), 691-751.

Andreoni, A. (2010). A Capability Theory of Production: learning in time, complementarities and proximities. In DIME workshop Process, Technology, and Organisation: Towards a useful Theory of Production, LEM, Scuola Superiore Sant'Anna, Pisa.

Andreoni, A. (2011). Productive capabilities indicators for industrial policy design. UNIDO

Working paper series, (17/11).

Andreoni, A. (2013). The Industrial Competitiveness of Nations-Looking back, forging ahead.

Andreoni, A., & Gregory, M. (2013). Why and how does manufacturing still matter: Old rationales, new realities. *Revue d'économie industrielle*, (144), 21-57.

Andersen, T. G., & Sørensen, B. E. (1996). GMM estimation of a stochastic volatility model: A Monte Carlo study. *Journal of Business & Economic Statistics*, *14*(3), 328-352.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, *58*(2), 277-297.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, *68*(1), 29-51.

Assche, A. V., & Gangnes, B. (2010). Electronics production upgrading: Is China exceptional?. *Applied Economics Letters*, *17*(5), 477-482.

Asteriou, D., & Hall, S. (2011). Applied Econometrics. Palgrave Macmillan.

Balassa, B. (1965). Trade liberalisation and "revealed" comparative advantage. *The Manchester School*, 33(2), 99-123.

Baliamoune-Lutz, M. (2011). Growth by destination (where you export matters): Trade with China and growth in African countries. *African Development Review*, *23*(2), 202-218.

Baltagi, B. (2008). *Econometric analysis of panel data*. John Wiley & Sons.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*(6), 1173.

Baran, P., & Sweezy, P. (1966). Monopoly capitalism. *An Essay on the American Economic and Social Order*.

Bell, M. (2007). Technological learning and the development of production and innovative capacities in the industry and infrastructure sectors of the Least Developed Countries: What roles for ODA. *UNCTAD Division for Africa, Least Developed Countries Specialised Programme, Brighton, Science Policy research*.

Blanchard, E. J., & Olney, W. W. (2017). Globalization and human capital investment: Export composition drives educational attainment. *Journal of International Economics*, *106*, 165-183.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, *87*(1), 115-143.

Blundell, R., & Bond, S. (2000). GMM estimation with persistent panel data: an application to production functions. *Econometric Reviews*, *19*(3), 321-340.

Bond, S. R. (2002). Dynamic panel data models: a guide to micro data methods and practice. *Portuguese Economic Journal*, *1*(2), 141-162.

Bond, S., Hoefller, A., & Temple, J. (2001). GMM estimation of empirical growth models.

Bowsher, C. G. (2002). On testing overidentifying restrictions in dynamic panel data models. *Economics Letters*, *77*(2), 211-220.

Busse, M., Erdogan, C., & Mühlen, H. (2016). China's impact on Africa–The role of trade, FDI and aid. *Kyklos*, *69*(2), 228-262.

Cabral, M. H., & Veiga, P. (2010). Determinants of export diversification and sophistication in Sub-Saharan Africa.

Cameron, A. C., & Trivedi, P. K. (2010). *Microeconometrics using stata* (Vol. 2). College Station, TX:

Stata press.

CEPAL (2012). Foreign Direct Investment in Latin America and the Caribbean.

Chen, G., Geiger, M., & Fu, M. (2015). Manufacturing FDI in Sub-Saharan Africa: trends, determinants, and impacts. World Bank.

Clemens, M. A., & Williamson, J. G. (2011). Why were Latin America's tariffs so much higher than Asia's before 1950?. *Revista de Historia Economica-Journal of Iberian and Latin American Economic History*, *30*(1), pp. 11-44.

Coe, D. T., & Helpman, E. (1995). International R&D spillovers. *European Economic Review*, *39*(5), 859-887.

Coe, D. T., Helpman, E., & Hoffmaister, A. W. (1997). North-south R & D spillovers. *The Economic Journal*, *107*(440), 134-149.

Davidson, P. (1990). A post Keynesian positive contribution to “theory”. *Journal of Post Keynesian Economics*, *13*(2), 298-303.

Demir, F., & Dahi, O. S. (2011). Asymmetric effects of financial development on South–South and South–North trade: Panel data evidence from emerging markets. *Journal of Development Economics*, *94*(1), 139-149.

Drummond, M. P., & Liu, M. E. X. (2013). Africa's Rising Exposure to China: How Large Are Spillovers Through Trade? (No. 13-250). International Monetary Fund.

Felipe, J., Kumar, U., & Abdon, A. (2010). As you sow so shall you reap: from capabilities to opportunities. Levy Economics Institute, Working Papers Series, (613).

Felipe, J., Kumar, U., Abdon, A., & Bacate, M. (2012). Product complexity and economic development. *Structural Change and Economic Dynamics*, *23*(1), 36-68.

Felipe, J., Kumar, U., & Abdon, A. (2014). How rich countries became rich and why poor countries remain poor: It's the economic structure… duh!. *Japan and the World Economy*, *29*, 46-58.

Fortunato, P., & Razo, C. (2014). Export sophistication, growth and the middle-income trap, in *Transforming Economies: Making Industrial Policy Work for Growth, Job and Development*. ILO: Geneva.

Frankel, J. A., & Romer, D. H. (1999). Does Trade Cause Growth?. *American Economic Review*, *89*(3), pp. 379-399.

Freund, C., & Ozden, C. (2009). The effect of China’s exports on Latin American trade with the world. *China’s and India’s challenge to Latin America: Opportunity or Threat*, 179-215.

Fu, X., Kaplinsky, R., & Zhang, J. (2012). The impact of China on low and middle income countries’ export prices in industrial-country markets. *World Development*, *40*(8), 1483-1496.

Gallagher, K. P., & Porzecanski, R. (2009). China and the Latin America commodities boom: a critical assessment. *PERI Working Papers*, 164.

Galor, O., & Mountford, A. (2008). Trading population for productivity: theory and evidence. *The Review of Economic Studies*, *75*(4), 1143-1179.

Gaulier, G., & Zignago, S. (2010). BACI: international trade database at the product-level (the 1994-2007 version).

Gerschenkron, A. (1962). *Economic backwardness in historical perspective: a book of essays* (No. 330.947 G381). Cambridge, MA: Belknap Press of Harvard University Press.

Giovannetti, G., & Sanfilippo, M. (2009). Do Chinese exports crowd-out African goods? An econometric analysis by country and sector. *The European Journal of Development Research*, *21*(4), 506-530.

Gottschalk, R., & Prates, D. (2006). *East Asia's growing demand for primary commodities: macroeconomic challenges for Latin America*. UN.

Grossman, G. M., & Helpman, E. (1991). Trade, knowledge spillovers, and growth. *European Economic Review*, *35*(2-3), 517-526.

Harding, T., & Javorcik, B. S. (2011). FDI and Export Upgrading.

Harrison, A., & Rodríguez-Clare, A. (2010). Trade, foreign investment, and industrial policy for developing countries. In *Handbook of Development Economics* (Vol. 5, pp. 4039-4214). Elsevier.

Hausmann, R., & Rodrik, D. (2003). Economic development as self-discovery. *Journal of Development Economics*, *72*(2), 603-633.

Hausmann, R., & Klinger, B. (2006). Structural transformation and patterns of comparative advantage in the product space.

Hausmann, R., Hwang, J., & Rodrik, D. (2007). What you export matters. *Journal of Economic Growth*, *12*(1), 1-25.

Hausmann, R., & Klinger, B. (2007). The structure of the product space and the evolution of comparative advantage (No. 146). Center for International Development at Harvard University.

Henn, C., Papageorgiou, C., Romero, J. M., & Spatafora, N. (2017). Export quality in advanced and developing economies: evidence from a new data set. The World Bank.

Hidalgo, C. A. (2009). *The dynamics of economic complexity and the product space over a 42-year period* (No. 189). Center for International Development at Harvard University.

Hidalgo, C. A., & Hausmann, R. (2009). The building blocks of economic complexity. *Proceedings of the national academy of sciences*, *106*(26), 10570-10575.

Hirschman, A. O. (1958). *The strategy of economic development* (No. 04; HD82, H5.).

Iwamoto, M., & Nabeshima, K. (2012). Can FDI promote export diversification and sophistication of host countries? Dynamic panel system GMM analysis (No. 347). Institute of Developing Economies, Japan External Trade Organization (JETRO).

Jenkins, R. (2010). China's global expansion and Latin America. *Journal of Latin American Studies*, *42*(4), 809-837.

Judson, R. A., & Owen, A. L. (1999). Estimating dynamic panel data models: a guide for macroeconomists. *Economics Letters*, *65*(1), 9-15.

Kaldor, N. (1966). *Causes of the slow rate of economic growth of the United Kingdom: an inaugural lecture*. Cambridge University Press.

Kaldor, N. (1967). Strategic factors in economic development.

Kaplinsky, R., & Santos-Paulino, A. (2005). Innovation and competitiveness: trends in unit prices in global trade. *Oxford Development Studies*, *33*(3-4), 333-355.

Kaplinsky, R. (2006). Revisiting the revisited terms of trade: will China make a difference?. *World Development*, *34*(6), 981-995.

Kaplinsky, R., McCormick, D., Morris, M. (2007). The Impact of China on Sub-Saharan Africa.

Kaplinsky, R., & Morris, M. (2008). Do the Asian drivers undermine export-oriented industrialization in SSA?. *World Development*, *36*(2), 254-273.

Kaplinsky, R. (2009). China and the terms of trade: The challenge to development strategy in Sub-Saharan Africa. In *Global Giant* (pp. 115-134). Palgrave Macmillan, New York.

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2011). The worldwide governance indicators:

methodology and analytical issues. *Hague Journal on the Rule of Law*, *3*(2), 220-246.
Kemeny, T. (2010). Does foreign direct investment drive technological upgrading?. *World Development*, *38*(11), 1543-1554.
Kiely, R. (1998). *Industrialization and Development: An Introduction*. Taylor & Francis Limited.
Kitching, G. (1982). *Development and Underdevelopment in Historical Perspective*. (Milton Keynes).
Klinger, B. (2009). Is South-South trade a testing ground for structural transformation?. *UN Policy Issues in International Trade and Commodities Study*, (40).
Kočenda, E., & Poghosyan, K. (2018). Export sophistication: A dynamic panel data approach. *Emerging Markets Finance and Trade*, *54*(12), 2799-2814.
Kummer-Noormamode, S. (2014). Does trade with China have an impact on African countries' growth?. *African Development Review*, *26*(2), 397-415.
Lall, S. (2000). The Technological structure and performance of developing country manufactured exports, 1985-98. *Oxford Development Studies*, *28*(3), 337-369.
Lall, S., Weiss, J., & Oikawa, H. (2005). China's competitive threat to Latin America: an analysis for 1990–2002. *Oxford Development Studies*, *33*(2), 163-194.
Lall, S., Weiss, J., & Zhang, J. (2006). The "sophistication" of exports: a new trade measure. *World Development*, *34*(2), 222-237.
Lavopa, A., & Szirmai, A. (2012). Manufacturing growth, manufacturing exports and economic development, 1960-2010. In *14th ISS Conference, Brisbane, Australia*.
Lectard, P., & Rougier, E. (2018). Can developing countries gain from defying comparative advantage? Distance to comparative advantage, export diversification and sophistication, and the dynamics of specialization. *World Development*, *102*, 90-110.
Lee, J. W. (1995). Capital goods imports and long-run growth. *Journal of Development Economics*, *48*(1), 91-110.
Lee, C. H., & Huang, B. N. (2002). The relationship between exports and economic growth in East Asian countries: A multivariate threshold autoregressive approach. *Journal of Economic Development*, *27*(2), 45-68.
Lederman, D., & Maloney, W. F. (2007). Neither curse nor destiny: Introduction to natural resources and development. *Natural resources: Neither curse nor destiny*, 1-12.
Leftwich, A. (1995). Bringing politics back in: Towards a model of the developmental state. *The Journal of Development Studies*, *31*(3), 400-427.
Lehmann, S. H., & O'Rourke, K. H. (2011). The structure of protection and growth in the late nineteenth century. *Review of Economics and Statistics*, *93*(2), 606-616.
Levchenko, A. A. (2007). Institutional quality and international trade. *The Review of Economic Studies*, *74*(3), 791-819.
Lo, D. (2004). China's Nexus of Foreign Trade and Economic Growth: Making Sense of the Anomaly.
Lo, D. (2012). *Alternatives to Neoliberal Globalization*. Palgrave Macmillan UK.
Lo, D. (2016). Developing or Under-developing? Implications of China's "Going out" for Late Development (SOAS Working Paper No. 198).
Lucas Jr, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, *22*(1), 3-42.
Ma, A. C., & Assche, A. V. (2011). China's role in global production networks.
Mahutga, M. C., & Smith, D. A. (2011). Globalization, the structure of the world economy and

economic development. *Social Science Research*, *40*(1), 257-272.
Manzano, O., & Rigobón, R. (2001). Resource curse or debt overhang? (No. w8390). National Bureau of Economic Research.
Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica*, *71*(6), 1695-1725.
Meyersson, E., i Miquel, G. P., & Qian, N. (2008). The rise of China and the natural resource curse in Africa. *London School of Economics and Political Science, Economic Organisation and Public Policy Programme, http://personal. lse. ac. uk/padro/meyersonpadroqian_20080407_all. pdf*.
Michaely, M. (1984). Trade, income levels, and dependence.
Minondo, A. (2010). Exports' quality-adjusted productivity and economic growth. *The Journal of International Trade & Economic Development*, *19*(2), 257-287.
Moore, B. (1966). Social origins of democracy and dictatorship. *Boston: Beacon*.
Moreira, M. M. (2007). Fear of China: is there a future for manufacturing in Latin America?. *World Development*, *35*(3), 355-376.
Narayan, P. K., & Smyth, R. (2008). Energy consumption and real GDP in G7 countries: new evidence from panel cointegration with structural breaks. *Energy Economics*, *30*(5), 2331-2341.
Nayyar, D. (Ed.). (1997). *Trade and Industrialization*. Oxford University Press, USA.
Nickell, S. (1981). Biases in dynamic models with fixed effects. *Econometrica: Journal of the Econometric Society*, 1417-1426.
Nunn, N., & Trefler, D. (2007). The political economy of tariffs and long-term growth. *Cambridge, MA: Harvard University. Mimeo. Available at www. economics. harvard. edu/faculty/nunn/files/lobbying. pdf.*
Ocampo, J. A., & Ros, J. (Eds.). (2011). *The Oxford Handbook of Latin American Economics*. Oxford University Press.
Page, J. (2012). Can Africa industrialise?. *Journal of African Economies*, *21*(suppl_2), 86-124.
Parteka, A., & Tamberi, M. (2013). What determines export diversification in the development process? Empirical assessment. *The World Economy*, *36*(6), 807-826.
Paus, E. (2009). The rise of China: implications for Latin American development. *Development Policy Review*, *27*(4), 419-456.
Power, R. (2008). What does the rise of China do for industrialisation in Sub-Saharan Africa?. *Review of African Political Economy*, *35*(115), 7-22.
Prebisch, R. (1950). The Economic Development of Latin America and Its Principal Problems. New York: United Nations.
Radelet, S., & Sachs, J. (1998). Shipping costs, manufactured exports, and economic growth. In American Economic Association Meetings, Harvard University, mimeo.
Raffer, K., & Singer, H. W. (2001). The Economic North-South Divide. *Six Decades of Unequal Development. Edward Elgar, Cheltenham/Northampton*.
Regolo, J. (2013). Export diversification: How much does the choice of the trading partner matter?. *Journal of International Economics*, *91*(2), 329-342.
Rodríguez, F., & Rodrik, D. (2000). Trade Policy and Economic Growth: A Skeptic's Guide to the Cross-National Evidence. *NBER Macroeconomics Annual*, *15*, pp. 261-325.
Rodrik, D. (2006). Industrial development: stylized facts and policies. 2006. Harvard University.
Roodman, D. (2006). How to do xtabond2: An introduction to difference and system GMM in Stata. *Oxford Bulletin of Economics and statistics*, *71*(1), 135-158.

Roodman, D. (2009). A note on the theme of too many instruments. *Oxford Bulletin of Economics and Statistics*, *71*(1), 135-158.
Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy*, *98*(5, Part 2), S71-S102.
Sachs, J. D., & Warner, A. M. (1995). Natural resource abundance and economic growth (No. w5398). National Bureau of Economic Research.
Sachs, J. D., & Warner, A. M. (1997). Sources of slow growth in African economies. *Journal of African economies*, *6*(3), 335-376.
Sachs, J. D., & Warner, A. M. (2001). The curse of natural resources. *European Economic Review*, *45*(4-6), 827-838.
Sandrey, R., & Edinger, H. (2011). China's manufacturing and Industrialization in Africa. African Development Bank Group.
Saviotti, P. P., & Frenken, K. (2008). Export variety and the economic performance of countries. *Journal of Evolutionary Economics, 18* (2), 201-218.
Schott, P. K. (2004). Across-product versus within-product specialization in international trade. *The Quarterly Journal of Economics*, *119*(2), 647-678.
Schott, P. K. (2008). The relative sophistication of Chinese exports. *Economic Policy*, *23*(53), 6-49.
Schiff, M., & Wang, Y. (2006). North-South and South-South trade-related technology diffusion: an industry-level analysis of direct and indirect effects. *Canadian Journal of Economics/Revue canadienne d'économique*, *39*(3), 831-844.
Seddon, D., & Belton-Jones, T. (1995). The political determinants of economic flexibility, with special reference to the East Asian NIQs. *The Flexible Economy: Causes and Consequences of the Adaptability of National Economies*, 325.
Singer, H. W. (1950). The distribution of gains between investing and borrowing countries. *The American Economic Review*, *40*(2), 473-485.
Singer, H. W. (1975). The distribution of gains from trade and investment-revisited. *The Journal of Development Studies*, *11*(4), 376-382.
Singer, H. W. (1998). *Growth, Development, and Trade: Selected Essays of Hans W. Singer*. Edward Elgar Pub.
Somel, C. (2005). Surplus Allocation and Development under Global Capitalism (No. 0505). ERC-Economic Research Center, Middle East Technical University.
Soytas, U., & Sari, R. (2006). Energy consumption and income in G-7 countries. *Journal of Policy Modeling*, *28*(7), 739-750.
Spatafora, M. N., Anand, R., & Mishra, M. S. (2012). Structural transformation and the sophistication of production (No. 12-59). International Monetary Fund.
Thirlwall, A. P. (1979). The Balance of Payments Constraint as an Explanation of International Growth Rate Differences. Banca Nazionale del Lavoro. *Quarterly Review*.
Thirlwall, A. P. (2003). *The nature of economic growth: an alternative framework for understanding the performance of nations*. Edward Elgar Publishing.
Thirlwall, A. P. (2011). The balance of payments constraint as an explanation of international growth rate differences. *PSL Quarterly Review*, *64*(259), 429-438.
UNIDO (2013). Country grouping in UNIDO statistics. Vienna: United Nations.
Wang, Z., & Wei, S. J. (2010). What accounts for the rising sophistication of China's exports?. In *China's growing role in world trade* (pp. 63-104). University of Chicago Press.

Wei, S. J. (1999). *Natural Openness and Good Government*. The World Bank.
Weldemicael, E. (2012). Determinants of export sophistication. *The University of Melbourne*.
Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators. *Journal of Econometrics*, *126*(1), 25-51.
World Bank. (2014). Foreign Direct Investment Flows into Sub-Saharan Africa.
Xu, B. (2007). Measuring China’s export sophistication. China Europe International Business School.
Xu, B. (2010). The sophistication of exports: Is China special?. *China Economic Review*, *21*(3), 482-493.
Yang, R., & Yao, Y. (2008). Limited catch-up and economic growth. *Economic Research*. 8, 29-41 (in Chinese).
Zhu, S., Fu, X., Lai, M., & Xuan, J. (2010). What Drives the Export Sophistication of Countries?. *Journal of World Economy*, *4*, 28-43.

Appendix A. Recent Studies on China's Impact on Developing Countries

Table A1. Summary of recent studies on China's impact on developing countries

Paper	Theme	Methodology	Relevant Findings
Busse, Erdogan and Mühlen (2016)	The impact of China's trade, FDI, and aid on African countries' growth (1991-2010) ***Direct Impact***[56]	Fixed-effects regression and System GMM regression	1. Imports from China modestly reduce African countries' GDP p.c. growth, implying displacement effect. 2. Improvement in terms of trade increases African countries' GDP p.c. growth, implying benefits from resource exports to China. 3. Revenues from exports to China increase investment. 4. Exports to China and FDI from China do not matter.
Drummond and Liu (2013)	The impact of China's domestic investment on Africa's export growth (1995-2012)	Fixed-effects regression	1. Growing trade links between China and Africa make Africa susceptible to China's domestic volatility. 2. China's domestic fixed assets investment growth stimulates Africa's export growth. 3. The effect is stronger for resource-rich African countries.
Kummer-Noormamode (2014)	The impact of trade with China on SSA's growth (1985-2012) ***Direct Impact***	Fixed-effects regression	1. Trade with China does not have impact on SSA countries' GDP p.c. growth between 1985 and 1999. 2. Trade with China increases SSA countries' GDP p.c. growth between 2000 and 2012.

[56] The "Direct Impact" and "Indirect Impact" are defined as China's impact on developing countries in their home market and in third market, respectively, according to Kaplinsky (2009). These concepts are irrelevant to the "direct channel" and "indirect channel" of China's impact on developing countries defined in this chapter.

			3. The effect of trade with China is greater than that of trade with EU between 2000 and 2012.
He (2013)	The impact of manufactured imports from China on SSA's manufactured exports (1988-2005) ***Direct Impact***	Random-effects regression and IV regression (sectoral level)	1. Manufactured imports in each sector from China increase SSA countries' manufactured exports in corresponding sector. 2. Manufactured imports from the US and France hardly have significant impact. 3. Capital goods from China are more suitable for SSA countries than those from developed countries for their export upgrading.
Fu, Zhang, and Kaplinsky (2012)	The impact of China on developing countries' export unit value in developed market (1989-2006) ***Indirect Impact***	System GMM regression (HS 8-digit)	1. China's impact on medium-income countries takes effect through price competition. 2. China's impact on low-income countries takes effect through market expansion. 3. After 1997, medium-income countries lost most due to China's exports, while before 1997 low-income countries lost most. 4. Price competition due to China has been decreasing.
Baliamoune-Lutz (2011)	The growth effect of Africa's trade with China (1995-2008) ***Direct Impact***	Difference GMM regression	1. High concentration of Africa's exports to China and high diversification of China's exports to Africa. 2. Exports to China do not unconditionally enhance African countries' growth. 3. Countries exporting one major commodity to China enjoy higher growth than those with diverse exports. 4. Imports from China have robust growth-enhancing effect.
Sandrey and Edinger (2011)	China's manufactured exports and SSA's industrialisation	Descriptive statistical analysis	1. Poor export performance impedes SSA's manufacturing. 2. SSA's industrial policy is impeded by: low investment, poor infrastructure, poor institution and governance, problematic industrial policy, and rigid macroeconomic framework. 3. Competitiveness of China's manufactured exports is not due to low wage. 4. Governments of resource-rich SSA countries tend not to have incentive to diversify exports or invest revenues from commodity boom in other sectors, and do not have appropriate management of those revenues.
Jenkins (2010)	The impact of trade with China on Latin America	Descriptive statistical analysis	1. Trade is the dominant channel that links China and Latin America. 2. China's competitiveness in manufactures and demand for primary commodities impede Latin American

			countries' industrialisation and push them back to specialising in primary commodities.
Freund and Ozden (2009)	The impact of China's export growth on Latin American countries' exports in third markets (1985-2004) ***Indirect Impact***	Weighted OLS (SITC 4-digit)	1. China's negative impacts on Latin America concentrate in Mexico's manufactured exports to the US. 2. Export price of Latin America as a whole faces downward pressure, due to China's competition. 3. China's competition concentrates in high-wage sectors, which restricts Latin America's export upgrading.
Giovannetti and Sanfilippo (2009)	The impact of China on Africa's manufactured exports in third markets (1995-2005) ***Indirect Impact***	IV regression and GMM regression (sectoral and product level) (HS 6-digit)	1. China's exports reduce Africa's exports, especially in manufactures, in third markets. 2. China's displacement effect is particularly significant in clothing and textile sector and machine and equipment sector. 3. China's displacement effect is particularly significant for intra-SSA trade.
Paus (2009)	Changing pattern of trade between Latin American countries and China and their development prospects ***Direct Impact***	Descriptive statistical analysis	1. Latin America's exports to China concentrate in primary commodities. 2. The pattern of trade between China and Latin America does not fit their comparative advantage: China is labour-intensive, but its medium and high technology-intensive exports to Latin America are disproportionately high. 3. Latin America's exports are technologically moving down, partly due to China's move-up. 4. Latin American countries register trade deficit with China, except the few who have surplus in primary commodity exports. 5. TOT has improved in only few resource-rich Latin American countries.
Power (2008)	The impact of China's manufactured exports on SSA's industrialisation	Descriptive statistical analysis	1. SSA's MVA has been unchanged between 1996 and 2004. 2. Intra-SSA exports are more technology-intensive than outward exports 3. China's impacts are predominantly harmful for SSA's industrial growth. 4. It is difficult to see a bright future of SSA's manufacturing.
Meyersson, i Miquel and Qian (2008)	The impact of resource exports to China on SSA's growth and institution (1990-2006) ***Direct Impact***	IV regression	1. Natural resource exports to China increase SSA countries' GDP growth, human capital formation, and manufacturing. 2. Natural resource exports to China negatively impact on human rights.
Kaplinsky McCormick, and Morris (2007)	The impact of China's trade and FDI on SSA	Descriptive statistical analysis	1. SSA benefits from primary commodity exports to China and cheap consumer/capital goods from China. 2. Few trade outside primary

			commodities and clothing and textile. 3. China's trade impact on SSA takes effect more through indirect channel (in third and global markets) than direct channel (domestic markets). 4. SSA runs increasing trade deficit with China. 5. The benefits of commodity boom do not come automatically, since effective management of resource revenues is necessary.
Moreira (2007)	The trade impact of China on Latin America in third markets (1990-2004) ***Indirect Impact***	Descriptive statistical analysis (market share analysis) (Up to HS 6-digit)	1. China's advantages lie in labour endowment (Heckscher-Ohlin type), productivity (Ricardian type), economic scale (Krugmanian type), and state intervention. 2. Latin American countries bear small but growing loss in market share, due to China's exports.
Lall, Weiss, and Oikawa (2005)	The trade impact of China on Latin America (1990-2002) ***Direct and Indirect Impact***	Descriptive statistical analysis (SITC 3-digit)	1. China's export structure is complementary to that of Latin America, but bilateral trade is limited. 2. Competition in third markets is small. 3. China has become a net exporter of manufactures, while Latin America has become a net exporter of primary commodities. 4. Latin America has experienced export downgrading. 5. China's continuous technological upgrading will further strengthen Latin America's downgrading.

Source: Author's elaboration.

Appendix B. List of Countries by Export Specialisation Pattern

Table B1. List of countries in each group of export specialisation

AGRIs	MINEs	FUELs	MANUs
Belize	Armenia	Algeria	Albania
Benin	D. R. Congo	Angola	Antigua and Barbuda
Burkina Faso	Guinea	Azerbaijan	Bahamas
Burundi	Guyana	Cameroon	Bangladesh
Cameroon	Jamaica	Chad	Barbados
Central African Rep.	Mauritania	Congo	Bhutan
Comoros	Mongolia	Ecuador	Bosnia and Herzegovina
Cote d'Ivoire	Peru	Equatorial Guinea	Cambodia
Ecuador	Tajikistan	Gabon	Cape Verde

Ethiopia	Zambia	Iran	Djibouti
Fiji		Iraq	Dominica
Gambia		Libya	Dominican Republic
Ghana		Nigeria	Egypt
Grenada		Syrian Arab Republic	El Salvador
Guatemala		Trinidad and Tobago	Eritrea
Guinea-Bissau		Turkmenistan	Georgia
Guyana		Yemen	Guatemala
Kenya			Haiti
Kiribati			Honduras
Laos			Jordan
Madagascar			Lebanon
Malawi			Liberia
Maldives			Moldova
Mali			Morocco
Mauritania			Nepal
Moldova			Nicaragua
Mozambique			Niger
Myanmar			Pakistan
Nicaragua			Panama
Paraguay			Philippines
Rwanda			Saint Vincent and the Grenadines
Sao Tome and Principe			Samoa
Senegal			Sri Lanka
Seychelles			Vietnam
Solomon Islands			
Tanzania			
Tonga			
Uganda			
Uzbekistan			
Vanuatu			

Source: Author's elaboration.

Appendix C. Descriptive Statistics

Table C1. Descriptive statistics (62-country panel)

Variables	Obs.	Mean	Std.	Min	Max
EXPY (ln)	1,240	9.04	0.34	7.55	9.78
Landlock	1,240	0.32	0.47	0	1
Remoteness	1,240	1727.79	49.81	1574.55	1827.2
Population (ln)	1,237	16.2	1.11	13.88	19.04
Human Capital (years)	1,169	5.44	2.84	0.9	12.2
Institutions	992	-0.66	0.43	-2.01	0.6
Productive Investment (ln)	1,177	5.86	1.34	-2.78	8.95
Income TOT (ln)	1,139	9.97	3.36	-0.61	17.75
Manu. Imports (% of total imports)	1,240	26.86	10.92	7.27	92.88
FDI Inflow (% of GDP)	1,204	4.09	7.14	-82.89	89.48
Imports from CHN (% of total imports)	1,240	9.21	8.66	0.004	56.26
Exports to CHN (% of total exports)	1,204	5.44	11.08	0.0003	88.13
Residual Openness	1,200	0.01	0.13	-0.36	0.83
AGRIs	1,240	0.44	0.5	0	1
MANUs	1,240	0.4	0.49	0	1
MINEs	1,240	0.16	0.37	0	1

Source: Author's elaboration.

Chapter 4. The Directionality of Developing Countries' Export Sophistication and Its Determinants

4.1. Introduction

A country's exports to different directions may embody different levels of technology and capital (Amsden, 1986). In the 1970s and the 1980s, economists observed that many developing countries' exports to other developing countries contained more physical and human capital than their exports to developed countries (e.g., Amsden, 1976; Havrylyshyn, 1985; Amsden, 1987; Cizeljc and Fuks, 1987). This raises the issue of the directionality of developing countries' export sophistication. Provided that more sophisticated exports are more development-enhancing, export direction with higher sophistication level is expected to be more beneficial to development. Therefore, it has been widely believed that South-South exports have greater developmental effect than South-North exports (Amsden, 1980; Amsden, 1987; Lall, 1987; Klinger, 2009)[57].

Understanding the pattern and mechanism of export directionality has great relevance for trade policy, because export direction with greater sophistication should, in theory, be particularly promoted. A telling example is regional integration and trade agreement. If Southbound exports are more sophisticated, then trade integration with other developing countries may be of greater interest for policy makers. The reverse is true, if Northbound exports are more sophisticated. However, the determinants of developing countries' export directionality have not been sufficiently explored, neither theoretically nor empirically. Conventional international trade theories, either those traditional ones based on comparative

[57] However, there is opposite viewpoint that export direction is not important and the higher skill and capital intensity in South-South trade is largely a result of the distrotion generated by import substitution industrialisation (e.g., Havrylyshyn, 1985; Havrylyshyn and Wolf, 1987).

advantages or those new ones based on economies of scale and consumers' love of variety, do not deal with export directionality, because they only explain single export direction, either North-South trade or South-South / North-North trade. In the 1980s, there were some discussions on why South-South exports had higher level of skill and capital than South-North exports (e.g., the World Bank symposium on exports of developing countries in 1987), and some alternative arguments were proposed, such as industrial policy distortion, cultural and geographical proximity, and uncertainty in developing countries' markets. However, empirical explorations have been still lacking.

Furthermore, empirical observation on developing countries' export directionality need to be revisited, because the aforementioned export directionality observed in the 1970s and the 1980s were largely influenced by those outward-looking Newly Industrialised Countries (NICs), most of which should not be defined as developing countries since the 1990s. Recent evidence on developing countries' export directionality is quite limited, and recent studies are subject to inappropriate treatment of country grouping. For instance, Klinger (2009) defines some developed countries (e.g., the Czech Republic and Slovakia) and emerging countries (e.g., China) under developing countries, and Bernhardt (2014) use *de facto* developed and emerging countries (e.g., South Korea, Argentina, Brazil, and China) as representatives of developing countries.

Considering the research gap and the problems in the recent studies, this paper aims to provide the latest evidence on the directionality of developing countries' export sophistication from 1995 to 2014 and examines the determinants of this directionality, say, what factors lead some developing countries to have more sophisticated Southbound exports than Northbound exports or the opposite. In this sense, this chapter revisits and extends the discussion in the 1980s on the directionality of the level of skill and capital in developing countries' exports. In order to avoid the distortion led by inappropriate country grouping and to reflect the latest changes in the global economic hierarchy, this chapter applies the industrialisation-based UNIDO country grouping system (UNIDO, 2013) to distinguish between emerging countries and developing countries and redefines South-South trade exclusively as trade between real developing countries. Because, to my best knowledge, there have not been studies that specifically examine the determinants of the directionality of developing countries' export sophistication, this chapter is an exploratory study.

This chapter uses the EXPY index (Hausmann, Hwang, and Rodrik, 2007) to measure the sophistication of a country's export basket. The underlying assumption is that products mainly exported by rich countries tend to be more sophisticated [58]. Specialising in such "rich-country products" reflects higher export sophistication and generates more promising development prospect. The BACI export data at the HS 6-digit level show that, between 1995 and 2014, more than half of developing countries have more sophisticated Southbound exports than Northbound exports in more than half of the 20-year period, whereas others tend to have more sophisticated Northbound exports. Econometric analyses based on both continuous and binary measures of export directionality show that productive capabilities are a major contributor to the directionality of developing countries' export sophistication. Developing countries with greater productive capabilities are less likely to have more sophisticated Southbound exports than Northbound exports, while those with lower productive capabilities are more likely to have more sophisticated Southbound exports. This finding suggests that productively more advanced developing countries may be able to enter the highly competitive developed markets and/or the downstream value chains with relatively sophisticated products, but those productively less advanced developing countries do not have such capability

[58] A striking exception is mineral fuel, especially oil and natural gas, which has relatively high associated income level (PRODY) but limited technological level, because some rich but not developed countries (e.g., the Gulf countries) account for a major share in the global exports in mineral fuels.

and thus are only able to export their relatively sophisticated products to the less competitive developing markets. Given this finding, the conventional argument that South-South trade benefits developing countries more than North-South trade should be understood conditionally. For those productively less advanced developing countries, South-South trade seems to be, in the words of Klinger (2009), a "testing ground" for structural transformation, because this export direction tends to be more sophisticated. However, for those productively more advanced developing countries, exports to the North should be expected to have greater developmental effect.

This chapter is organised as follows. Section 4.2 reviews theories on the determinants of developing countries' export directionality. Section 4.3 presents data, country grouping, and the directionality of export sophistication. Section 4.4 gives descriptive evidence on the directionality of developing countries' export sophistication. Section 4.5 discusses empirical strategy and shows regression results for the determinants of export directionality. Section 4.6 concludes the findings.

4.2. Determinants of the Directionality of Export Sophistication

4.2.1. Conventional Trade Theories and Export Directionality

The explorations into why countries trade with each other fall in the very core of international trade studies. This question is answered by two major strands of international trade theories, which are defined as conventional trade theories here. Classical trade theories base their arguments on countries' comparative advantages. The Ricardian model focuses on a country's comparative advantages in productivity. The Heckscher-Ohlin model and its subsequent variants, such as the Heckscher-Ohlin-Samuelson (HOS) model and the Heckscher-Ohlin-Vanek (HOV) model, base their arguments on a country's comparative advantages in resource endowments or production factors. That is to say, the Ricardian model assumes that countries differ in their productivity, whereas the Heckscher-Ohlin-like models assume homogeneous productivity but heterogeneous endowments across countries (Morrow, 2010). This traditional strand of trade theories explains traditional trade relationship between differently endowed countries (e.g., North-South trade during the colonial era). A country should export the product that has comparatively lower production costs or intensively uses the country's well-endowed production factors. In brief, countries trade with each other because they are different (Debaere, 2003; Gourdon, 2009). Since the end of the Second World War, however, intra-industry trade has begun to account for a major share in international trade. Traditional trade theories cannot explain this trade flow in similar products between similarly endowed countries (e.g., North-North trade). Thus, new trade theories, represented by the Krugman model, arise. The Krugman model bases its argument on specialisation in a particular product niche[59]. Each country produces a similar but differentiated product in comparison with those produced by other similar countries. By doing this, each country can gain from increasing returns to scale through producing only particular differentiated products and can fulfil foreign consumers' love of variety.

However, theoretical analyses on export directionality are lacking (Havrylyshyn, 1985). Traditional comparative advantage-based theories do not leave space for export directionality in their analytical framework (Havrylyshyn, 1985; Havrylyshyn and Wolf, 1987). This problem applies to new trade theories as well. Both of them deal with single export direction, either between different countries or between similar countries. However, the presence of export directionality implies that a country exports to both similar and dissimilar countries. In a typical traditional two-country and two-factor comparative advantage model, the

---

[59] The new trade theory by Krugman (1979) uses more formal model to further ascribe the motivation of trade between similar countries to firms' economies of scale, consumers' love of variety, and reduced post-trade price.

developing country only unidirectionally exports primary commodity or resource- or labour-intensive manufacture to the developed country. However, in the 1970s and the 1980s, Newly Industrialised Countries stood out in the developing world. These countries became manufacture-oriented exporters and their manufactured exports to developed countries were observed to be more labour-intensive and less capital-intensive than their manufactured exports to other (less advanced) developing countries. As a response to this phenomenon, Deardorff (1987) extends the traditional two-country and two-factor comparative advantage model to a three-country model with a continuous distribution of goods rather than assuming two or three tradable goods. In Deardorff's extended comparative advantage model, the world consists of a developing country, an emerging country (rich developing country), and a developed country. The emerging country, which is relatively capital-abundant, exports relatively capital-intensive goods to the developing country, which is least capital-abundant. In turn, the developing country exports labour-intensive goods to the emerging country, and the emerging country exports relatively labour-intensive goods to the developed country. Krueger (1977) and Baldwin (1979) have also demonstrated similar analytical frameworks. This strand of model adjusts the traditional comparative advantage theories to the rise of Newly Industrialised Countries. Hanson (2012) discusses the paradigm shift of the "return of comparative advantage" in post-1990s international trade research. The 1980s and the 1990s were dominated by new trade theories based on firms' economies of scale and consumers' love of variety, and traditional comparative advantage theories were believed to largely lose the relevance. However, the rise of emerging countries since the 1990s has retrieved the interests in comparative advantage. Those (relatively) resource-poor and capital/skill-rich emerging countries source primary commodities and perhaps also resource/labour-intensive manufactures from those resource/labour-rich but capital/skill-poor developing countries, and the latter sources capital/skill-intensive manufactures from the former (IMF, 2011).

The three-country comparative advantage model, however, only partially explains export directionality. They have explicitly dealt with different sophistication levels of exports to different directions from the "middle countries", but they do not deal with export directionality of countries at the bottom, say, those real developing countries. The aforementioned comparative advantage models and the Krugman model (except the assumption of consumers' love of variety) stand on the supply side of motivations to trade. However, as suggested by Cizeljc and Fuks (1987), demand similarity is a contributor to South-South trade. Therefore, export directionality of developing countries may be analysed from the demand side rather than the supply side. The model of Linder (1961) provides a demand-side explanation for trade and can better explain the observed phenomenon that South-South trade tends to be more skill- and capital-intensive than North-South trade. The Linder model argues that countries with similar income level have similar preference that generates "overlapping demand". It is this "overlapping demand" that makes similar countries to trade more with each other, especially in manufactures. It is easy to see that this "overlapping demand" is different from the "love of variety" in the Krugman model. The latter is more relevant to consumers in developed countries, while the former applies more to developing countries[60]. Because of different demands and preferences, skill- and capital-intensive manufactures from developing countries tend not to find market in developed countries[61]. Instead, other developing countries provide market outlet for these manufactures. Therefore, the directionality of developing countries' export sophistication may be explained by combining the supply-side comparative

[60] As well-documented in the literature, more developed countries tend to have more demand for more sophisticated imports. This pattern actually does not contradict with the observation that developing countries' exports to developed countries tend to be less sophisticated than their exports to other developing countries. As demonstrated by "overlapping demand" and "love of variety", trade in more sophisticated products is more likely to take place between similar countries, either developed or developing. Therefore, although developed countries have more demand for more sophisticated products, this demand tends to be supplied by other developed countries. In turn, developed countries still demand less sophisticated imports from developing countries.

[61] One exception is manufactured export from some emerging countries (e.g., China), provided that these countries are classified under developing countries.

advantage models and the demand-side Linder model. Developing countries' less skill- and capital-intensive but more labour- and resource-intensive exports to developed countries reflect their comparative advantages in labour and resource and disadvantages in skill and capital. On the other hand, similarity in preference and demand due to comparable income level generates greater space for exporting more skill- and capital-intensive products to other developing countries.

Developing countries' comparative advantages in labour- and resource-intensive products can be understood as their capabilities to compete with developed countries' producers of similar products, if any, in the latter's home market. Regolo (2013) develops a North-South trade model, predicting that exports tend to be more diverse between similarly endowed countries. That is to say, developing countries' Southbound export diversification should be higher than their Northbound export diversification. The underlying rationale is that in the Northern markets the competition in skill- and capital-intensive products is too tough for producers from developing countries to enter, because they do not have price advantages in skill- and capital-intensive products. Instead, developing countries' labour- and resource-intensive products and primary commodities are competitive in the Northern markets. On the other hand, similar comparative advantages in labour- and resource-intensive products and primary commodities reduce the opportunities of developing countries to export these products to other developing countries. Instead, they are more likely to export relatively skill- and capital-intensive products to each other. This model can be seen as a comparative advantage-based explanation for intra-industry and intra-group trade. It may also be seen as a capability-based explanation for export directionality. A developing country's capabilities of producing relatively sophisticated products determine whether it is capable of entering advanced countries' market with these products rather than those less sophisticated products or even primary commodities. Another contributor to the directionality of export diversification, according to Regolo (2013), is distance, which refers to not only geographical remoteness but also trade costs. Smaller distance increases the probability to export more diversified products (Amurgo-Pacheco and Piérola, 2008; Regolo, 2013). This goes beyond conventional trade theories and falls within the gravity-like explanation for trade. Since export diversification is often regarded as one of the indicators of the broad-sense export upgrading, the analytical framework of the directionality of export diversification can shed light on the directionality of export sophistication. Regarding the influence of distance, Melitz (2007) provides another interpretation. Larger distance in terms of differences in latitude implies differences in natural resources and conditions, and thus increases trade complementarity. Accordingly, developing countries are expected to export primary commodities (e.g., tropical agricultural products) to developed countries, and therefore their Northbound exports should be less sophisticated than their Southbound exports. This is in line with the comparative advantage theories.

4.2.2. Alternative Perspectives

Section 4.2.1 discusses the directionality of developing countries' export sophistication from the perspective of conventional trade theories. This section reviews some alternative contributions to the discussion on export directionality, going beyond the conventional trade theories. Havrylyshyn and Wolf (1987) summarise some factors that may determine the directionality of export sophistication: comparative advantages, distortions in trade and industrial policy, restrictive commercial policy, similarity in demand, cultural and geographical proximity, and market size. Comparative advantages have already been discussed as the theoretical basis of traditional trade theories. Distortions in trade and industrial policy are argued by Havrylyshyn (1985) and Havrylyshyn and Wolf (1987) as a major contributor to developing countries' more skill- and capital-intensive Southbound exports. According to them, the distortion is represented by inward-looking development strategy, in particular import substitution industrialisation. Such policy can widen a country's production range beyond where its comparative advantages fall in, especially towards skill- and capital-intensive sectors. This widened production range then reflects on increasing skill- and capital-intensive exports to other developing countries, because these products tend not to have market in developed countries and because some developing countries have established regional trade agreement for promoting trade in manufactures between each other. As a result, the difference between Northbound export sophistication and Southbound export sophistication has been enlarged. An interesting fact in the 1970s and the 1980s is that developing countries that followed "distortive" policy (e.g., Latin American countries and South Asian countries) tended to have more exports to other developing countries and their exports were more capital- and skill-intensive, whereas those pursuing "open" policy (e.g., Southeast Asian countries) relied much more on developed countries as a target market and their exports were more labour-intensive (Havrylyshyn, 1985). According to Havrylyshyn (1985), this kind of trade and industrial policy is a distortion with respect to comparative advantages[62]. Furthermore, the effect of distortive policy can be strengthened by restrictive commercial policy (e.g., import barrier), which confines a developing country's exports to products that the importing country cannot produce domestically. However, because inward-looking strategy has been basically abandoned by developing countries since the 1980s, industrial policy distortion and restrictive commercial policy tend to be irrelevant to developing countries' export directionality under today's context.

Besides similarity in demand, which has been discussed in Section 4.2.1, the other

---

[62] It must be noted that whether import substitution industrialisation is justifiable is beyond the scope of this chapter. Havrylyshyn (1985) treats it as a distortion with respect to comparative advantages and argues that it is inefficient and growth-impeding. However, many studies have shown that defying comparative advantages promotes developing countries' growth (e.g., Hausmann *et al*., 2007; Lectard and Rougier, 2018). Actually, the failure of many developing countries in the 1960s and the 1970s should not be attributed to import substitution industrialisation *per se*, but to policy makers' problematic interpretation and implementation of import substitution industrialisation.

two factors relevant to export directionality are geographical and cultural proximity and market size. These are intrinsically in line with the rationales of gravity model. It is straightforward and natural to understand that a developing country may trade more with other developing countries that are geographically and culturally close. According to the Linder model, trade between similar countries tends to contain more manufactures. Therefore, developing countries' Southbound exports can be expected to be relatively sophisticated. For another thing, colonial history of many developing countries may facilitate their trade with previous colonisers in primary commodities, which lies in the scope of North-South trade and reduces their Northbound export sophistication. Market size has always entered gravity equation as a robust driver of bilateral trade. Economic growth and industrialisation of some emerging and developing countries expand their market size and increase their demand for both primary commodities and capital goods. Moreover, greater economic size of trade partners implies not only higher trade volume, but also more traded varieties, because larger countries tend to have more diverse and differentiated demand (Bergstrand, 1990; Amurgo-Pacheco and Piérola, 2008). Therefore, developed and emerging countries' greater economic size and growth may increase Northbound export sophistication of some developing countries that are able to export relatively sophisticated products. However, for those less advanced developing countries, greater economic size and growth of developed and emerging countries may imply more demand for primary commodities, which may reduce their Northbound export sophistication.

Amsden (1987) gives another explanation for the higher skill and capital intensity of developing countries' Southbound exports. Less advanced developing countries' markets are riskier and more uncertain due to poor functioning and unstable economic situation. Therefore, these markets are less attractive to producers from developed countries. However, producers from those more advanced developing countries (newly industrialising countries) tend to enter such markets due to less entry costs, especially in comparison with the costs in developed markets, and less competition from their counterparts from developed countries. For another thing, consumers in less advanced developing countries have lower requirement for quality but more stringent requirement for price. Due to similar development and income level, products from those more advanced developing countries are more suitable for the demand of consumers in those less advanced developing countries. To some extent, Amsden's reasoning accords with the Linder model and the model of Regolo (2013). For developing countries, it is more difficult to sell their relatively sophisticated products to developed countries than to other developing countries (Cizeljc and Fuks, 1987). It should be noted that Amsden (1987) treats developing countries' Southbound exports as exports from more advanced developing countries (newly industrialising countries) to less advanced developing countries. However, this analytical framework may apply to trade between less advanced developing countries themselves as well.

4.3. Measurement, Data, and Country Classification

4.3.1. The Measure of Export Sophistication

A country's export sophistication is measured by the index of EXPY (Hausmann *et al*., 2007). The details of this index, including its properties, criticisms, and responses to criticisms, have been discussed in Section 3.3.1, and thus this section just briefly introduces this index. The responses to the three major criticisms of the PRODY index, which are documented in Section 3.3.1, also apply to this chapter. The first step to calculate EXPY is to construct the weighted mean income level associated with each product, that is PRODY (of product k in year t):

$$PRODY_{k,t} = \sum_{i} \left\{ \frac{\left(x_{i,t}^{k} / X_{i,t} \right)}{\sum_i \left(x_{i,t}^{k} / X_{i,t} \right)} Y_{i,t} \right\}$$

where $Y_{i,t}$ equals GDP per capita of country *i* in year *t*, $x_{i,t}^{k}$ equals the export value of product *k* by country *i* in year *t*, and $X_{i,t}$ refers to total export values of country *i*. The numerator is the share of product *k* in the country's total exports, and the denominator is the sum of this share across all countries exporting product *k*. Therefore, the PRODY of product *k* is the mean GDP per capita of all exporting countries, weighted by each country's normalised revealed comparative advantage (RCA) in this product.

Then, the EXPY of country *i* in year *t* is calculated as:

$$EXPY_{i,t} = \sum_{k} \left\{ \frac{x_{i,t}^{k}}{X_{i,t}} \right\} PRODY_k$$

A country's EXPY is the average of PRODY values of all of its exported products, weighted by the share of each product in the country's export basket. Importantly, each product's annual PRODY values ($PRODY_{k,t}$) during a given period are averaged to generate a single static PRODY of this product ($PRODY_k$, instead of $PRODY_{k,t}$). A country's annual EXPY is calculated based on the static PRODY values, which give each product a constant associated income level. The fixed value of PRODY ensures that any change in EXPY is due to change in this country's export structure, instead of change in GDP per capita of other exporting countries.

4.3.2. Country Classification and the Measure of Export Directionality

As in previous chapters, this chapter uses the 2013 UNIDO country grouping, which divides the world into four tiers: Industrialised Economies (IEs), Emerging Industrial Economies (EIEs) and China[63], Other Developing Economies (ODEs), and Least Developed Countries (LDCs). The classification criterion is a country's

[63] According to statistical criterion, China is in the group of EIEs, but China is separately treated in the UNIDO statistics due to its size.

industrialisation level measured by manufacture value added (MVA) per capita[64]. This chapter makes minor modifications with respect to the original UNIDO country grouping. The modification is mostly concerned with moving some countries from *Emerging Industrial Economies* to *Industrialised Economies* (i.e., some advanced former European socialist countries, advanced former Soviet Republics, advanced constituent republic of the former Socialist Federal Republic of Yugoslavia, the Southern Cone, and Brunei). Montenegro is moved away from the group of *Other Developing Economies* to *Emerging Industrial Economies*. Moreover, Angola, Cape Verde, Equatorial Guinea, and Maldives are moved away from the group of *Other Developing Economies* to *Least Developed Countries*, following the original UN definition. This modification serves more as a conceptual work and is unlikely to generate major differences to empirical analyses, because countries under modification are not big players in the global trade. The details and reasons for each individual country case in this modification is documented in Appendix A. However, it has to be admitted that, even if after the modification, India and Indonesia are still two exceptions with obviously lower socio-economic development in the group of *Emerging Industrial Economies* (EIEs). As aforementioned in footnote 18, these two countries are classified under EIEs by UNIDO due to an exceptional criterion of the share in the world MVA higher than 0.5 % rather than the normal criterion of MAV per capita or GDP per capita for other EIEs countries. Because India and Indonesia have relatively large shares in the world trade, it seems to be better to conform to the original UNIDO grouping, instead of reclassifying them.

In this chapter, Other Developing Economies (ODEs), which are the richer half of the developing world, and Least Developed Countries (LDCs), which are the poorer half of the developing world, constitute the group of *Developing Countries*. **Southbound**

[64] $MVA_{pc} = \frac{GDP\ (PPP)}{Population} \times \frac{MVA}{GDP}$

exports of a developing country are then defined as its exports to all other developing countries, say, South-South exports. This is different from the common definition of "South-South exports", because those so-called "emerging countries" are excluded. Emerging Industrial Economies (EIEs) and China are defined as *Emerging Countries*. It is important to note that the concept of emerging countries here is not comparable with the well-known concept of emerging markets outside of the academia (e.g., the FTSE list and the MSCI list). The concept of emerging markets outside of the academia primarily concerns a country's business and investment environment rather than economic development level, which generates a country list quite different from the list based on a development perspective. Industrialised Economies (IEs) correspond to developed countries. A developing country's **Northbound exports** are defined in two distinct ways based on different considerations. The **broadly-defined** Northbound exports (**N-bound 1**) are defined as a developing country's exports to both developed countries (IEs) and emerging countries (EIEs and China), both of which are economically positioned north to developing countries. The **narrowly-defined** Northbound exports (**N-bound 2**) are defined as a developing country's exports exclusively to developed countries. This is similar to the conventional way to define North-South trade. The broadly-defined and the narrowly-defined Northbound export sophistication will be examined separately in the following descriptive and econometric analyses. In the following tables and figures, any titles with "1" refer to the case of the broadly-defined Northbound exports, and those with "2" refer to the case of the narrowly-defined Northbound exports.

As in Chapter 3, 27 out of the total of 128 countries in the UNIDO group of ODEs and LDCs are completely dropped in the empirical analyses, for the reasons of centrally planned economies (Cuba and D.P.R. Korea), long-term (civil) war and/or the lack of an effective central government (Afghanistan, Somalia, and Palestine), territorial alteration and/or newly-established countries between 1995 and 2014

(Sudan, South Sudan, and Timor Leste), non-sovereign entity (e.g., Marshall Islands), associate states of another country (e.g., Palau), countries with population less than 50,000 (e.g., Saint Kitts and Nevis), and countries without export data in the BACI database (Namibia, Swaziland, and Lesotho). Furthermore, since major exporting countries of mineral fuels have special pattern of export sophistication and directionality (the majority of exports in mineral fuels from developing countries go to developed and emerging countries, namely, the Northbound direction), these countries are dropped in the econometric analysis in Section 4.5 and in part of the descriptive analysis in Section 4.4. Major exporting countries of mineral fuels are defined as countries with the mean share of mineral fuels (SITC 3) in total export values in 1995, 2005, and 2014 being larger than 40%. Countries with population less than one million are dropped too in part of the econometric analysis. Most of these countries are small island economies with special economic and export structure. This treatment results in a panel database of 62 developing countries.

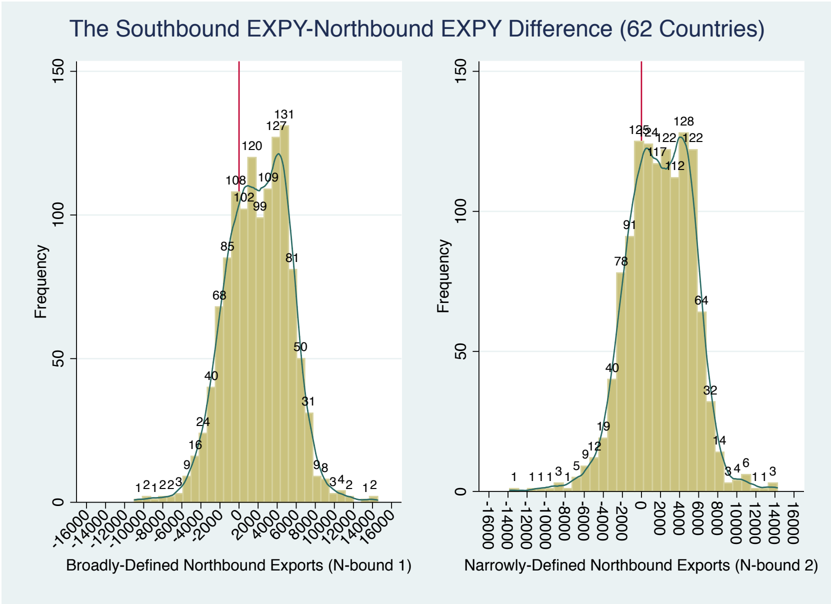
4.3.3. Data

Export data are from the BACI database at the 1992-version Harmonised System (HS 92) 6-digit disaggregation level from 1995 to 2014. Export values are reported in current US Dollars. Data on GDP per capita (PPP, in 2011 constant International Dollars) are from the World Development Indicators (WDI) database. Each product's PRODY in each year between 1995 and 2014 is calculated based on data of 165 countries. Then, each product's annual PRODY values during the 20 years are averaged into a single fixed PRODY, which is used for constructing each country's annual EXPY. Other details of data and the calculation of PRODY and EXPY have been shown in Section 3.3.2, and are not repeated here.

4.4. The Directionality of Developing Countries' Export Sophistication: Descriptive Evidence

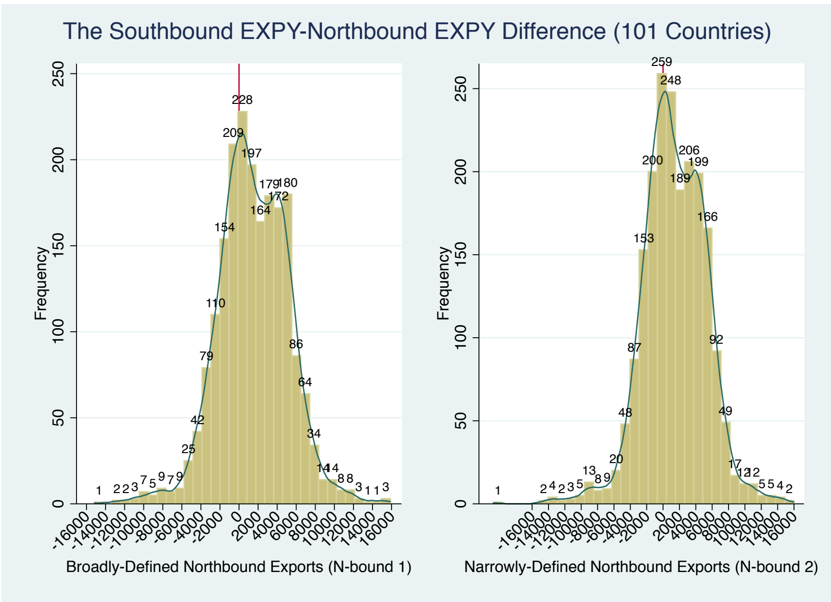
Developing countries' exports to developed and emerging countries, concentrating on primary commodities and labour- and resource-intensive manufactures, reflect their comparative advantages, which is explained by traditional trade theories. In contrast, their exports to other developing countries correspond to the pattern predicted by alternative trade theories (e.g., the Linder model), according to which trade between similar countries contains more manufactures and is relatively sophisticated and diverse. Thus, developing countries' Southbound exports should be anticipated to be more sophisticated than their Northbound exports. However, disaggregated data on developing countries' exports show a story that somewhat deviates from theoretical prediction. Here, the directionality of export sophistication is proxied by a country's Southbound export sophistication (EXPY of this country's Southbound exports without being weighted by the share of Southbound exports in total exports) minus its Northbound export sophistication (EXPY of this country's Northbound exports). According to theoretical prediction and the previous literature, this value of Southbound EXPY minus Northbound EXPY should be positive. Figure 4.1 presents the distribution of 1240 observations (62 countries×20 years) of the Southbound EXPY-Northbound EXPY difference for the broadly-defined Northbound exports (N-bound 1) and the narrowly-defined Northbound exports (N-bound 2). The two graphs in Figure 4.1 are quite similar. There is a bimodal distribution with one mode positioned far right to the zero value (around 4000 Dollars) and another mode more or less around the zero value. The majority of observations support the theoretical prediction that developing countries' Southbound exports are more sophisticated than their Northbound exports, but many other observations show negative values, which implies more sophisticated Northbound exports. Figure 4.2 shows the case for the panel of 101 developing countries, including major exporting countries of mineral fuels and small countries with population less than one million. A similar pattern of the directionality of export sophistication is observed.

Figure 4.1. Distribution of the directionality of export sophistication (62 countries)



Source: Author's calculation based on the BACI database.

Figure 4.2. Distribution of the directionality of export sophistication (101 countries)



Source: Author's calculation based on the BACI database.

Furthermore, developing countries are classified into two groups, in order to see the pattern of directionality in each world region. The first group is termed as **DCS**, which refers to countries whose **S**outhbound exports are more sophisticated than **N**orthbound exports in a particular year. The second group is **DCN**, which refers to those whose **N**orthbound exports are more sophisticated than **S**outhbound exports in a given year. Table 4.1 shows the percentage of countries that have different year ranges to be DCS countries during the 20-year period from 1995 to 2014 in the 101-country panel, based on the broadly-defined Northbound exports (N-bound 1). Taken as an example, 9% of Ex-Socialist countries in the group of ODEs (there are no Ex-Socialist countries in the group of LDCs) have 1-5 years to be DCS countries during the 20-year period. The corresponding proportions of Ex-Socialist countries in the group of ODEs with 6-10 years, 11-15 years, 16-19 years, and 20 years to be DCS countries are 18%, 27%, 36%, and 9%, respectively. Sub-Saharan African (SSA) countries, Ex-Socialist countries (those in the group of ODEs), and Latin American and the Caribbean (LAC) countries tend to have more than ten years to be DCS countries. In comparison, Asian countries (mostly Southeast Asian countries) and MENA countries in the group of ODEs tend to have less years to be DCS countries. An explanation is that these countries have closer trade ties with Northern countries, especially through global production chain. Moreover, the theoretical prediction that developing countries' Southbound exports should be more sophisticated than their Northbound exports is further deviated by the fact that many developing countries' directionality of export sophistication varies over years. Results based on the narrowly-defined Northbound exports show similar pattern, and are thus not shown.

Table 4.1. Percentage of countries with various year ranges to be DCS[65]

ODEs	***0 of 20 years***	***1-5 of 20 years***	***6-10 of 20 years***	***Total (0-10 of 20 years)***	***11-15 of 20 years***	***16-19 of 20 years***	***20 of 20 years***	***Total (11-20 of 20 years)***[66]
Ex-Socl.	0	0.09	0.18	0.27	0.27	0.36	0.09	0.72
MENA	0	0.5	0.1	0.6	0	0.1	0.3	0.4
SSA	0	0.11	0.33	0.44	0.11	0.11	0.33	0.55
LAC	0.05	0.1	0	0.15	0.1	0.43	0.33	0.86

[65] The definition of each world region is shown in Section 3.4.2.
[66] The sum of the Total (0-10 of 20 years) and Total (11-20 of 20 years) is not equal to one for several country groups due to rounding.

Asia	0	1	0	1	0	0	0	0
Oceania	0	0.33	0	0.33	0	0	0.67	0.67
Total	0.02	0.23	0.11	0.36	0.11	0.26	0.28	0.65
LDCs	***0 of 20 years***	***1-5 of 20 years***	***6-10 of 20 years***	***Total (0-10 of 20 years)***	***11-15 of 20 years***	***16-19 of 20 years***	***20 of 20 years***	***Total (11-20 of 20 years)***
Ex-Socl	-	-	-	-	-	-	-	-
MENA	1	0	0	1	0	0	0	0
SSA	0	0.1	0.13	0.23	0.26	0.19	0.32	0.77
LAC	0	0	0	0	0	1	0	1
Asia	0	0.43	0.29	0.72	0.29	0	0	0.29
Oceania	0	0	0.5	0.5	0.25	0.25	0	0.5
Total	0.02	0.14	0.18	0.34	0.25	0.18	0.23	0.66

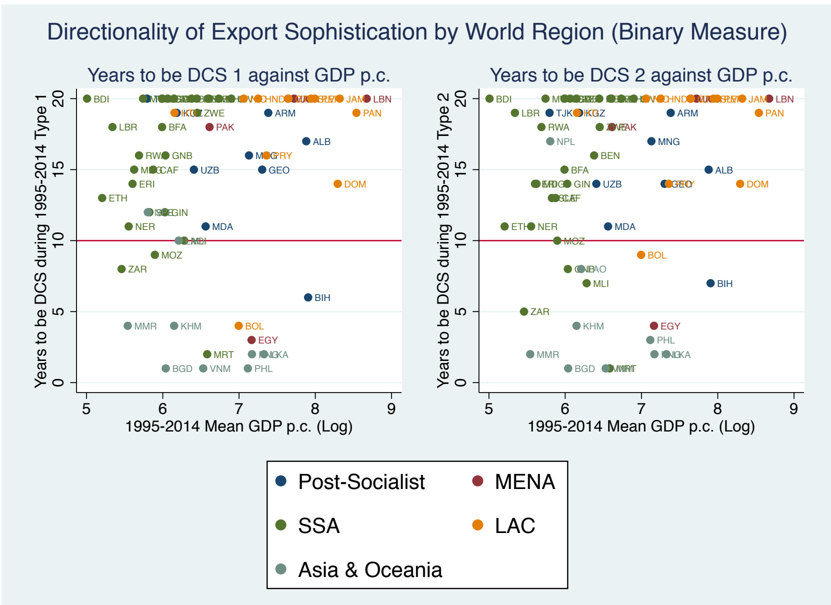
Source: Author's calculation based on the BACI database.

Table B1, B2, and B3 in Appendix B show each country's number of years of being DCS country during the 20 years for the group of the 62 developing countries, the group of major exporting countries of mineral fuels, and the group of small countries, respectively. Under the broadly-defined Northbound exports, countries with no more than five years to be DCS countries are (ascending in the number of years to be DCS) Bangladesh, Vietnam, the Philippines, Papua New Guinea, Mauritania, Sri Lanka, Egypt, Bolivia, Myanmar, and Cambodia. The corresponding list under the narrowly-defined Northbound exports is similar. All of these countries are Southeast Asian/Oceanian countries, except Mauritania, Egypt, and Bolivia. Bangladesh, Vietnam, and the Philippines have only one year to be DCS countries. This is quite understandable, because these three countries are deeply involved in the global production chain led by developed and emerging countries: the Philippines in electronics and Bangladesh and Vietnam in textile and garment. On the other hand, most of countries with all the 20 years of being DCS are SSA and LAC countries. Among the 17 major exporting countries of mineral fuels, only Cameroon and Ecuador have more than ten years to be DCS. This is consistent with the stylised fact that mineral fuels with disproportionately high PRODY value dominate these countries' Northbound exports. However, such high export sophistication due to exports in mineral fuels cannot be associated with higher possibility of technological progress, which is why major exporting countries of mineral fuels will be excluded in the following econometric analysis. Table B4 gives each country's 20-year mean

Southbound EXPY-Northbound EXPY difference for the 62-country panel. This list is basically consistent with Table B1. Countries with less years to be DCS countries tend to have more sophisticated Northbound exports or less sophisticated Southbound exports.

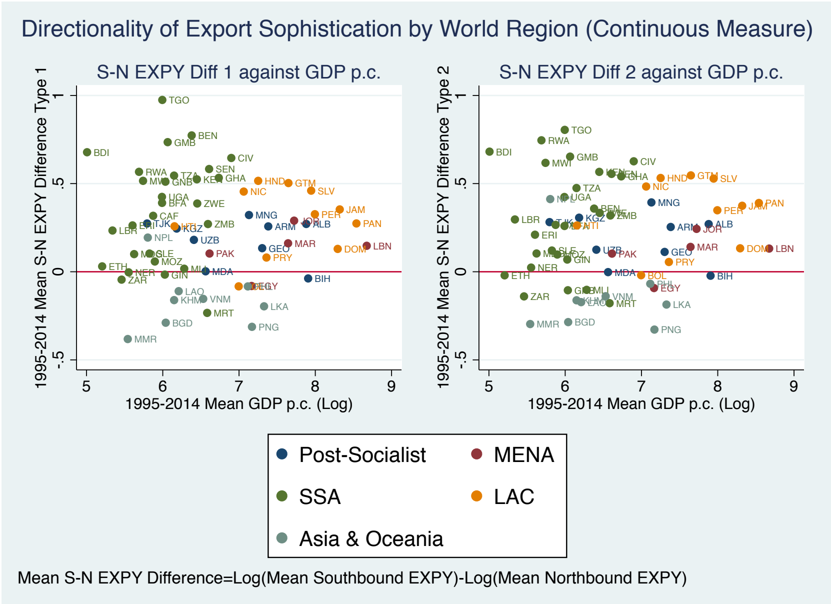
Figure 4.3 and Figure 4.4 visualise the aforementioned descriptions with respect to the 62-country panel. The directionality of export sophistication is plotted against mean GDP per capita between 1995 and 2014. Four kinds of directionality, based on different measures and definitions of Northbound exports, are presented. In addition to observations already discussed, it is clear to see that there is no clear correlation between the directionality of export sophistication and GDP per capita.

Figure 4.3. GDP p.c. and the directionality of export sophistication (binary measure)



Source: Author's calculation based on the BACI database.

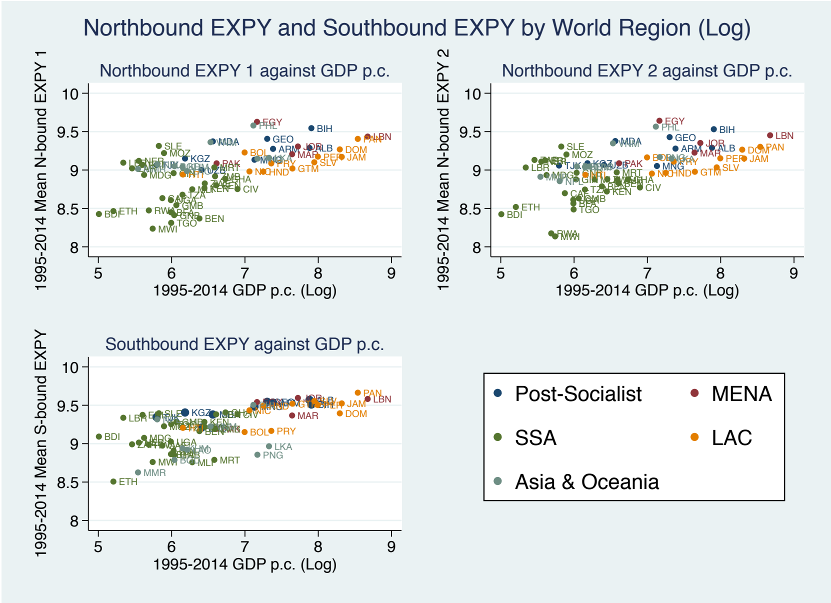
Figure 4.4. GDP p.c. and the directionality of export sophistication (continuous measure)



Source: Author's calculation based on the BACI database.

Figure 4.5 plots the sophistication level of the 62 developing countries' Southbound exports and Northbound exports against their GDP per capita, respectively. Richer developing countries have both more sophisticated Southbound and Northbound exports than poorer countries. SSA countries are positioned at the bottom in terms of both GDP per capita and Southbound and Northbound export sophistication. The logarithm of Northbound export sophistication concentrates below 9.25, while the logarithm of Southbound export sophistication concentrates above 9.25. This indicates that, generally speaking, developing countries' Southbound exports tend to be more sophisticated than their Northbound exports.

Figure 4.5. Southbound and Northbound export sophistication by world region



Source: Author's calculation based on the BACI database.

4.5. Determinants of the Directionality of Developing Countries' Export Sophistication

4.5.1. Empirical Strategy of Dynamic and Static Nonlinear Models

This section discusses the empirical model of the determinants of the directionality of developing countries' export sophistication, say, what kind of countries tend to have more sophisticated Southbound exports than Northbound exports or the reverse. Following Section 4.4, two measures of the comparison between a country's Southbound and Northbound export sophistication are used as the dependent variable. Dependent Variable Type 1 (DepVar 1) is a binary measure. Since using binary variable as dependent variable in dynamic model induces quite complex econometric issues, this sub-section deals with econometric techniques and the details of the empirical model (e.g., definitions of variables) are presented in Section 4.5.2. The binary dependent variable is defined as:

$$S/N\ Dummy = \begin{cases} 0, & Southbound\ EXPY < Northbound\ EXPY \\ 1, & Southbound\ EXPY > Northbound\ EXPY \end{cases}$$

Since there are no observations for which Southbound EXPY is exactly equal to Northbound EXPY, only inequality between the two EXPY values is defined. The binary measure clearly provides a distinction between countries having more sophisticated Southbound exports than Northbound exports and countries having the opposite pattern in a particular year. The broadly-defined Northbound exports (N-bound 1) and the narrowly-defined Northbound exports (N-bound 2) are examined separately, and thus the Dependent Variable Type 1 has two sub-types: *S/N Dummy 1* and *S/N Dummy 2*.

Considering that the binary variable cannot measure the magnitude of the difference between a country's Southbound and Northbound export sophistication, it is complemented by the continuous Dependent Variable Type 2 (DepVar 2). It is defined as:

$$S - N\ Diff = Log(Southbound\ EXPY) - Log(Northbound\ EXPY)$$

If a country's Southbound export sophistication is higher than its Northbound export sophistication in a particular year, then *S-N Diff* in that year is positive. The greater the sophistication advantage of Southbound exports over Northbound exports is, the greater is the *S-N Diff*. If a country's Northbound exports are more sophisticated than its Southbound exports, then *S-N Diff* is negative. Correspondingly, there are two sub-types of *S-N Diff* based on the broadly-defined Northbound exports (*S-N Diff 1*) and the narrowly-defined Northbound exports (*S-N Diff 2*).

Binary dependent variable requires logistic regression. Furthermore, as shown in Table 4.2, in the 62-country panel, around one-thirds of countries (22 for *S-N Dummy*

1 and 20 for *S-N Dummy 2*) have zero standard deviation in the binary outcome of the directionality of export sophistication between 1995 and 2014. That is to say, these countries' Southbound exports have always been more sophisticated than their Northbound exports, or the reverse, over the 20 years. As a result, within variation of the dependent variable is zero for these countries, which renders fixed-effects model inappropriate. This is because that fixed-effects model, which is based on within estimation, only utilises information from variation within individuals and ignores information from variation across individuals. All countries without any change in the directionality of their export sophistication will be automatically dropped in fixed-effects model. This results in not only a great loss of observations, but, more importantly, also a sample selection bias leading to biased estimates of coefficients (Heckman, 1976 and 2013), because one kind of countries is "selectively" and "systematically" singled out and another kind of countries is "selectively" and "systematically" dropped. Those zero-variation countries are valuable for estimating the influence of potential heterogeneity in some country characteristics on the binary outcome of the directionality of export sophistication. In this regard, the loss of these countries will result in the loss of some important information. Given this, random-effects model is a better choice, because it utilises information from both within and between variation, which increases estimation efficiency. Moreover, for some variables of interest in the database, their within variations are dominated by between variations. Allison (2009) points out that within estimators of fixed-effects model generate intolerably large standard errors if within variation is too small relative to between variation. This may damage the efficiency of the estimators (Cameron and Trivedi, 2010). An extreme case is demonstrated by time-invariant and individual-variant variables (e.g., distance), which are completely omitted from estimation by fixed-effects model. This further justifies the use of random-effects logistic model. A concern on logistic model is the small-sample bias for rare events, say, extreme probability. If the probability of an outcome is extremely low, such as lower than 5% and the sample size is relatively small, then logistic model may be biased. However, this should not matter for the database here, because neither having more sophisticated Northbound exports nor having more sophisticated Southbound exports is rare event.

Table 4.2. Standard deviation of S/N Dummy

SD	Countries	Percentage
S/N Dummy 1		
0	22	35.48%
0.2-0.3	8	12.90%
0.3-0.4	8	12.91%
0.4-0.5	15	24.19%
0.5-0.6	9	14.52%
S/N Dummy 2		
0	20	32.26%
0.2-0.3	9	14.52%
0.3-0.4	9	14.52%
0.4-0.5	17	27.42%
0.5-0.6	7	11.29%

Source: Author's calculation based on the BACI database.

The above discussion refers to the static situation. However, the change in the directionality of export sophistication is likely to be subject to a dynamic pattern or a kind of inertia. If a country's Southbound export sophistication is higher than its Northbound export sophistication in year 1, then it may be anticipated that in year 2 such a state is more likely to hold, instead of being reversed. A reason is that a country's established relationship with its trade partners at both firm and country level is likely to follow state dependence. Moreover, if the directionality of export sophistication is determined by a country's economic or production structure, then it tends to be relatively sticky. This is partly supported by the evidence in Table 4.2 that many developing countries do not have any changes in the directionality of their export sophistication, or have only a few changes. Econometrically speaking, the past realisation of the binary outcome of export directionality tends to impact on the current realisation. This state dependence requires introducing the lagged binary dependent variable to the right-hand side of the regression equation as a regressor, which transforms the static model to a dynamic one. Dynamic nonlinear model features two major difficulties for econometric estimation: unobservable heterogeneity and initial condition. Heckman (1978, 1981a, and 1981b) suggests two kinds of state dependence: one purely induced by past experience, known as structural state dependence, and the other one induced by unobserved individual heterogeneity, known as spurious state dependence. Unobservable country-specific characteristics, either permanent or highly correlated across time, may generate persistence in a country's directionality of export sophistication. Without controlling for such unobservable country heterogeneity, it is likely to overestimate the impact of the past directionality (the lagged dependent variable) on the current directionality, because the impact of unobservable country-specific effects is incorporated into the impact of the lagged dependent variable. In other words, without controlling for the unobservable country heterogeneity, the impact of structural state dependence in which economists are interested is compounded by the impact of spurious state dependence, which is normally beyond economists' interests.

For another thing, the initial state of the binary outcome y_{i1} (supposing that time 1, rather than time 0, is the first time point of the database) on the right-hand side of the equation is not exogenous, because it may be correlated with the unobservable individual-specific effects or determined by the pre-sample history of the entire stochastic process. This is the so-called "initial conditions problem" in estimating discrete variable. A formal description of this issue is provided by Heckman (1981c). To be specific, it is reasonable to suppose that the process in operation to generate the state of the binary outcome had already existed prior to the time point at which the initial observations in the database were recorded. In other words, assuming an entire process from time *1* to time *T*, in the real world it is very likely that what a database records is only the recent part of the entire process, say, observations from time *J* (the initial time point in the database) to time *T* (the last or the current time point) rather than from time 1 (the first time point of the entire process) to time T. Thus, the initial condition, which is the probability of the initial binary outcome $p(i, J)$, is endogenously determined by the logic of the entire process or the summation of probabilities of all the realisations of the binary outcome during the pre-J history of the process. In this regard, the initial condition is dependent on unobservable heterogeneity. If time J in the entire history of the binary outcome is the starting point of a new process (in other words, the pre-J time points belong to an old and different process) or if there is no unobservable heterogeneity across individuals, then the initial conditions problem does not exist. However, these two assumptions are too strong to practically hold true. Therefore, simply assuming the initial condition as exogenous leads to inconsistent and upward-biased estimation of the state dependence variable (Heckman, 1981c; Chay and Hyslop, 1998). Similar to the situation in dynamic linear model, the bias due to the endogeneity decreases in the number of time dimension of a panel. However, since the database of this chapter has only 20 years (time dimension=20), this endogeneity is anticipated to matter.

In order to deal with this initial conditions problem and country heterogeneity, the random-effects dynamic nonlinear model (Wooldridge, 2005) is adopted. Random-effects model is a common and exclusive choice in dynamic nonlinear estimation. For example, Roberts and Tybout (1997) and Bernard and Jensen (2004) use random-effects probit model to estimate firms' exporting decision. In addition to the aforementioned small-sample selection bias, Heckman (1981c) uses Monte Carlo simulation to show that fixed-effects dynamic model generates downward-biased estimator of the lagged dependent variable, and he suggests that fixed-effects model is not a qualified solution to the initial conditions problem. Instead, random-effects model produces less biased and more reliable estimation. Wooldridge's dynamic nonlinear approach is originally designed for probit model, but Wooldridge (2005) suggests that it can fit the binary dependent variable in either the probit form or the logit form. Panel logit model is used in this chapter, as it directly allows for easier interpretation of the results by odds ratios. The general equation for dynamic nonlinear model allowing for unobservable heterogeneity but assuming initial condition as exogenous can be expressed as:

$$y_{i,t} = \beta_1 y_{i,t-1} + X'_{i,t}\beta_2 + Z'_i\beta_3 + \gamma_i + \varepsilon_{i,t} \qquad (1)$$

where $y_{i,t-1}$ is the lagged dependent variable used as a regressor for controlling for state dependence, $X'_{i,t}$ is a vector of time-variant regressors, and Z'_i refers to a vector of time-invariant regressors. γ_i refers to unobservable individual effects, and $\varepsilon_{i,t}$ is the idiosyncratic error term. γ_i and $\varepsilon_{i,t}$ jointly constitute the composite error term. The coefficient β_1 measures the state dependence effect of the lagged state on the current state. The model here is slightly different from the standard random-effects dynamic nonlinear model. In order to allow for a kind of correlation between the individual effects and regressors, following Mundlak (1978) and Chamberlain (1984), the overall unobservable individual effects $\gamma_{i,t}$ are decomposed into a longitudinally averaged observable individual-specific characteristics part ($\rho\bar{X}_i'$), which is correlated with the individual-specific regressors $X'_{i,t}$, and a purely unobservable part (u_i), namely, $\gamma_i = \bar{X}_i'\rho + u_i$ where $u_i \sim iid\ N(0, \sigma_{u_i}^2)$, $cov(u_i, X'_{i,t}) = cov(u_i, \varepsilon_{i,t}) = 0\ \forall\ i, t$. Since $\bar{X}_i'$ captures some underlying individual-specific characteristics, u_i as the rest part of the overall individual effects is assumed to be uncorrelated with the observable individual-specific characteristics $X'_{i,t}$.

The Wooldridge's Conditional Maximum Likelihood (CML) estimation separately models the distribution of the binary outcome starting from the second time point and the binary outcome of the first time point, rather than the joint distribution of the entire sequence of the binary outcome conditional only on exogenous regressors. Moreover, it models the distribution of the individual heterogeneity conditional on the initial condition $y_{i,1}$ and time-specific observable individual characteristics. The latter can be in the form of either $X_i' = (X_{i,1}', \ldots, X_{i,t}')$, which is the row vector of all time- and individual-variant regressors at all time points, or $\bar{X}_i'$ as defined previously. Since the database has 20 time points and four time- and country-variant regressors, $\bar{X}_i'$, rather than X_i', is used in order to avoid computationally disrupting the statistical software[67]. Finally, the overall individual effects abstracting from $\rho\bar{X}_i'$ are defined as $\gamma_i = \theta_0 + \theta_1 y_{i,1} + u_i + \varepsilon_{i,t}$. Plugging $\rho\bar{X}_i'$ and the Wooldridge specification of the overall individual effects γ_i into equation (1), the Wooldridge random-effects dynamic nonlinear model is expressed as:

$$y_{i,t} = \theta_0 + \beta_1 y_{i,t-1} + \theta_1 y_{i,1} + X_{i,t}'\beta_2 + \bar{X}_i'\rho + Z_i'\beta_3 + u_i + \varepsilon_{i,t} \tag{2}$$

where $\bar{X}_i'$ is the vector of the longitudinally averaged regressors, and $y_{i,1}$ refers to the value of the binary dependent variable at the initial time point, say, the initial condition. Introducing $y_{i,1}$ and $\bar{X}_i'$ allows for the endogeneity of the initial condition. Otherwise, β_1 will be overestimated. The Wooldridge's approach is a simpler solution to the initial conditions problem in comparison with the random-effects probit estimation by Heckman (1981c), according to which two separate equations are used for the initial condition and the binary outcomes of the following time points, respectively. The initial condition equation ($y_{i,1} = \alpha X_{i,1}' + \lambda_i$, where $\lambda_i = \phi\gamma_i + \varepsilon_{i,1}$) and the dynamic equation for the following time points are jointly estimated. Furthermore, in comparison to Heckman (1981c), the Wooldridge's approach can easily fit the function of logistic model in standard statistical software.

Following Stewart (2007), dynamic linear model by System GMM (Arellano and Bover, 1995; Blundell and Bond, 1998) is used as an alternative to the dynamic

[67] If the original method suggested by Wooldridge (2005) is used to control for the time-specific observable individual characteristics by introducing loop regressors, then all the loop regressors are omitted and the functioning of Stata is broken. A possible reason is the relatively large time dimension (20 years).

nonlinear model (Wooldridge, 2005). System GMM is an augmented version of the earlier Difference GMM (Arellano and Bond, 1991), solving the weak instrument problem of lagged level variables in Difference GMM. This method is particularly suitable for small-T and large-N dynamic database (Roodman, 2009). Difference GMM uses first differencing to eliminate individual effects and then uses lagged level variables as instruments to estimate the differenced equation. System GMM, instead, uses both differenced equation and level equation to establish an equation system. In this two-equation system, lagged differenced endogenous or predetermined variables are used as instruments in the level equation, and lagged level endogenous or predetermined variables are used as instruments in the differenced equation. Thus, System GMM allows to include time-invariant variables in the model. More technical details of System GMM have been discussed in Section 3.4.2. The use of System GMM in estimating binary outcome variable transforms the dynamic logistic model to dynamic linear probability model (dynamic LPM). The LPM assumes the probability of the binary outcome as a linear function of regressors. A concern regarding the LPM is that linear model may generate fitted probability above one or below zero, which is practically impossible because probability only ranges between zero and one. However, this happens only in the situation of extreme probabilities. Long (1997) demonstrates the nearly linear relationship between odds ratio and probability for probabilities between 20% and 80%. Hellevik (2007) further argues that the results of linear probability model and those of logistic model are often practically indifferent.

System GMM is also used to estimate the continuous Dependent Variable Type 2. For the same reason as in the case of the binary Dependent Variable Type 1, path dependence[68] of the directionality of export sophistication requires dynamic model. When estimating dynamic panels, static model is subject to the "dynamic panel bias"

[68] State dependence is used to describe the dynamic pattern of binary variable, because the outcome of being 1 or 0 is a kind of state. In comparison, path dependence is more appropriate to describe the dynamic pattern of continuous variable.

(Nickell, 1981), due to the correlation between the lagged dependent variable and the error term. The bias is subject to an order of $1/T$ and tends to disappear if the time dimension approaches infinity (Baltagi, 2008). Asteriou and Hall (2011) suggest that adding exogenous regressors can reduce this bias, provided that the time dimension *T* is large. However, as shown by Judson and Owen (1999), the bias only decreases from 50% of the true value to 20%, which is still a significant level, if the time dimension substantially increases from 5 to 30. Given that the database has only 20 time points, System GMM is necessary.

4.5.2. The Model of the Directionality of Export Sophistication

Given the lack of a systematic approach towards the directionality of export sophistication, its determinants have to be derived from several different strands of literature as discussed in Section 4.2. The static random-effects logistic model without time effects to estimate the binary Dependent Variable Type 1 (*S/N Dummy*) is expressed as:

$$
\begin{aligned}
S/N\ Dummy_{i,t} \\
&= \beta_1 ln(Total\ GDP)_{i,t} + \beta_2 ln(Overall\ Export\ Sophistication)_{i,t} \\
&+ \beta_3 ln(FDI\ Inflow\ p.c.)_{i,t} + \beta_4 Resource\ Rents_{i,t} \\
&+ \beta_5 ln(Distance\ to\ North)_i + \beta_6 ln(Distance\ to\ South)_i \\
&+ \beta_7 GDP\ p.c.\ Growth\ Rate\ (North)_t \\
&+ \beta_8 GDP\ p.c.\ Growth\ Rate\ (South)_t + \eta_t + \varepsilon_{i,t}
\end{aligned}
$$

where *i* refers to country, *t* refers to year, η_t represents year-specific effects (used in specifications without *GDP p.c. Growth Rate North/South*), and $\varepsilon_{i,t}$ is the idiosyncratic error term. Robust standard errors are used in all specifications, regardless of static model or the following dynamic model. *Total GDP* controls for a country's economic size. *Overall Export Sophistication* is the overall sophistication level of a country's total exports measured by the index of EXPY, regardless of Northbound or Southbound exports. Because characteristics associated with products at a given level of sophistication allow countries with corresponding income level to compete in the market (Lall, Weiss, and Zhang, 2006), overall export sophistication can also be read as a proxy for a country's competitiveness in target markets. Moreover, as discussed in Section 3.2.2 and Section 3.3.1, from the perspective of the capability theory of production (Andreoni, 2010 and 2011), the overall sophistication of a country's export basket reveals this country's productive capabilities. In this sense, this variable tests the capability-based explanation for export directionality implicitly derived from the North-South trade model by Regolo (2013). Productive capabilities reflect a country's static capabilities (e.g., skills, knowledge, and experience in particular productive tasks), dynamic/technological capabilities (e.g., R&D), production capacity (e.g., means of production), and capability enablers (e.g., infrastructures). The "catch-all" characteristic of export sophistication makes it a reflection of a country's overall capabilities of performing particular productive tasks. It is this characteristic that makes export sophistication an overwhelmingly better proxy for a country's capabilities than other commonly-used indicators that biasedly focus on the technological aspect of production (e.g., R&D expenditure and TFP[69]), especially for developing countries. Andreoni (2011) distinguishes between productive activities, which depend on a country's static capabilities, and technical change activities, which depend on dynamic/technological capabilities. The realisation of both of them has to be conditional on production capacity and capability enablers. As discussed in Section 3.3.1, technological capabilities, which particularly reflects on R&D, may be less

[69] Both R&D and TFP have biases that they do not reflect the capital and labour aspect of productivity and do not take into account the efficiency of the utilisation of resource and employment issues. In particular, the relationship between TFP and real economic and productive performance is sometimes blurred and even misleading. High TFP may accompany idle capital and unemployment, while low TFP may accompany efficient utilisation of resource. For example, China's quite low level of TFP, as shown in Figure C1 of Chapter 5, is inconsistent with its technological progress and capital deepening. That is to say, the validity of TFP as a proxy for productivity is based on assumptions of full employment and exogenous technological progress.

relevant to developing countries than static capabilities, production capacity, and capability enablers.

Meanwhile, R&D is actually poor indicator of technological intensity of products, because it does not reflect the contribution of knowledge-intensive intangibles (e.g., coordination and marketing) and technology and skill embodied in production process rather than in R&D process, which have been increasingly important (Kaplinsky and Santos-Paulino, 2005). Also, the world distribution of R&D expenditure is highly biased in favour of developed countries, which makes R&D less relevant to developing countries, and only part of R&D expenditure can actually translate into real production (Kemeny, 2010). For developing countries, the upgrading of their export composition can be expected to take place mainly in production process (e.g., as a result of the transfer of production from more advanced countries) rather than in R&D process, which further renders R&D less relevant to the technological and managerial intensity of developing countries' exports. In contrast, the index of export sophistication reflects technology and management embodied in both R&D process, if any, and real production process. Moreover, the availability of some commonly-used indicators, such as TFP and R&D expenditure, is not sufficient. Thus, using TFP or R&D expenditure will result in a significant loss of observations. Instead, the own calculated *Overall Export Sophistication* is available for all countries in all the years.

FDI Inflow p.c. measures inflow of foreign investment per capita, which is associated with the inflow of foreign technology and know-how. Data are from the World Development Indicators (WDI) database. *Resource Rents* measures a country's revenues from fuels, minerals, and forests, which reflects this country's natural resource endowment in general and the dependence of the economy on natural resources in particular. Because developing countries' resource exports largely go to developed and emerging countries, higher share of resource rents in GDP may affect the directionality of developing countries' export sophistication. Data are from the WDI database.

The other two sets of variables are distance to trade partner and growth rate of trade partner, which are inspired by gravity model. *Distance to North* measures the mean distance between a particular developing country and all countries in the northern direction (IEs, EIEs, and China for N-bound 1 and IEs for N-bound 2). Distance has always been used in gravity model to explain the magnitude of trade between two countries. Moreover, distance reflects trade costs in general and transportation costs in particular. Regolo (2013) demonstrates that export diversification decreases in the distance between the exporting and the importing countries. The distance variable is calculated as the simple average of all bilateral distances between a particular developing country and all countries in the northern direction. In comparison with distance weighted by countries' trade share or GDP, simple mean distance is expected to measure a country's absolute remoteness. While the former may be more suitable for examining the level of export sophistication or trade volume, the latter is more suitable for examining export directionality. Each bilateral distance is measured by the distance between the most populous city of each country. Similarly, *Distance to South* measures the mean distance between a particular developing country and all other developing countries (ODEs and LDCs). Data are from the CEPII database.

GDP p.c. Growth Rate (North) is the growth rate of GDP per capita for countries in the North as a whole (IEs, EIEs, and China for N-bound 1 and IEs for N-bound 2), namely, the growth rate of the ratio of total GDP to total population of the North. *GDP p.c. Growth Rate (South)* is the growth rate of GDP per capita for all developing countries as a whole. This variable measures macroeconomic situation and dynamics of the country group of interest, considering that higher growth of the South (North) stimulates South-South (North-South) trade (Havrylyshyn, 1985;

Demir and Dahi, 2011). In specifications without *GDP p.c. Growth Rate (North)* and *GDP p.c. Growth Rate (South)*, dummies of year effects are included, which can control for all forms of time effects, including linear time trend and country-invariant but time-variant common shocks (e.g., the global trade slowdown and the 2007-2008 crisis). Including both time-variant but individual-invariant variables (e.g., *GDP p.c. Growth Rate (North)*) and year dummies leads to multicolinearity. This applies to all the following specifications. Data are from the UNCTAD database.

The dynamic version of the binary Dependent Variable Type 1 is estimated by both the linear System GMM (Arellano and Bover, 1995; Blundell and Bond, 1998) and the nonlinear dynamic logistic model (Wooldridge, 2005). The equation of System GMM is the same as that of the static logistic model, except the addition of the lagged dependent variable on the right-hand side and country-specific fixed effects. Several conditions must hold for a valid system GMM estimation. There should be first order serial correlation but no second order serial correlation in the residual of the specification (Arellano-Bond (AR) Test) and instruments should be jointly valid (Hansen Overidentification Test). Moreover, two-step estimation is adopted in all System GMM regressions. Cameron and Trivedi (2010) suggest that two-step estimator generates more efficient estimation under overidentification. Windmeijer finite-sample corrected standard errors are used.

The dynamic random-effects logistic model has quite a different form:

$$\begin{aligned}
S/N\ Dummy_{i,t} = {} & \beta_1 S/N\ Dummy_{i,t-1} + \beta_2 ln(Total\ GDP)_{i,t} \\
& + \beta_3 ln(Overall\ Export\ Sophistication)_{i,t} + \beta_4 ln(FDI\ Inflow\ p.c.)_{i,t} \\
& + \beta_5 Resource\ Rents_{i,t} + \beta_6 ln(Distance\ to\ North)_i + \beta_7 ln(Distance\ to\ South)_i \\
& + \beta_8 GDP\ p.c.Growth\ Rate\ (North)_t + \beta_9 GDP\ p.c.Growth\ Rate\ (South)_t \\
& + \beta_{10} S/N\ Dummy_{i,1} + \beta_2' \overline{ln(Total\ GDP)_i} \\
& + \beta_3' \overline{ln(Overall\ Export\ Sophistication)_i} + \beta_4' \overline{ln(FDI\ Inflow\ p.c.)_i} \\
& + \beta_5' \overline{Resource\ Rents_i} + \eta_t + \varepsilon_{i,t}
\end{aligned}$$

where variables with the bar symbol represent the longitudinal averages along the whole period for the corresponding time- and country-variant regressors, and $S/N\ Dummy_{i,1}$ refers to the initial condition. In the following regression tables, however, the longitudinal averages and the initial condition variable are not shown, because they just serve as controls for unobservable heterogeneity and initial conditions problem.

Another concern lies in the potential endogeneity of explanatory variables other than the lagged dependent variable. A major doubt arises from using *Overall Export Sophistication* to explain the directionality of export sophistication. This concern seemingly makes sense, but by definition the use of *Overall Export Sophistication* is not problematic. A country's overall export sophistication (overall EXPY) may be approximately regarded as the weighted average of this country's export sophistication to each direction where the weight is the share of the export value to each direction in total exports. However, here a country's Southbound EXPY and Northbound EXPY are calculated in absolute terms, without considering the value share of exports to each direction in this country's total exports. To some extent, this eliminates the correlation between a country's overall EXPY value and its Northbound and Southbound EXPY values. More importantly, binary outcome of the directionality and the difference between Southbound and Northbound EXPY, rather than the absolute Southbound and Northbound EXPY values, are used as the dependent variable. This further reduces the likelihood of reverse causality. There may be one scenario in which even unweighted Northbound and Southbound EXPY values may still lead to reverse causality. If a country's Northbound (Southbound) exports account for the dominant share in its total exports and have substantially greater sophistication level than that of Southbound (Northbound) exports, then overall EXPY may tend to be largely determined by the EXPY of the dominant export direction, regardless of the use of the share of export value as weight. However, endogeneity tests robustly support the null hypothesis of the exogeneity of *Overall*

Export Sophistication for all types of dependent variables.

The baseline regressions are based on annual data of 62 developing countries from 1995 to 2014. Appendix C gives descriptive statistics of all variables in the 62-country panel. Since different kinds of dependent variables and econometric methods are already applied in the baseline analyses, robustness checks focus on the different choices of country sample and time interval. Three robustness checks are carried out. First, in order to further control for the inertia and stickiness of export directionality, annual data are rearranged by taking average of every two non-overlapping years. Thus, the 20-year panel becomes a 10-year non-overlapping panel. Second, a three-year overlapping interval panel is examined. For example, the first three-year interval is 1995-1997, the second one is 1996-1998, and the last one is 2012-2014, which results in 18 overlapping three-year periods. Third, countries with population less than one million but more than 50,000 are added to the panel, which increases the number of countries from 62 to 84. Most of these countries are small island economies. Major exporting countries of mineral fuels are still excluded, because their pattern of export sophistication and directionality is too special. For space limit, only the results of the first robustness check are shown.

4.5.3. Results

Table 4.3, 4.4, 4.5, and 4.6 show baseline regressions for the 62-country panel. N-bound 1 refers to the broadly-defined Northbound exports, say, a developing country's exports to all countries in the group of IEs, EIEs, and China, which corresponds to *S/N Dummy 1*. N-bound 2 refers to the narrowly-defined Northbound exports, say, a developing country's exports to all countries in the group of IEs, which corresponds to *S/N Dummy 2*. The dependent variable is equal to one if in a particular year a country's Southbound EXPY is higher than its Northbound EXPY, otherwise it is equal to zero. Odds ratios, rather than default coefficients, are reported for all panel logit regressions. The default output for logit model is *log odds* (the logarithm of the ratio of the probability of having a particular outcome to the probability of having the opposite outcome), which is not straightforward to interpret. Rather, odds ratio, which is the exponentiation of *log odds*, is easier for interpretation. Odds ratio ranges from zero onwards without upper bound, and the threshold is one. If odds ratio is larger than one, then the probability to have the dependent variable equal to one is larger than the probability to have it equal to zero. If odds ratio lies between zero and one, then the probability to have the dependent variable equal to zero is larger than the probability to have it equal to one. Here, if the odds ratio of a variable lies between zero and one, then this variable increases (reduces) the probability of a developing country to have more sophisticated Northbound (Southbound) exports than Southbound (Northbound) exports. Odds ratio closer to zero indicates stronger effect. In turn, if odds ratio is larger than one, then this variable increases the probability to have more sophisticated Southbound exports than Northbound exports. Each dependent variable is estimated with two specifications, one controlling for year effects without GDP per capita growth rates of the North and the South and the other one controlling for GDP per capita growth rates of the North and the South but without year effects. Finally, the data have been tested to be stationary through panel unit-root tests, and thus the regressions are not spurious.

Random-effects static panel logit regressions for the binary Dependent Variable Type 1 (*S/N Dummy*) are presented in Table 4.3. *Overall Export Sophistication*, measured as the overall EXPY, increases (reduces) the probability of a developing country to have more sophisticated Northbound (Southbound) exports than Southbound (Northbound) exports in all the four specifications. The magnitude of impact is stronger for the broadly-defined Northbound exports (N-bound 1) with significance at 1% level and odds ratios lower than 0.025. For the narrowly-defined Northbound exports (N-bound 2), the impact is slightly weaker (odds ratios are around 0.15) at the 5% significance level. An increase in *Overall Export Sophistication* by one percentage point generates an odds ratio of approximately 0.96[70] for Northbound 1 and 0.98 for Northbound 2, indicating an reduction in the odds of having more sophisticated Southbound exports than Northbound exports by 4 and 2 percentage points, respectively. *Resource Rents* increases the probability to have more sophisticated Northbound exports than Southbound exports (odds ratios are around 0.96), which is statistically significant in three out of the four specifications. A one-percent increase in the share of resource revenues in GDP reduces the odds of having more sophisticated Southbound exports than Northbound exports by approximately 4 percentage point. The insignificant case in Column 3 lies just beyond the 10% significance level (*p*-value=0.137). Larger *Distance to South* increases the probability to have more sophisticated Northbound exports than Southbound exports at the 10% significance level in all the four specifications. A one-percent increase in *Distance to South* produces an odds ratio of approximately 0.94 for Northbound 1 and 0.95 for Northbound 2, indicating a reduction in the odds of having more sophisticated Southbound exports than Northbound exports by 6 and 5 percentage points. Other variables are not statistically significant. The four specifications give very consistent results. Countries with higher overall export sophistication or higher revenues from natural resources and countries being more remote from other developing countries are more likely to have more sophisticated Northbound exports than Southbound exports.

Table 4.3. Static panel logit regressions for S/N Dummy

DepVar S/N Dummy 1 or 2	(1) N-bound 1	(2) N-bound 1	(3) N-bound 2	(4) N-bound 2
Total GDP	1.285	1.247	1.510	1.171
	(0.361)	(0.348)	(0.589)	(0.335)
Overall Export Sophistication	0.0227***	0.0225***	0.136**	0.152**
	(0.0155)	(0.0154)	(0.123)	(0.137)
FDI Inflow p.c.	1.167	1.168	1.028	1.029
	(0.119)	(0.119)	(0.115)	(0.102)
Resource Rents	0.961**	0.962**	0.964	0.961*
	(0.0187)	(0.0187)	(0.0236)	(0.0200)
Distance to North 1	15.71	14.99		

[70] $0.96 \approx \exp(\ln(0.0226) \times \ln(1.01))$.

	(41.89)	(39.99)		
Distance to South	0.00216*	0.00238*	0.00251*	0.00733*
	(0.00704)	(0.00778)	(0.00784)	(0.0206)
Distance to North 2			27.14	16.93
			(60.57)	(35.24)
GDP p.c. Growth Rate (North 1)		5.64e-05		
		(0.000402)		
GDP p.c. Growth Rate (South)		0.766		2.474
		(6.393)		(21.09)
GDP p.c. Growth Rate (North 2)				0.000847
				(0.00521)
Observations	1,192	1,192	1,192	1,192
Number of Countries	62	62	62	62
Year Dummy	Yes	No	Yes	No
Wald chi2 (p)	58.83***	60.39***	52.95***	32.92***
Log Likelihood	-411.92	-410.94	-446.13	-458.68

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. Odds ratios are reported.

Table 4.4 gives the random-effects dynamic logit regressions. The first lags of the dependent variable *S/N Dummy* have positive odds ratios at the 1% significance level in all specifications. The high statistical significance robustly justifies the consideration of the state dependence of the directionality of developing countries' export sophistication. Omitting the lagged dependent variable will overestimate the effects of other regressors. As in the static setting, *Overall Export Sophistication* has highly significant positive impact on the probability to have more sophisticated Northbound exports than Southbound exports in all specifications. The magnitude of impact is quite similar to that in the static setting. The odds ratios of *Resource Rents* are almost the same as those in the static setting, but this variable loses significance in all specifications. Similar to the static setting, larger *Distance to South* increases the probability to have more sophisticated Northbound exports than Southbound exports in all specifications. Moreover, *Distance to North 2*, namely, distance to developed countries, turns to be statistically significant with negative impact on the probability to have more sophisticated Northbound exports. That is to say, being remote from developed countries reduces a developing country's probability to have more sophisticated exports to these countries.

Table 4.4. Dynamic panel logit regressions for S/N Dummy

DepVar	(1)	(2)	(3)	(4)
S/N Dummy 1 or 2	N-bound 1	N-bound 1	N-bound 2	N-bound 2
Lagged S/N Dummy 1	4.751***	4.166***		

	(1.263)	(1.053)		
Lagged S/N Dummy 2			7.592***	6.324***
			(1.738)	(1.268)
Total GDP	3.044	1.456	4.465	1.189
	(3.390)	(0.778)	(4.284)	(0.608)
Overall Export Sophistication	0.0188***	0.0260***	0.136***	0.170**
	(0.0128)	(0.0175)	(0.104)	(0.126)
FDI Inflow p.c.	1.022	1.069	0.948	0.989
	(0.0991)	(0.0981)	(0.0908)	(0.0903)
Resource Rents	0.976	0.972	0.975	0.968
	(0.0203)	(0.0179)	(0.0244)	(0.0214)
Distance to North 1	33.62	25.93		
	(81.35)	(59.43)		
Distance to South	0.00292**	0.00409**	0.00841**	0.0125**
	(0.00753)	(0.0100)	(0.0169)	(0.0235)
Distance to North 2			24.02*	17.62*
			(42.59)	(29.20)
GDP p.c. Growth Rate (North 1)		0.000158		
		(0.00129)		
GDP p.c. Growth Rate (South)		1.516		3.102
		(13.99)		(26.11)
GDP p.c. Growth Rate (North 2)				6.40e-05
				(0.000409)
Observations	1,140	1,140	1,140	1,140
Number of Countries	62	62	62	62
Year Dummy	Yes	No	Yes	No
Wald chi2 (p)	136.1***	130.4***	149.8***	141.4***
Log-Likelihood	-350.95	-362.93	-373.80	-390.75

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. Odds ratios are reported.

Table 4.5 shows the dynamic linear probability model by System GMM. Standard coefficients are reported, instead of odds ratios. Negative coefficients are qualitatively equivalent to odds ratios between zero and one in the logistic model, and positive coefficients correspond to odds ratios larger than one. The first lags of the dependent variable *S/N Dummy* have positive coefficients at the 1% significance level in all the four specifications, which confirms the consideration of state dependence. *Overall Export Sophistication* significantly reduces the probability to have more sophisticated Southbound exports than Northbound exports. In other words, it increases the probability to have more sophisticated Northbound exports than Southbound exports. The magnitude of impact is greater for the broadly-defined Northbound exports, which is consistent with the logit model. *FDI Inflow* *p.c.* turns to be significant with positive impact on the probability to have more sophisticated Southbound exports or less sophisticated Northbound exports in all the four specifications. *Resource Rents* reduces the probability to have more sophisticated Southbound exports at the 1% significance level in all specifications, which confirms the results in logit model. While *Distance to North 1* and *Distance to North 2* are not significant, *Distance to South* reduces the probability to have more sophisticated Southbound exports in all specifications, which is consistent with the logit model. *GDP p.c. Growth Rate (North 2)* significantly reduces (increases) the probability to have more sophisticated Southbound (Northbound) exports. That said, higher economic growth of developed countries increases developing countries' Northbound export sophistication. The Arellano-Bond test confirms the existence of first order serial correlation and reject the existence of second order serial correlation. Hansen test for the joint validity of the instruments does not reject the null hypothesis of exogeneity and Difference-in-Hansen tests (for the sake of space, details are not shown) show the validity of each subset of instruments.

Table 4.5. Dynamic linear probability model for S/N Dummy

DepVar S/N Dummy 1 or 2	(1) N-bound 1	(2) N-bound 1	(3) N-bound 2	(4) N-bound 2
Lagged S/N Dummy 1	0.181***	0.197***		
	(0.0533)	(0.0571)		
Lagged S/N Dummy 2			0.243***	0.270***
			(0.0442)	(0.0466)
Total GDP	-0.0133	-0.0148	-0.00955	-0.0124
	(0.0282)	(0.0272)	(0.0268)	(0.0265)
Overall Export Sophistication	-0.312***	-0.337***	-0.166*	-0.168*
	(0.0970)	(0.0937)	(0.0927)	(0.0912)
FDI Inflow p.c.	0.0414***	0.0445***	0.0311**	0.0314**
	(0.0155)	(0.0150)	(0.0142)	(0.0139)
Resource Rents	-0.00837***	-0.00841***	-0.00794***	-0.00760***
	(0.00318)	(0.00308)	(0.00261)	(0.00246)
Distance to North 1	0.345	0.314		
	(0.264)	(0.265)		
Distance to South	-0.552*	-0.544*	-0.437*	-0.406*
	(0.316)	(0.299)	(0.250)	(0.241)
Distance to North 2			0.265	0.240
			(0.190)	(0.189)
GDP p.c. Growth Rate (North 1)		-0.895		
		(0.664)		
GDP p.c. Growth Rate (South)		0.687		0.591
		(0.887)		(0.895)
GDP p.c. Growth Rate (North 2)				-1.043*
				(0.578)
Constant	5.468***	5.975***	3.687***	3.800***

	(1.568)	(1.554)	(1.419)	(1.439)
Observations	1140	1140	1140	1140
Number of Countries	62	62	62	62
Number of Instruments	28	12	28	12
AR(1)	0.000	0.000	0.000	0.000
AR(2)	0.735	0.700	0.426	0.525
Hansen Test (p)	0.288	0.283	0.667	0.425
Difference-in-Hansen Test	Pass	Pass	Pass	Pass
Wald chi2 (p)	0.000	0.000	0.000	0.000

Two-step System GMM regression: Windmeijer finite-sample corrected standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 4.6 gives System GMM regressions for the continuous Dependent Variable Type 2, which is defined as the log difference between a country's Southbound and Northbound EXPY. Positive value indicates more sophisticated Southbound exports than Northbound exports. The larger the positive difference is, the greater is the sophistication advantage of Southbound exports over Northbound exports. Two definitions of Northbound exports are examined separately. Column 1 and 3 control for year effects, and Column 2 and 4 control for GDP per capita growth rates of the North and the South without year effects. The first lags of the dependent variable have positive coefficients of quite similar magnitude at the 1% significance level in all the four specifications. This result confirms the path dependence of the directionality of export sophistication. *Overall Export Sophistication* reduces Southbound export sophistication or increases Northbound export sophistication. This impact is more statistically significant and has larger magnitude for the broadly-defined Northbound exports, N-bound 1, (at the 1% significance level) than the narrowly-defined Northbound exports, N-bound 2, (at the 10% and 5% significance level), which is fully consistent with results from the binary Dependent Variable Type 1. *FDI Inflow p.c.* slightly increases the sophistication of Southbound exports or reduces the sophistication of Northbound exports in all the four specifications, whereas *Resource Rents* has the opposite impact. *Distance to North 1* and *Distance to North 2* significantly increase Southbound export sophistication or reduce Northbound export sophistication, and *Distance to South* has the opposite impact in all specifications. These results are consistent with those from the binary dependent variable, except *Distance to North 1*, which is insignificant for the case of the binary dependent variable. Generally speaking, continuous dependent variable gives quite similar results with those from the binary dependent variable.

Table 4.6. System GMM regressions for S-N Difference

DepVar S-N EXPY Diff. 1 or 2	(1) N-bound 1	(2) N-bound 1	(3) N-bound 2	(4) N-bound 2
Lagged S-N Diff. 1	0.292***	0.291***		
	(0.0624)	(0.0661)		
Lagged S-N Diff. 2			0.274***	0.285***
			(0.0467)	(0.0534)
Total GDP	-0.0142	-0.0143	-0.0109	-0.0180
	(0.0180)	(0.0169)	(0.0185)	(0.0178)
Overall Export Sophistication	-0.331***	-0.325***	-0.165*	-0.203**
	(0.0831)	(0.0807)	(0.0870)	(0.0959)
FDI Inflow p.c.	0.0247**	0.0260**	0.0230**	0.0215*
	(0.0113)	(0.0109)	(0.0116)	(0.0113)
Resource Rents	-0.00725***	-0.00706***	-0.00682***	-0.00699***
	(0.00207)	(0.00192)	(0.00188)	(0.00188)
Distance to North 1	0.319	0.327*		
	(0.197)	(0.193)		
Distance to South	-0.482*	-0.497**	-0.455**	-0.403*
	(0.247)	(0.243)	(0.215)	(0.216)
Distance to North 2			0.349**	0.309*
			(0.164)	(0.167)
GDP p.c. Growth Rate (North 1)		-1.155**		
		(0.458)		
GDP p.c. Growth Rate (South)		0.200		0.0643
		(0.741)		(0.789)
GDP p.c. Growth Rate (North 2)				-0.400
				(0.533)
Constant	4.887***	4.959***	2.840**	3.239***
	(1.051)	(1.037)	(1.173)	(1.214)
Observations	1140	1140	1140	1140
Number of Countries	62	62	62	62
Number of Instruments	28	12	28	12
AR(1)	0.00200	0.00206	0.000583	0.000840
AR(2)	0.162	0.162	0.185	0.215
Hansen Test (p)	0.333	0.441	0.426	0.268
Difference-in-Hansen Test	Pass	Pass	Pass	Pass
Wald chi2 (p)	0.000	0.000	0.000	0.000

Two-step System GMM regression: Windmeijer finite-sample corrected standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 4.7, 4.8, 4.9, and 4.10 show the robustness check by using the 62-country panel of two-year non-overlapping interval. In a two-year period, if a country has more sophisticated Southbound exports than Northbound exports in at least one year, then the S/N dummy is coded as one. Table 4.7 gives the random-effects static logit regressions for the binary Dependent Variable Type 1. *Overall Export Sophistication* increases the probability to have more sophisticated Northbound exports than Southbound exports. Similar to the situation in the baseline annual panel, this impact is greater and more statistically significant for the broadly-defined Northbound exports. *Resource Rents* increases the probability to have more sophisticated Northbound exports than Southbound exports in all specifications with the odds ratios quite similar to those in the baseline regressions. However, variables of distance do not show statistical significance.

Table 4.7. Static panel logit regressions for S/N Dummy (two-year interval panel)

DepVar S/N Dummy 1 or 2	(1) N-bound 1	(2) N-bound 1	(3) N-bound 2	(4) N-bound 2
Total GDP	1.070	1.022	1.113	1.033
	(0.352)	(0.294)	(0.443)	(0.345)
Overall Productive Investment	0.00534***	0.00643***	0.0756**	0.0811**
	(0.00532)	(0.00642)	(0.0896)	(0.0953)
FDI Inflow p.c.	1.292	1.305	1.056	1.057
	(0.238)	(0.219)	(0.204)	(0.188)
Resource Rents	0.931**	0.927***	0.948*	0.946**
	(0.0278)	(0.0262)	(0.0286)	(0.0265)
Distance to North 1	1.302	1.493		
	(3.645)	(3.916)		
Distance to South	0.0469	0.0419	0.0121	0.0166
	(0.174)	(0.140)	(0.0436)	(0.0561)
Distance to North 2			10.55	9.261
			(27.90)	(23.39)
GDP p.c. Growth Rate (North 1)		0.000656		
		(0.00998)		
GDP p.c. Growth Rate (South)		0.0900		44.91
		(1.590)		(800.4)
GDP p.c. Growth Rate (North 2)				0.00662
				(0.0847)
Observations	594	594	594	594
Number of Countries	62	62	62	62
Year dummy	Yes	No	Yes	No
Wald chi2 (p)	42.35***	39.80***	25.18**	20.98***
Log Likelihood	-215.1	-217.21	-223.09	-225.85

Robust standard errors in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Odds ratios are reported.

Table 4.8 shows random-effects dynamic logit regressions for the two-year interval panel. The lags are highly significant in all the specifications. *Overall Export Sophistication* increases the probability to have more sophisticated Northbound exports than Southbound exports in all specifications. As in previous regressions, the impact is stronger and more statistically significant for the broadly-defined Northbound exports. *Distance to South* increases the probability to have more sophisticated Northbound exports, which is in line with previous regressions on annual basis.

Table 4.8. Dynamic panel logit regressions for S/N Dummy (two-year interval panel)

DepVar S/N Dummy 1 or 2	(1) N-bound 1	(2) N-bound 1	(3) N-bound 2	(4) N-bound 2
Lagged S/N Dummy 1	6.163***	5.470***		
	(2.885)	(2.280)		
Lagged S/N Dummy 2			4.144***	3.527***
			(1.968)	(1.404)
Total GDP	5.839	1.695	6.880	1.448
	(9.688)	(1.445)	(9.857)	(1.177)
Overall Productive Investment	0.00269***	0.00255***	0.0564**	0.0540**
	(0.00345)	(0.00333)	(0.0741)	(0.0731)
FDI Inflow p.c.	0.989	1.000	0.845	0.847
	(0.215)	(0.210)	(0.146)	(0.129)
Resource Rents	0.971	0.965	0.969	0.965
	(0.0360)	(0.0373)	(0.0313)	(0.0308)
Distance to North 1	11.52	9.848		
	(23.91)	(19.48)		
Distance to South	0.00499*	0.00632**	0.00405*	0.00509*
	(0.0139)	(0.0162)	(0.0124)	(0.0146)
Distance to North 2			37.36	32.31
			(90.82)	(74.25)
GDP p.c. Growth Rate (North 1)		7.02e-05		
		(0.00119)		
GDP p.c. Growth Rate (South)		1.478		193.9
		(25.59)		(3,235)
GDP p.c. Growth Rate (North 2)				0.000899
				(0.0124)
Observations	537	537	537	537
Number of Countries	62	62	62	62
Year dummy	Yes	No	Yes	No
Wald chi2 (p)	89.70***	90.13***	63.50***	61.67***
Log Likelihood	-168.73	-171.66	-176.75	-180.86

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. Odds ratios are reported.

Table 4.9 shows the dynamic linear probability regressions for the two-year interval panel. The second lag of the dependent variable is included. This is because that, in this two-year interval panel with *S/N Dummy*, using only the first lag leads to second order serial correlation of the residuals, which weakens the System GMM estimation. Both the first lags and the second lags of the binary dependent variables have highly significant and positive coefficients, and the second lags have smaller coefficients than the first lags in all the four specifications. *Overall Export Sophistication* increases the probability to have more sophisticated Northbound exports than Southbound exports, but this effect is only significant for the broadly-defined Northbound exports (Column 1 and 2). *FDI Inflow p.c.* reduces the probability to have more sophisticated Northbound exports but only for the broadly-defined Northbound exports. *Resource Rents* increases the probability to have more sophisticated Northbound exports than Southbound exports in all the four specifications. Other variables are not significant.

Table 4.9. Dynamic linear probability model for S/N Dummy (two-year interval panel)

DepVar S/N Dummy 1 or 2	(1) N-bound 1	(2) N-bound 1	(3) N-bound 2	(4) N-bound 2
1st Lagged S/N Dummy 1	0.355***	0.366***		
	(0.0912)	(0.0911)		
2nd Lagged S/N Dummy 1	0.174***	0.165**		
	(0.0587)	(0.0675)		
1st Lagged S/N Dummy 2			0.387***	0.383***
			(0.0843)	(0.0813)
2nd Lagged S/N Dummy 2			0.198***	0.194***
			(0.0687)	(0.0673)
Total GDP	-0.00482	-0.00557	-0.0131	-0.0144
	(0.0205)	(0.0214)	(0.0232)	(0.0196)
Overall Export Sophistication	-0.319***	-0.298***	-0.119	-0.126
	(0.0889)	(0.0929)	(0.109)	(0.0976)
FDI Inflow p.c.	0.0301*	0.0290*	0.0122	0.0123
	(0.0172)	(0.0148)	(0.0157)	(0.0132)
Resource Rents	-0.00633**	-0.00634**	-0.00538**	-0.00601**
	(0.00260)	(0.00265)	(0.00273)	(0.00234)
Distance to North 1	0.000207	0.0355		
	(0.225)	(0.225)		
Distance to South	-0.154	-0.182	-0.230	-0.195
	(0.283)	(0.269)	(0.256)	(0.213)
Distance to North 2			0.110	0.121
			(0.214)	(0.177)
GDP p.c. Growth Rate (North 1)		-0.843		
		(1.590)		
GDP p.c. Growth Rate (South)		-0.480		0.939
		(1.571)		(1.688)
GDP p.c. Growth Rate (North 2)				-0.878
				(1.076)
Constant	4.688***	4.487***	2.740**	2.443**
	(1.323)	(1.261)	(1.338)	(1.131)
Observations	478	478	478	478
Number of Countries	62	62	62	62
Number of Instruments	18	13	20	13
AR(1)	0.0000562	0.0000301	0.000756	0.000171
AR(2)	0.539	0.314	0.786	0.954
Hansen Test (p)	0.191	0.335	0.120	0.557
Difference-in-Hansen Test	Pass	Pass	Pass	Pass
Constant	4.688***	4.487***	2.740**	2.443**

Two-step System GMM regression: Windmeijer finite-sample corrected standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Finally, Table 4.10 shows the System GMM regressions for the continuous Dependent Variable Type 2 with the two-year interval panel. The first lags have highly significant and positive coefficients in all specifications. *Overall Export Sophistication* increases Northbound export sophistication or reduces Southbound export sophistication. The impact, as previously, is greater and more significant for the broadly-defined Northbound exports than the narrowly-defined Northbound exports. *FDI Inflow p.c.* slightly increases Southbound export sophistication or reduces Northbound export sophistication, which is only significant for the broadly-defined Northbound exports. *Resource Rents* has highly significant but quite small effect to increase Northbound export sophistication or reduce Southbound export sophistication in all specifications. *Distance to South* increases Northbound export sophistication or reduces Southbound export sophistication, but this impact is only significant in Column 2. GDP per capita growth rates of the broadly-defined and the narrowly-defined North turn to be significant. Higher economic growth in the North increases developing countries' Northbound export sophistication or reduces their Southbound export sophistication. Finally, in Column 3 and 4 the Arellano and Bond test rejects the null of the absence of second order serial correlation. This problem cannot be solved, even if the second lag of the dependent variable is added. However, the Difference-in-Hansen test for the first-differenced equation does not reject the null hypothesis of lagged level dependent variables as valid instruments. Thus, the Blundell and Bond mean stationarity condition holds and the Arellano-Bond test should not be a major problem.

Table 4.10. System GMM regressions for S-N Difference (two-year interval panel)

DepVar S-N EXPY Diff. 1 or 2	(1) N-bound 1	(2) N-bound 1	(3) N-bound 2	(4) N-bound 2
Lagged S-N Diff. 1	0.478***	0.501***		
	(0.139)	(0.148)		
Lagged S-N Diff. 2			0.551***	0.563***
			(0.129)	(0.121)
Total GDP	-0.00651	-0.00589	-0.00663	-0.00618
	(0.0112)	(0.0112)	(0.0116)	(0.0106)
Overall Productive Investment	-0.314***	-0.290***	-0.162*	-0.137*
	(0.0975)	(0.0999)	(0.0834)	(0.0798)

FDI Inflow p.c.	0.0227**	0.0222**	0.0118	0.00985
	(0.0100)	(0.0106)	(0.00912)	(0.00878)
Resource Rents	-0.00610***	-0.00600***	-0.00522***	-0.00518***
	(0.00192)	(0.00203)	(0.00190)	(0.00182)
Distance to North 1	0.168	0.197		
	(0.131)	(0.132)		
Distance to South	-0.267	-0.301*	-0.178	-0.196
	(0.171)	(0.171)	(0.159)	(0.150)
Distance to North 2			0.152	0.167
			(0.120)	(0.116)
GDP p.c. Growth Rate (North 1)		-1.877**		
		(0.895)		
GDP p.c. Growth Rate (South)		0.899		-0.240
		(0.998)		(0.968)
GDP p.c. Growth Rate (North 2)				-1.162*
				(0.604)
Constant	3.963***	3.808***	1.963**	1.776*
	(1.241)	(1.271)	(0.961)	(0.920)
Observations	537	537	537	537
Number of Countries	62	62	62	62
Number of Instruments	18	12	18	12
AR(1)	0.0000140	0.000125	0.000406	0.000190
AR(2)	0.171	0.168	0.0474	0.0483
Hansen Test (p)	0.559	0.484	0.293	0.493
Difference-in-Hansen Test	Pass	Pass	Pass	Pass
Wald chi2 (p)	0.000	0.000	0.000	0.000

Two-step System GMM regression: Windmeijer finite-sample corrected standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Furthermore, two additional robustness checks have also been carried out. First, small countries with population between 50,000 and one million are added to the sample, which expands the number of countries from 62 to 84. Second, the three-year overlapping interval panel is examined. The first three-year interval is 1995-1997, the second one is 1996-1998, and the last one is 2012-2014, which results in 18 overlapping three-year periods. The results do not show major differences. In particular, *Overall Export Sophistication* is still a robust contributor to the directionality of export sophistication. Higher *Overall Export Sophistication* increases the probability to have more sophisticated Northbound exports than Southbound exports. *Distance to South* and *Resource Rents* increase the probability to have more sophisticated Northbound exports than Southbound exports. For the space limit, the results of the two additional robustness checks are not shown.

In summary, this section gives regressions on the determinants of the directionality of developing countries' export sophistication based on (1) binary and continuous measures of the directionality of export sophistication, (2) broadly-defined and narrowly-defined Northbound exports, (3) static and dynamic models, (4) linear and nonlinear models, (5) smaller and larger country samples, and (6) annual, two-year non-overlapping interval, and three-year overlapping interval panels. Different specifications give quite consistent results. First, state/path dependence of the directionality of developing countries' export sophistication is confirmed in all dynamic regressions, regardless of linear or nonlinear model or binary or continuous measures of the directionality. Second, *Overall Export Sophistication* has highly significant effect to reduce the probability to have more sophisticated Southbound exports than Northbound exports or reduce (increase) Southbound (Northbound) export sophistication in almost all specifications. It can be regarded as a major and robust determinant of the directionality of developing countries' export sophistication. Developing countries with more sophisticated overall export structure or, deeply speaking, greater productive capabilities are less likely to have more sophisticated Southbound exports. Third, *Resource Rents* is found to reduce the probability to have more sophisticated Southbound exports than Northbound exports or reduce (increase) Southbound (Northbound) export sophistication. Fourth, in the majority of specifications *Distance to South* reduces the probability to have more sophisticated Southbound exports than Northbound exports or reduces (increases) Southbound (Northbound) export sophistication. In some specifications, *Distance to North 1* and *Distance to North 2* increase the probability to have more sophisticated Southbound exports than Northbound exports or increase (reduce) Southbound (Northbound) export sophistication. The impact of the three "distance" variables supports the role of remoteness in the directionality of developing countries' export sophistication. Geographical closeness reduces trade costs and increases export sophistication. This is similar to the prediction of bilateral trade flow in gravity model. Fifth, *FDI Inflow p.c.* shows mixed but small impacts, which is insignificant in many specifications. Sixth, GDP per capita growth rate of the North reduces the probability to have more sophisticated Southbound exports than

Northbound exports or reduces (increases) Southbound (Northbound) export sophistication. This implies that macroeconomic dynamics of trade partners impact on export sophistication. Provided that economic growth is a rough indicator of demand, increase in demand by trade partners raises the sophistication of this export direction. The above results are not sensitive to the broadly-defined or the narrowly-defined Northbound exports. Moreover, since developing countries specialising in mineral fuels have been dropped from the sample, the results are not distorted by the fact that the majority of developing countries' exports in mineral fuels go to the northern direction.

4.6. Conclusion

Since the 1970s, it has been observed that South-South exports tend to be more sophisticated than South-North exports and thus are believed to have greater developmental effects. This phenomenon raises the issue of the directionality of developing countries' export sophistication. However, explorations into this export directionality, either theoretical or empirical, have been insufficient. Recent evidence is quite limited and existing studies are largely subject to outdated country grouping. By adopting the industrialisation-based country grouping system, this chapter shows that, between 1995 and 2014, more than half of developing countries tend to have more sophisticated Southbound exports than Northbound exports on average, and the reverse is true for the others. This reflects the heterogeneity within developing countries in terms of export directionality.

In addition to the evidence on the pattern of the directionality of developing countries' export sophistication, another issue is what factors determine this directionality. This chapter finds that a country's productive capabilities that are measured by its overall export sophistication are a major and robust determinant. Developing countries that have greater productive capabilities are less likely to have more sophisticated Southbound exports than Northbound exports. By contrast, lower productive capabilities lead to lower Northbound export sophistication or higher Southbound export sophistication. The mechanism underlying this finding may be that developing countries with greater productive capabilities are able to export their relatively sophisticated products to the more competitive markets of developed and emerging countries. Those with lower productive capabilities do not have such ability to enter more advanced markets with their relatively sophisticated products, if any. Instead, they have to serve more advanced market with their less sophisticated products, and markets of other developing countries are an outlet for their relatively sophisticated products. Another explanation for this finding is the integration into the global value chains. Developing countries tend to be at the lower tier of the global value chains, serving as suppliers of primary commodities or simple manufactures. This is particularly the case in Sub-Saharan Africa (Foster-McGregor and Stehrer, 2013). Because the downstream of the global value chains concentrates in the Global North, developing countries' participation in the upstream as primary suppliers naturally leads to less sophisticated Northbound exports. However, developing countries with greater productive capabilities may be able to supply more sophisticated products to downstream producers and thus take relatively higher position in the value chains. As a result, these countries may have more sophisticated Northbound exports than Southbound exports.

The findings imply that the conventional wisdom that South-South trade is more beneficial to developing countries than North-South trade should be treated conditionally. This chapter argues that developing countries should not be taken as a homogeneous whole. Provided that more sophisticated export direction has greater developmental effect, Northbound exports should be more beneficial to those productively more advanced developing countries, and Southbound exports may be an opportunity for those productively less advanced ones, in terms of industrialisation and structural transformation. However, this implication must be treated cautiously, because the sophistication of exports to different directions is examined without considering the corresponding export volume. For example, a country's Northbound exports may be highly sophisticated, but have a very low volume. In other words, high export quality may accompany low export quantity. In this case, can we say that Northbound exports are a greater opportunity for this country? This may be an empirical question and may not be answered without case-by-case studies. A preliminary answer may be that efforts to expand the small but sophisticated export direction are helpful.

Finally, what has been discussed so far refers to the export side of developing countries' South-North trade and South-South trade. Even if a developing country's Southbound exports are more sophisticated, its Northbound imports, say imports from developed countries, as found by Schiff and Wang (2006), tend to be definitely more sophisticated than Southbound imports, indicating greater technology diffusion. Therefore, learning by doing through Southbound exports and technology diffusion through Northbound imports should be taken into account at the same time. In this sense, echoing the literature since the 1950s from Myrdal (1956) to Klinger (2009), the development of South-South trade is a solution to the dilemma facing developing countries as demonstrated in radical political economy (e.g., Prebisch-Singer thesis, dependency theory, and world-system theory) that exporting primary commodities in exchange of manufactures from the centre impedes the periphery's development.

References

Allison, P. D. (2009). Fixed effects regression models (Vol. 160). SAGE publications.

Amurgo-Pacheco, A., & Piérola, M. D. (2008). *Patterns of export diversification in developing countries: intensive and extensive margins*. The World Bank.

Amsden, A. H. (1976). Trade in manufactures between developing countries. *The Economic Journal*, *86*(344), 778-790.

Amsden, A. H. (1980). The industry characteristics of intra-Third World trade in manufactures.

Economic Development and Cultural Change, *29*(1), 1-19.

Amsden, A. H. (1986). The direction of trade-past and present-and the 'learning effects' of exports to different directions. *Journal of Development Economics*, *23*(2), 249-274.

Amsden, A. H. (1987). The directionality of trade: historical perspective and overview. In Exports of developing countries: how direction affects performance. World Bank Conference South-South versus South-North Trade (No. PROG IV-E71 H388). Banco Mundial, Washington, DC (EUA).

Andreoni, A. (2011). Productive capabilities indicators for industrial policy design. UNIDO Working paper series, (17/11).

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, *58*(2), 277-297.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, *68*(1), 29-51.

Baldwin, R. E. (1979). Determinants of trade and foreign investment: Further evidence. *The Review of Economics and Statistics*, 40-48.

Bergstrand, J. H. (1990). The Heckscher-Ohlin-Samuelson model, the Linder hypothesis and the determinants of bilateral intra-industry trade. *The Economic Journal*, *100*(403), 1216-1229.

Bernard, A. B., & Jensen, J. B. (2004). Why some firms export. *Review of Economics and Statistics*, *86*(2), 561-569.

Bernhardt, T. (2016). South-South trade and South-North trade: which contributes more to development in Asia and South America? Insights from estimating income elasticities of import demand. *CEPAL Review*.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, *87*(1), 115-143.

Chamberlain, G. (1984). Panel data. *Handbook of Econometrics*, *2*, 1247-1318.

Chay, K. Y., & Hyslop, D. (1998). *Identification and estimation of dynamic binary response panel data models: empirical evidence using alternative approaches* (No. 5). Center for Labor Economics, University of California, Berkeley.

Cizeljc, B., & Fuks, M. (1987). Trade Among Developing Countries: Achievements and Potential. In *World Bank Symposium Exports of Developing Countries: How Direction Affects Performance* (pp. 141-148).

Deardorff, A. V. (1987). The directions of developing-country trade: examples of pure theory. Exports of developing countries: how direction affects performance. *World Bank Conference South-South versus South-North Trade* (No. PROG IV-E71 H388). Banco Mundial, Washington, DC (EUA).

Debaere, P. (2003). Relative factor abundance and trade. *Journal of Political Economy*, *111*(3), 589-610.

Demir, F., & Dahi, O. S. (2011). Asymmetric effects of financial development on South–South and South–North trade: Panel data evidence from emerging markets. *Journal of Development Economics*, *94*(1), 139-149.

Fortunato, P., & Razo, C. (2014). Export sophistication, growth and the middle-income trap, in *Transforming Economies: Making Industrial Policy Work for Growth, Job and Development*. ILO: Geneva.

Foster-McGregor, N., & Stehrer, R. (2013). Value added content of trade: A comprehensive approach. *Economics Letters*, *120*(2), 354-357.

Gourdon, J. (2009). Explaining trade flows: traditional and new determinants of trade patterns. *Journal of Economic Integration*, 53-86.

Hanson, G. H. (2012). The rise of middle kingdoms: emerging economies in global trade. *The Journal of Economic Perspectives*, *26*(2), 41-63.

Hausmann, R., & Klinger, B. (2006). Structural transformation and patterns of comparative advantage in the product space.

Hausmann, R., Hwang, J., & Rodrik, D. (2007). What you export matters. *Journal of Economic Growth*, *12*(1), 1-25.

Havrylyshyn, O. (1985). The direction of developing country trade: Empirical evidence of differences between South-South and South-North trade. *Journal of Development Economics*, *19*(3), 255-281.

Havrylyshyn, O., & Wolf, M. (1987). What have we learned about South-South trade?. *Exports of developing countries: How direction affects performance*.

Heckman, J. J. (1976). The common structure of statistical models of truncation, sample selection and limited dependent variables and a simple estimator for such models. In *Annals of Economic and Social Measurement, Volume 5, number 4* (pp. 475-492). NBER.

Heckman, J. J. (1978). Simple statistical models for discrete panel data developed and applied to test the hypothesis of true state dependence against the hypothesis of spurious state dependence. In *Annales de l'INSEE* (pp. 227-269). Institut national de la statistique et des études économiques.

Heckman, J. J. (1981a). Heterogeneity and state dependence. In *Studies in labor markets* (pp. 91-140). University of Chicago Press.

Heckman, J. J. (1981b). Statistical models for discrete panel data, in Charles F. Manski and Daniel McFadden, eds., *Structural analysis of discrete data with econometric applications*. *MIT Press, Cambridge, MA*, 114-178.

Heckman, J. J. (1981c). The Incidental Parameters Problem and the Problem of Initial Conditions in Estimating a Discrete Time-Discrete Data Stochastic Process, in Charles F. Manski and Daniel McFadden, eds., *Structural analysis of discrete data with econometric applications*. *MIT Press, Cambridge, MA*, 179-195.

Heckman, J. (2013). Sample selection bias as a specification error. *Applied Econometrics*, *31*(3), 129-137.

Hellevik, O. (2009). Linear versus logistic regression when the dependent variable is a dichotomy. *Quality & Quantity*, *43*(1), 59-74.

IMF (2011). New growth drivers for low-income countries: the role of BRICs. Washington DC: IMF.

Kemeny, T. (2010). Does foreign direct investment drive technological upgrading?. *World Development*, *38*(11), 1543-1554.

Klinger, B. (2009). Is South-South trade a testing ground for structural transformation?. *UN Policy Issues in International Trade and Commodities Study*, (40).

Krueger, A. O. (1977). *Growth, distortions, and patterns of trade among many countries* (No. 40). International Finance Section, Dept. of Economics, Princeton University.

Lall, S. (1987). India's economic relations with the South. *Exports of developing countries: How direction affects performance*.

Lall, S. (2000). The Technological structure and performance of developing country manufactured exports, 1985-98. *Oxford Development Studies*, *28*(3), 337-369.

Lall, S., Weiss, J., & Zhang, J. (2006). The "sophistication" of exports: a new trade measure. *World Development*, *34*(2), 222-237.

Linder, S. (1961). *An essay on trade and transformation*. Stockholm: Almqvist and Wiksell.

Long, J. S. (1997). Regression models for categorical and limited dependent variables. *Advanced quantitative techniques in the social sciences*, *7*.

Melitz, J. (2007). North, South and distance in the gravity model. *European Economic Review*, *51*(4), 971-991.
Morrow, P. M. (2010). Ricardian–Heckscher–Ohlin comparative advantage: Theory and evidence. *Journal of International Economics, 82(2)*, 137-151.
Mundlak, Y. (1978). On the pooling of time series and cross section data, *Econometrica*, 46, 69–85.
Radelet, S., & Sachs, J. (1998). Shipping costs, manufactured exports, and economic growth. In American Economic Association Meetings, Harvard University, mimeo.
Regolo, J. (2013). Export diversification: How much does the choice of the trading partner matter?. *Journal of International Economics*, *91*(2), 329-342.
Roberts, M. J., & Tybout, J. R. (1999). *An empirical model of sunk costs and the decision to export*. The World Bank.
Rodrik, D. (2006). Industrial development: stylized facts and policies. 2006. Harvard University.
Stewart, M. B. (2007). The interrelated dynamics of unemployment and low-wage employment. *Journal of Applied Econometrics*, *22*(3), 511-531.
UNIDO (2013). Country grouping in UNIDO statistics. Vienna: United Nations.
Wooldridge, J. M. (2005). Simple solutions to the initial conditions problem in dynamic, nonlinear panel data models with unobserved heterogeneity. *Journal of Applied Econometrics*, *20*(1), 39-54.

Appendix A. Modifications of the UNIDO Country Grouping

The 2013 UNIDO country grouping divides the world into four tiers according to a country's manufacturing value added per capita (MVA_{pc}) [71] : Industrialised Economies (IEs), Emerging Industrial Economies (EIEs) and China [72] , Other Developing Economies (ODEs), and Least Developed Countries (LDCs). Table A1 (the same as Table 2.2 in Chapter 2) shows the UNIDO classification criteria. However, the UNIDO classification of some countries, mostly in the group of Emerging Industrial Economies (EIEs), is problematic. For this reason, this appendix discusses some minor modifications of the original UNIDO country grouping.

[71] $MVA_{pc} = \frac{GDP\ (PPP)}{Population} \times \frac{MVA}{GDP}$

[72] According to MVA_{pc}, China belongs to the group of EIEs. However, due to its size, China is separately listed in the UNIDO statistics.

Table A1. The UNIDO Country Grouping

Country Groups		*Statistical Thresholds*[73]	*Economies*
North	Industrialised Economies (IEs)	$MVA_{pc}(adjusted) \geq 2500$ or $GDP\ per\ capita\ (PPP) \geq 20000$	57
Emerging South (ES)	Emerging Industrial Economies (EIEs) & China	$1000 \leq MVA_{pc}(adjusted) < 2500$ or $GDP\ per\ capita\ (PPP) \geq 10000$ or share in world $MVA \geq 0.5\%$	33
Developing South (DS)	Other Developing Economies (ODEs)	All others (except LDCs)	82
	Least Developed Countries (LDCs)	Based on UN official list	46

Source: UNIDO (2013)

A.1. The Evolution of the UNIDO Country Grouping

Nielsen (2011) argues that a country grouping system based on development level, namely, development taxonomy, must firstly deal with the question of what "development" is. Only after clarifying the concept of development, can a development taxonomy be robustly established. However, because a unified understanding of development does not exist, there is no generally-accepted country grouping system or development taxonomy. The United Nations has even never issued any development taxonomy with respect to its member states, except the list of Least Developed Countries (LDCs). Different international organisations design their own groupings based on their different perceptions of development and different purposes. Because the primary mandate of UNIDO is to promote industrialisation worldwide, especially in the developing world, industrialisation level acts as the principle criterion to differentiate between country groups in the UNIDO system (UNIDO, 2013).

In 1983, UNIDO issued its first country grouping, which divides the world into

[73] At 2005 current prices, international dollars in PPP.

Developed Market Economies, Centrally Planned Economies, Developing Economies, and China. China is separately listed due to its size. However, as recognised in UNIDO (2013), the 1983 country grouping reflects the perception of political and economic differentiations between country groups rather than differentiations in statistical terms. In other words, it lacks statistical grounding. After the end of the Cold War, the 1983 country grouping lost its relevance to the reality. In a revision, Developed Market Economies and Centrally Planned Economies are combined as a new group of Industrialised Countries. The rest of the world, except China, then constitutes Developing Countries, which are further divided into Newly Industrialised Countries (incl. both the first-generation East Asian NICs and the second-generation NICs), Other Developing Countries, and Least Developed Countries. However, according to UNIDO (2013), the revised country grouping suffers from problems on some countries' accession to the group of Industrialised Countries. For instance, all countries that previously belonged to Centrally Planned Countries are simply classified under Industrialised Countries without considerations on the long-term unbalanced development among these countries, as well as their divergent situations after the Cold War. A striking example is the Soviet Union. It comprised a highly industrialised European part and a backward Central Asian and Caucasian part. Until 2013, UNIDO country groupings were designed without explicit statistical grounding, and thus lacked quantifiable criteria. For this reason, the 2013 UNIDO country grouping is developed based on manufacturing value added per capita (MVA_{pc}), which reflects a country's industrialisation stage.

A.2. Minor Modifications of the UNIDO Country Grouping

The problem of the 2013 UNIDO country grouping centres on the group of Industrialised Economies (IEs) and Emerging Industrial Economies (EIEs). In the 2013 grouping, only seven former centrally planned countries (i.e., Czech Republic, Estonia, Hungary, Lithuania, Slovakia, Slovenia, and Russian Federation) are classified under IEs. Some other former centrally planned countries that have comparable income or industrialisation level are classified under Emerging Industrial Economies (EIEs) by UNIDO. In earlier UNIDO country grouping, all former centrally planned countries were classified under Industrialised Countries. Although this earlier approach is somewhat arbitrary, it does justify a common perception that countries in the former Eastern Bloc tend to be highly industrialised, especially in comparison to developing countries. Besides those former centrally planned countries, several other countries are also subject to inappropriate exclusion from IEs.

Table A2 shows countries that are moved away from the group of EIEs to the group of IEs with the reasons for each individual case. Countries under change can be divided into four groups:

1. *Southern Cone Countries (Argentina, Chile, and Uruguay)*
2. *Advanced Ex-Soviet Republics (Belarus, Ukraine, and Latvia)*
3. *Advanced Ex-European Socialist Countries and Advanced Constituent Republic of the Former Socialist Federal Republic of Yugoslavia/SFRY (Bulgaria, Romania, Poland, and Croatia)*
4. *Traditional European Market Economies (Cyprus and Greece)*
5. *Advanced Petroleum Exporters (Brunei Darussalam)*

Table A2. Notes on modifications of the UNIDO group of EIEs

Country	***Reasons to be moved from EIEs to IEs***
Southern Cone Countries	
Argentina	1. (Very) High human development level (according to the UN HDI) 2. Two similar countries, Chile and Uruguay, are classified under High-Income Economies by the World Bank
Chile	1. High-Income Economy by the World Bank 2. (Very) High human development level
Uruguay	1. High-Income Economy by the World Bank

	2.	High human development level
Advanced Ex-Soviet Republics		
Belarus	1. 2. 3.	A high living-standard republic in the Soviet Union Industrialisation during the socialist period and strong industrial base (specialising in machine building within the Soviet Union, and currently having strong capabilities in engineering vehicle and optical equipment) Russian Federation, a country similar to Belarus, is classified under Industrialised Economies by UNIDO.
Ukraine	1. 2. 3.	A high living-standard republic in the Soviet Union Industrialisation during the socialist period and strong industrial base (specialising in machine building within the Soviet Union, and currently having strong capabilities in arms industry, especially engine and aircraft) Russian Federation, a coutry similar to Ukraine, is classified under Industrialised Economies by UNIDO.
Latvia	1. 2. 3. 4. 5. 6. 7.	One of the richest republics in the Soviet Union Industrialisation during the socialist period (specialising in electronics within the Soviet Union) EU member (since 2004) High-Income Economy by the World Bank (Very) High human development level Advanced Country by the IMF Two similar Baltic countries (Estonia and Lithuania) are classified under Industrialised Economies by UNIDO.
Advanced Ex-European Socialist Countries and SFRY Republic		
Bulgaria	1. 2. 3.	Industrialisation during the socialist period (specialising in electronics within the COMECON[74]) (Very) High human development level EU member (since 2007)
Romania	1. 2. 3.	Industrialisation during the socialist period (specialising in mining and transportation machine within the COMECON) (Very) High human development level EU member (since 2007)
Poland	1. 2. 3.	Industrialisation during the socialist period (specialising in shipbuilding and construction machine within the COMECON) High-Income Economy by the World Bank (Very) High human development level

[74] COMECON refers to the Council for Mutual Economic Assistance led by the Soviet Union from 1949 to 1991.

	4. EU member (since 2004)
Croatia	1. The second richest republic (second to Slovenia and much more advanced than other republics) in the former Socialist Federal Republic of Yugoslavia 2. Industrialisation during the socialist period 3. High-Income Economy by the World Bank 4. (Very) High human development level 5. EU member (since 2013) 6. Slovenia, a country similar to Croatia, is classified under Industrialised Economies by UNIDO.
Traditional European Market Economies	
Greece	1. Traditional market economy 2. Traditional EU member 3. High-Income Economy by the World Bank 4. (Very) High human development level 5. Advanced Country by the IMF
Cyprus	1. Traditional market economy 2. EU member (since 2004) 3. High-Income Economy by the World Bank 4. (Very) High human development level 5. Advanced Country by the IMF
Advanced Petroleum Exporter	
Brunei Darussalam[75]	1. High-Income Economy by the World Bank (one of the richest countries in the world) 2. Very high human development level

Source: Author's own elaboration

Table A3 compares Human Development Index (HDI) of the reduced group of EIEs (after excluding the above thirteen countries) and the thirteen countries, which have been moved away from EIEs to IEs. Except for Belarus, Ukraine, Bulgaria, and Romania, the other nine countries' HDI values are all much higher than the highest HDI level in the reduced group of EIEs. Belarus, Ukraine, Bulgaria, and Romania have HDI comparable to the highest level in the reduced group of EIEs. That is to

[75] Besides Brunei Darussalam, Saudi Arabia and Oman are the other two petroleum exporters with high income level and high human development index in the original group of EIEs. However, due to their special socio-economic structure, Saudi Arabia and Oman cannot be moved from EIEs to IEs.

say, the thirteen countries (to a lesser degree for Belarus, Ukraine, Bulgaria, and Romania), which are proposed to be upgraded from EIEs to IEs, have higher human development level than other EIEs countries.

Table A3. HDI of the modified group of EIEs and removed EIEs countries

HDI	1980	1985	1990	1995	2000	2005	2010	2014
Reduced EIEs								
Max*	0.63	0.63	0.69	0.68	0.7	0.75	0.77	0.79
Southern Cone								
Argentina	0.68	0.69	0.71	0.73	0.76	0.78	0.81	0.84
Chile	0.64	0.65	0.7	0.72	0.75	0.79	0.81	0.83
Uruguay	0.66	0.67	0.69	0.71	0.74	0.76	0.78	0.79
Ex-Soviet Rep.								
Belarus					0.68	0.72	0.79	0.8
Ukraine			0.71	0.66	0.67	0.71	0.73	0.75
Latvia	0.71	0.74	0.76	0.77	0.8	0.85	0.87	0.87
Ex-Socialist Countries								
Bulgaria	0.67	0.69	0.7	0.7	0.71	0.75	0.77	0.78
Romania			0.7	0.69	0.71	0.75	0.79	0.79
Poland	0.69	0.7	0.71	0.74	0.79	0.81	0.83	0.84
Croatia			0.67	0.69	0.75	0.78	0.81	0.82
Traditional Market Economies								
Cyprus	0.67	0.7	0.73	0.78	0.8	0.83	0.85	0.85
Greece			0.69	0.67	0.73	0.81	0.81	0.82
Petroleum Exporter								
Brunei Darussalam		0.76	0.78	0.81	0.82	0.84	0.84	0.86

Source: Author's elaboration based on the United Nations HDI database
*Max refers to the maximum HDI value in the reduced group of EIEs after excluding the thirteen removed countries and Saudi Arabia and Oman, the two special outliers.

This modification also makes the country grouping more consistent with domestic disparity of the Soviet Union and the former Yugoslavia in history. Among the fifteen former Soviet Republics, Russian Federation, Estonia, and Lithuania are originally classified under IEs by UNIDO; Belarus, Ukraine, and Latvia have been moved away from EIEs to IEs; Kazakhstan remains under EIEs due to its weak manufacturing; Moldova, Georgia, Armenia, Azerbaijan, Kyrgyzstan, Uzbekistan, Turkmenistan, and Tajikistan are originally classified under ODEs by UNIDO. Such a classification corresponds to the inter-republic disparity in economic development within the Soviet Union: the rich republics, except for Kazakhstan (EIEs), are classified under IEs, and the poor republics are classified under ODEs. Among the six republics of the former Socialist Federal Republic of Yugoslavia (SFRY), Slovenia is originally classified under IEs by UNIDO; Croatia has been moved away from EIEs to IEs; Serbia remains under EIEs, instead of being moved to IEs, due to its long-term economic downturn and war after independence; Montenegro has been moved away from ODEs to EIEs, because it has similar economic development level with Serbia, and because Montenegro and Serbia had always constituted a unified country from the dissolution of the former SFRY until 2006; Macedonia is originally classified under EIEs by UNIDO; Bosnia and Herzegovina is classified under ODEs by UNIDO. Similar to the case of Soviet Republics, this re-classification also accords with the inter-republic disparity of the former Socialist Federal Republic of Yugoslavia. The richest republics (Slovenia and Croatia) are classified under IEs; the poorest republic (Bosnia and Herzegovina) is classified under ODEs; and republics in the middle (Serbia, Montenegro, and Macedonia) are classified under EIEs. A final note is given to the group of petroleum exporting countries. Besides Brunei Darussalam, Saudi Arabia and Oman are the other two petroleum exporters with high income level and high human development index in the original group of EIEs. However, due to their special socio-economic structure, Saudi Arabia and Oman cannot be moved to IEs.

To sum up, thirteen countries have been moved away from EIEs to IEs and one country (Montenegro) has been moved to EIEs from ODEs. Additionally, Angola, Cape Verde, Equatorial Guinea, and Maldives are moved away from ODEs to LDCs. Angola and Equatorial Guinea have always been on the list of the United Nations LDCs, but they are classified under ODEs in the UNIDO system. Cape Verde and Maldives just graduated from the LDCs list in the recent ten years, and thus it is better to still classify them under LDCs, considering that the time span of this thesis ranges from 1995 to 2014.

A.3. UNIDO Country Grouping in a Comparison

This section compares country grouping systems by UNDP, the World Bank, the IMF, UNCTAD, and UNIDO. The World Bank country grouping is established on a single measurement of GNI per capita and serves as a guidance for a country's accession to the World Bank's lending and preferential treatment (i.e., IDB eligibility and civil works preference). The IMF country grouping is based on three indicators: income level, export diversification, and financial market. The UNDP grouping is based on UNDP's Human Development Index (HDI). UNCTAD does not provide explanations for its taxonomy. It differs from other groupings in that Transition Economies are singled out as a separate group, which is a common practice in international trade statistics.

Table A4 compares the development taxonomies by UNCTAD, the World Bank, the IMF, UNDP, and UNIDO. Although different country grouping systems use different terminologies, each grouping system's sub-groups tend to have counterparts in other grouping systems. All the five country grouping systems divide the world into a developed part and a developing part, and they, except the IMF system, further divide the developing world into upper, medium, and lower parts. The upper part of the developing world basically corresponds to the Emerging South/Emerging Countries in this thesis, and the medium and lower part corresponds to the Developing South/Developing Countries. Thus, despite different conceptual bases, international agencies have relatively comparable development taxonomies. Table A5 lists countries by group in the five grouping systems. The last column gives the modified UNIDO grouping with red underlined names referring to countries that are different from the original UNIDO grouping. Because the IMF country grouping is a dichotomous taxonomy by simply dividing the world into Advanced Economies and Emerging and Developing Economies without sub-groups, Table A5 only lists Advanced Economies in the IMF column.

Table A4. A comparison of various development taxonomies

Division / Grouping Method	North	South		
		Emerging South	Developing South	
UNCTAD*	*Developed Economies*	*High-Income Developing Economies*	*Middle-Income Developing Economies*	*Low-Income Developing Economies*
World Bank	*High-Income Economies*	*Upper-Middle-Income Economies*	*Lower-Middle-Income Economies*	*Low-Income Economies*
IMF	*Advanced Economies*	*Emerging and Developing Economies (without further division)*		
UNDP	*Very High HDI Countries*	*High HDI Countries*	*Medium HDI Countries*	*Low HDI Countries*
UNIDO	*Industrialised Economies*	*Emerging Industrial Economies*	*Other Developing Economies*	*Least Developed Countries*

Source: Author's Own Elaboration

* The UNCTAD group of Transition Economies cannot be classified under the North or the South because it is by definition too heterogeneous.

Table A5. List of countries in various grouping systems

UNCTAD	World Bank	IMF	UNDP	UNIDO	Modified UNIDO*
Developed Economies	***High-Income Economies***	***Advanced Countries***	***Very High Human Development Countries***	***Industrialised Economies***	***Industrialised Economies***
Andorra	Andorra	Australia	Andorra	Andorra	Andorra
Australia	Antigua and Barbuda	Austria	Argentina	Aruba	Argentina
Austria	Aruba	Belgium	Australia	Australia	Aruba
Belgium	Australia	Canada	Austria	Austria	Australia
Bermuda	Austria	China, Hong Kong	Bahrain	Bahrain	Austria
Bulgaria	Bahamas	China, Macao	Belgium	Belgium	Bahrain
Canada	Bahrain	China, Taiwan	Brunei Darussalam	Bermuda	Belarus
Croatia	Barbados	Cyprus	Canada	British Virgin Islands	Belgium
Cyprus	Belgium	Czech Republic	Chile	Canada	Bermuda
Czech Republic	Bermuda	Denmark	China, Hong Kong	Cayman Islands	British Virgin Islands
Denmark	British Virgin Islands	Estonia	Croatia	China, Hong Kong	Brunei Darussalam
Estonia	Brunei Darussalam	Finland	Cuba	China, Macao	Bulgaria

Faeroe Islands	Canada	France	Cyprus	China, Taiwan	Canada
Finland	Cayman Islands	Germany	Czech Republic	Czech Republic	Cayman Islands
France	Chile	Greece	Denmark	Denmark	Chile
Germany	China, Hong Kong	Iceland	Estonia	Estonia	China, Hong Kong
Gibraltar	China, Macao	Ireland	Finland	Finland	China, Macao
Greece	Croatia	Israel	France	France	China, Taiwan
Greenland	Curaçao	Italy	Germany	French Polynesia	Croatia
Hungary	Cyprus	Japan	Greece	Germany	Cyprus
Iceland	Czech Republic	Korea, Republic of	Hungary	Greenland	Czech Republic
Ireland	Denmark	Latvia	Iceland	Hungary	Denmark
Israel	Estonia	Lithuania	Ireland	Iceland	Estonia
Italy	Faeroe Islands	Luxembourg	Israel	Ireland	Finland
Japan	Finland	Malta	Italy	Israel	France
Latvia	France	Netherlands	Japan	Italy	French Polynesia
Lithuania	French Polynesia	New Zealand	Korea, Republic of	Japan	Germany
Luxembourg	Germany	Norway	Kuwait	Korea, Republic of	Greece
Malta	Gibraltar	Portugal	Latvia	Kuwait	Greenland
Netherlands	Greece	Puerto Rico	Liechtenstein	Lithuania	Hungary
New Zealand	Greenland	San Marino	Lithuania	Luxembourg	Iceland
Norway	Guam	Singapore	Luxembourg	Malaysia	Ireland
Poland	Hungary	Slovak Republic	Malta	Malta	Israel
Portugal	Iceland	Slovenia	Netherlands	Netherlands	Italy
Romania	Ireland	Spain	New Zealand	New Caledonia	Japan
San Marino	Israel	Sweden	Norway	New Zealand	Korea, Republic of
Slovakia	Italy	Switzerland	Poland	Norway	Kuwait
Slovenia	Japan	United Kingdom	Portugal	Portugal	Latvia
Spain	Korea, Republic of	United States	Qatar	Qatar	Lithuania
Sweden	Kuwait		Saudi Arabia	Russian Federation	Luxembourg
Switzerland	Latvia		Singapore	San Marino	Malaysia
United Kingdom	Lithuania		Slovakia	Singapore	Malta
United States	Luxembourg		Slovenia	Slovakia	Netherlands
	Malta		Spain	Slovenia	New Caledonia
	Nauru		Sweden	Spain	New Zealand
	Netherlands		Switzerland	Sweden	Norway
	Netherlands Antilles		United Arab Emirates	Switzerland	Poland
	New Caledonia		United Kingdom	United Arab Emirates	Portugal
	New Zealand		United States	United Kingdom	Qatar
	Norway			United States	Romania
	Oman				Russian Federation

	Poland				San Marino
	Portugal				Singapore
	Qatar				Slovakia
	Saint Kitts and Nevis				Slovenia
	San Marino				Spain
	Saudi Arabia				Sweden
	Seychelles				Switzerland
	Singapore				Ukraine
	Sint Maarten				United Arab Emirates
	Slovakia				United Kingdom
	Slovenia				United States
	Spain				Uruguay
	Sweden				
	Switzerland				
	Trinidad and Tobago				
	Turks and Caicos Islands				
	United Arab Emirates				
	United Kingdom				
	United States				
	Uruguay				

High-Income Developing Economies	***Upper-Middle-Income Economies***	***Emerging and Developing Countries (not listed here)***	***High Human Development Country***	***Emerging Industrial Economies***	***Emerging Industrial Economies***
Algeria	Albania		Albania	Argentina	Brazil
American Samoa	Algeria		Algeria	Belarus	Colombia
Angola	American Samoa		Antigua and Barbuda	Brazil	Costa Rica
Anguilla	Angola		Armenia	Brunei Darussalam	India
Antigua and Barbuda	Argentina		Azerbaijan	Bulgaria	Indonesia
Argentina	Azerbaijan		Bahamas	Chile	Kazakhstan
Aruba	Belarus		Barbados	Colombia	Mauritius
Bahamas	Belize		Belarus	Costa Rica	Mexico
Bahrain	Bosnia and Herzegovina		Belize	Croatia	Oman
Barbados	Botswana		Bosnia and Herzegovina	Cyprus	Saudi Arabia
Bonaire	Brazil		Brazil	Greece	Serbia
Botswana	Bulgaria		Bulgaria	India	South Africa
Brazil	China		China	Indonesia	Suriname
British Virgin Islands	Colombia		Colombia	Kazakhstan	Thailand
Brunei Darussalam	Costa Rica		Costa Rica	Latvia	TFYR of Macedonia

Cayman Islands	Cuba	Dominica	Mauritius	Tunisia
Chile	Dominica	Dominican Republic	Mexico	Turkey
China	Dominican Republic	Ecuador	Oman	Venezuela
China, Hong Kong	Ecuador	Fiji	Poland	Montenegro
China, Macao	Equatorial Guinea	Georgia	Romania	
China, Taiwan	Fiji	Grenada	Saudi Arabia	
Colombia	Gabon	Iran	Serbia	
Cook Islands	Georgia	Jamaica	South Africa	
Costa Rica	Grenada	Jordan	Suriname	
Cuba	Guyana	Kazakhstan	Thailand	
Curaçao	Iran	Lebanon	TFYR of Macedonia	
Dominica	Iraq	Libya	Tunisia	
Dominican Republic	Jamaica	Malaysia	Turkey	
Ecuador	Jordan	Mauritius	Ukraine	
Equatorial Guinea	Kazakhstan	Mexico	Uruguay	
Falkland Islands	Lebanon	Montenegro	Venezuela	
French Polynesia	Libya	Oman		
Gabon	Malaysia	Palau		
Grenada	Maldives	Panama		
Guam	Marshall Islands	Peru		
Iran	Mauritius	Romania		
Iraq	Mexico	Russian Federation		
Jamaica	Montenegro	Saint Kitts and Nevis		
Korea, Republic of	Namibia	Saint Lucia		
Kuwait	Palau	Saint Vincent and the Grenadines		
Lebanon	Panama	Serbia		
Libya	Paraguay	Seychelles		
Malaysia	Peru	Sri Lanka		
Maldives	Romania	Suriname		
Mauritius	Russian Federation	Thailand		
Mexico	Saint Lucia	TFYR of Macedonia		
Montserrat	Saint Vincent and the Grenadines	Tonga		
Namibia	Serbia	Trinidad and Tobago		
Nauru	Serbia and Montenegro	Tunisia		
Netherlands Antilles	South Africa	Turkey		
New Caledonia	Suriname	Ukraine		
Niue	Thailand	Uruguay		
Oman	TFYR of Macedonia	Venezuela		
Palau	Turkey			

Panama	Turkmenistan				
Peru	Tuvalu				
Qatar					
Saint Helena					
Saint Kitts and Nevis					
Saint Lucia					
Saint Vincent and the Grenadines					
Saudi Arabia					
Seychelles					
Singapore					
Sint Maarten					
South Africa					
Suriname					
Thailand					
Trinidad and Tobago					
Turkey					
Turks and Caicos Islands					
United Arab Emirates					
Uruguay					
Venezuela					
Middle-Income Developing Economies	***Lower-Middle-Income Economies***		***Medium Human Development Countries***	***Other Developing Economies***	***Other Developing Economies***
Belize	Armenia		Bangladesh	Albania	Albania
Bhutan	Bangladesh		Bhutan	Algeria	Algeria
Bolivia	Bhutan		Bolivia	Angola	Anguilla
Cape Verde	Bolivia		Botswana	Anguilla	Antigua and Barbuda
Cameroon	Cape Verde		Cambodia	Antigua and Barbuda	Armenia
Congo	Cambodia		Cape Verde	Armenia	Azerbaijan
Côte d'Ivoire	Cameroon		Congo	Azerbaijan	Bahamas
Djibouti	Congo		Egypt	Bahamas	Barbados
Egypt	Côte d'Ivoire		El Salvador	Barbados	Belize
El Salvador	Djibouti		Equatorial Guinea	Belize	Bolivia
Fiji	Egypt		Gabon	Bolivia	Bosnia and Herzegovina
Ghana	El Salvador		Ghana	Bosnia and Herzegovina	Botswana
Guatemala	Ghana		Guatemala	Botswana	Cameroon
Guyana	Guatemala		Guyana	Cameroon	Congo
Honduras	Honduras		Honduras	Cape Verde	Cook Islands
India	India		India	Congo	Côte d'Ivoire

Indonesia	Indonesia		Indonesia	Cook Islands	Cuba
Jordan	Kenya		Iraq	Côte d'Ivoire	Dominica
Kiribati	Kiribati		Kiribati	Cuba	Dominican Republic
Lao P.D.R.	Kyrgyzstan		Kyrgyzstan	Dominica	Ecuador
Lesotho	Lao P.D.R.		Lao P.D.R.	Dominican Republic	Egypt
Marshall Islands	Lesotho		Maldives	Ecuador	El Salvador
Mauritania	Mauritania		Micronesia	Egypt	Fiji
Micronesia	Micronesia		Mongolia	El Salvador	Gabon
Mongolia	Mongolia		Morocco	Equatorial Guinea	Georgia
Morocco	Morocco		Namibia	Fiji	Ghana
Myanmar	Myanmar		Nicaragua	Gabon	Grenada
Nicaragua	Nicaragua		Palestine, State of	Georgia	Guadeloupe
Nigeria	Nigeria		Paraguay	Ghana	Guatemala
Pakistan	Pakistan		Philippines	Grenada	Guyana
Papua New Guinea	Papua New Guinea		Republic of Moldova	Guadeloupe	Honduras
Paraguay	Philippines		Samoa	Guatemala	Iran
Philippines	Republic of Moldova		Sao Tome and Principe	Guyana	Iraq
Samoa	Samoa		South Africa	Honduras	Jamaica
Sao Tome and Principe	Sao Tome and Principe		Syrian Arab Republic	Iran	Jordan
Solomon Islands	Solomon Islands		Tajikistan	Iraq	Kenya
South Sudan	Sri Lanka		Timor-Leste	Jamaica	Korea, D.P.R.
Sri Lanka	State of Palestine		Turkmenistan	Jordan	Kyrgyzstan
State of Palestine	Sudan		Uzbekistan	Kenya	Lebanon
Sudan	Swaziland		Vanuatu	Korea, D.P.R.	Libya
Swaziland	Syrian Arab Republic		Vietnam	Kyrgyzstan	Marshall Islands
Syrian Arab Republic	Tajikistan		Zambia	Lebanon	Martinique
Tanzania	Timor-Leste			Libya	Micronesia
Timor-Leste	Tonga			Maldives	Mongolia
Tonga	Tunisia			Marshall Islands	Montserrat
Tunisia	Ukraine			Martinique	Morocco
Tuvalu	Uzbekistan			Micronesia	Namibia
Vanuatu	Vanuatu			Mongolia	Nicaragua
Vietnam	Vietnam			Montenegro	Nigeria
Yemen	Yemen			Montserrat	Pakistan
Zambia	Zambia			Morocco	Palau
				Namibia	Palestine
				Nicaragua	Panama
				Nigeria	Papua New Guinea

				Pakistan	Paraguay
				Palau	Peru
				Palestine	Philippines
				Panama	Republic of Moldova
				Papua New Guinea	Réunion
				Paraguay	Saint Kitts and Nevis
				Peru	Saint Lucia
				Philippines	Saint Vincent and the Grenadines
				Republic of Moldova	Seychelles
				Réunion	Sri Lanka
				Saint Kitts and Nevis	Swaziland
				Saint Lucia	Syrian Arab Republic
				Saint Vincent and the Grenadines	Tajikistan
				Seychelles	Tonga
				Sri Lanka	Trinidad and Tobago
				Swaziland	Turkmenistan
				Syrian Arab Republic	Uzbekistan
				Tajikistan	Vietnam
				Tonga	Zimbabwe
				Trinidad and Tobago	
				Turkmenistan	
				Uzbekistan	
				Vietnam	
				Zimbabwe	
Low-Income Developing Economies	***Low-Income Economies***		***Low Human Development Countries***	***Least Developed Countries***	***Least Developed Countries***
Afghanistan	Afghanistan		Afghanistan	Afghanistan	Afghanistan
Bangladesh	Benin		Angola	Bangladesh	Angola
Benin	Burkina Faso		Benin	Benin	Bangladesh
Burkina Faso	Burundi		Burkina Faso	Bhutan	Benin
Burundi	Central African Rep		Burundi	Burkina Faso	Bhutan
Cambodia	Chad		Cameroon	Burundi Cambodia	Burkina Faso
Central African Rep	Comoros		Central African Republic	Central African Rep	Burundi Cambodia
Chad	Congo, Dem. Rep		Chad	Chad	Cape Verde
Comoros	Eritrea		Comoros	Comoros	Central African Rep
Congo, Dem. Rep	Ethiopia		Congo, Dem. Rep	Congo, Dem. Rep	Chad

Eritrea	Gambia		Côte d'Ivoire	Djibouti	Comoros
Ethiopia	Guinea		Djibouti	Eritrea	Congo, Dem. Rep
Gambia	Guinea-Bissau		Eritrea	Ethiopia	Djibouti
Guinea	Haiti		Ethiopia	Gambia	Equatorial Guinea
Guinea-Bissau	Korea, D.P.R.		Gambia	Guinea	Eritrea
Haiti	Liberia		Guinea	Guinea-Bissau	Ethiopia
Kenya	Madagascar		Guinea-Bissau	Haiti	Gambia
Korea, D.P.R.	Malawi		Haiti	Kiribati	Guinea
Liberia	Mali		Kenya	Lao P.D.R.	Guinea-Bissau
Madagascar	Mozambique		Lesotho	Lesotho	Haiti
Malawi	Nepal		Liberia	Liberia	Kiribati
Mali	Niger		Madagascar	Madagascar	Lao P.D.R.
Mozambique	Rwanda		Malawi	Malawi	Lesotho
Nepal	Senegal		Mali	Mali	Liberia
Niger	Sierra Leone		Mauritania	Mauritania	Madagascar
Rwanda	Somalia		Mozambique	Mozambique	Malawi
Senegal	South Sudan		Myanmar	Myanmar	Maldives
Sierra Leone	Tanzania		Nepal	Nepal	Mali
Somalia	Togo		Niger	Niger	Mauritania
Togo	Uganda		Nigeria	Mozambique	Mozambique
Tokelau	Zimbabwe		Pakistan	Myanmar	Mozambique
Uganda			Papua New Guinea	Nepal	Myanmar
Zimbabwe			Rwanda	Niger	Myanmar
			Senegal	Rwanda	Nepal
			Sierra Leone	Sao Tome and Principe	Nepal
			Solomon Islands	Senegal	Niger
			Sudan	Sierra Leone	Niger
			Swaziland	Solomon Islands	Rwanda
			Tanzania	Somalia	Samoa
			Togo	South Sudan	Sao Tome and Principe
			Uganda	Sudan	Senegal
			Yemen	Samoa	Sierra Leone
			Zimbabwe	Timor-Leste	Solomon Islands
				Togo	Somalia
				Tanzania	South Sudan
				Vanuatu	Sudan
				Yemen	Tanzania
				Zambia	Timor-Leste
					Togo
					Vanuatu
					Yemen

					Zambia
Transition Economies					
Albania					
Armenia					
Azerbaijan					
Belarus					
Bosnia and Herzegovina					
Georgia					
Kazakhstan					
Kyrgyzstan					
Montenegro					
Republic of Moldova					
Russian Federation					
Serbia					
Serbia and Montenegro					
Tajikistan					
TFYR of Macedonia					
Turkmenistan					
Ukraine					
Uzbekistan					

Source: Author's own elaboration.

* Red names stand for countries that are moved to other country group.

Appendix B. Years to be DCS Countries

Table B1. Years to be DCS countries (62 countries)

Country	Years to be DCS 1	Country	Years to be DCS 2
Bangladesh	1	Vietnam	1
Vietnam	1	Bangladesh	1
Philippines	1	Mauritania	1
Papua New Guinea	2	Myanmar	2
Mauritania	2	Papua New Guinea	2
Sri Lanka	2	Sri Lanka	2
Egypt	3	Philippines	3
Bolivia	4	Egypt	4
Myanmar	4	Cambodia	4
Cambodia	4	D. R. Congo	5
Bosnia and Herzegovina	6	Mali	7

D. R. Congo	8
Mozambique	9
Mali	10
Laos	10
Moldova	11
Niger	11
Guinea	12
Sierra Leone	12
Nepal	12
Ethiopia	13
Eritrea	14
Dominican Republic	14
Georgia	15
Uzbekistan	15
Madagascar	15
Central African Rep.	15
Paraguay	16
Rwanda	16
Guinea-Bissau	16
Mongolia	16
Albania	17
Pakistan	18
Liberia	18
Burkina Faso	18
Haiti	19
Armenia	19
Panama	19
Zimbabwe	19
Kyrgyzstan	19
Jamaica	20
Togo	20
Ghana	20
Kenya	20
Benin	20
Burundi	20
Nicaragua	20
Morocco	20
Zambia	20
Lebanon	20
Malawi	20
Senegal	20
Tanzania	20
Cote d'Ivoire	20

Bosnia and Herzegovina	7
Guinea-Bissau	8
Laos	8
Bolivia	9
Mozambique	10
Niger	11
Ethiopia	11
Moldova	11
Central African Rep.	13
Sierra Leone	13
Madagascar	14
Paraguay	14
Dominican Republic	14
Uzbekistan	14
Eritrea	14
Georgia	14
Guinea	14
Burkina Faso	15
Albania	15
Benin	16
Mongolia	17
Nepal	17
Zimbabwe	18
Rwanda	18
Pakistan	18
Kyrgyzstan	19
Armenia	19
Tajikistan	19
Haiti	19
Liberia	19
Panama	19
Jamaica	20
Jordan	20
Togo	20
Honduras	20
Burundi	20
Morocco	20
Peru	20
Zambia	20
Uganda	20
Gambia	20
Tanzania	20
Guatemala	20

Peru	20	Kenya	20
Honduras	20	Malawi	20
Gambia	20	Senegal	20
Jordan	20	Ghana	20
Uganda	20	Nicaragua	20
Guatemala	20	Cote d'Ivoire	20
El Salvador	20	Lebanon	20
Tajikistan	20	El Salvador	20

Source: Author's calculation based on the BACI database.

Table B2. Years to be DCS countries (major exporting countries of mineral fuels)

Country	Years to be DCS 1	Country	Years to be DCS 2
Trinidad and Tobago	0	Trinidad and Tobago	0
Yemen	0	Gabon	0
Algeria	1	Yemen	1
Iraq	2	Iraq	2
Iran	2	Algeria	2
Angola	3	Iran	2
Syria	3	Angola	3
Nigeria	3	Nigeria	3
Azerbaijan	4	Syria	3
Equatorial Guinea	5	Azerbaijan	4
Congo	9	Equatorial Guinea	4
Gabon	9	Turkmenistan	6
Turkmenistan	9	Congo	9
Libya	9	Libya	9
Chad	10	Chad	10
Cameroon	15	Cameroon	15
Ecuador	20	Ecuador	20

Source: Author's calculation based on the BACI database.

Table B3. Years to be DCS countries (small countries)

Country	Years to be DCS 1	Country	Years to be DCS 1
Dominica	4	Solomon Islands	1
Maldives	6	Maldives	3
Solomon Islands	8	Bhutan	6
Seychelles	9	Kiribati	7
Kiribati	10	Seychelles	8
Vanuatu	13	Vanuatu	12
Barbados	13	Dominica	12
Bhutan	14	Djibouti	14

Cape Verde	15	Barbados	14
Belize	16	Cape Verde	15
Guyana	17	Belize	16
Bahamas	17	Bahamas	17
Djibouti	18	Guyana	17
Saint Lucia	18	Saint Lucia	18
Grenada	18	Grenada	18
Samoa	19	Comoros	19
Saint Vincent and the Grenadines	19	Samoa	19
Antigua and Barbuda	19	Antigua and Barbuda	19
Comoros	19	Saint Vincent and the Grenadines	19
Tonga	20	Fiji	20
Fiji	20	Tonga	20
Sao Tome and Principe	20	Sao Tome and Principe	20

Source: Author's calculation based on the BACI database.

Table B4. The Southbound EXPY-Northbound EXPY Difference (62 countries)

Country	S-N EXPY Diff 1	Country	S-N EXPY Diff 2
Myanmar	-2644.1	Papua New Guinea	-2573.1
Papua New Guinea	-2382.5	Bangladesh	-1927
Bangladesh	-1959.1	Myanmar	-1847.7
Mauritania	-1822.1	Sri Lanka	-1564.7
Sri Lanka	-1660.8	Egypt	-1463.2
Vietnam	-1502.5	Vietnam	-1335.9
Egypt	-1248.7	Mauritania	-1298.4
Philippines	-1043.1	D. R. Congo	-1202.8
Niger	-911.4	Laos	-995.9
Cambodia	-815.7	Guinea-Bissau	-833.2
Bolivia	-759.6	Philippines	-829
Laos	-502.8	Niger	-823.2
Bosnia and Herzegovina	-486.3	Cambodia	-814.7
Guinea	-404.6	Mali	-805.9
D. R. Congo	-249.6	Bosnia and Herzegovina	-296.7
Mali	57.1	Bolivia	-126.5
Mozambique	62.9	Ethiopia	-60.6
Moldova	81.6	Moldova	25.9
Ethiopia	199.3	Guinea	201.1
Paraguay	737	Mozambique	242
Sierra Leone	949.1	Paraguay	528.1
Pakistan	999.8	Pakistan	990.7
Madagascar	1131.2	Sierra Leone	1041.4

Dominican Republic	1430.4	Madagascar	1148.2
Morocco	1736.5	Uzbekistan	1324.7
Georgia	1802.5	Dominican Republic	1466.1
Uzbekistan	1880.3	Georgia	1529.3
Lebanon	1982.5	Morocco	1530.2
Central African Rep.	2284.9	Lebanon	1770.7
Haiti	2310.4	Burkina Faso	1822.1
Zambia	2364.6	Central African Rep.	1912.2
Nepal	2370.9	Haiti	2345.9
Burkina Faso	2392.4	Eritrea	2596.3
Liberia	2436.4	Zambia	2691.8
Guinea-Bissau	2483	Uganda	2821.6
Malawi	2601.1	Tajikistan	2856.1
Kyrgyzstan	2746.9	Zimbabwe	2898.1
Tajikistan	2784.6	Malawi	2962.6
Uganda	2843.7	Liberia	2977.3
Eritrea	3121.4	Benin	2980
Armenia	3141.9	Armenia	3108.9
Rwanda	3202.2	Jordan	3175.6
Zimbabwe	3286.5	Kyrgyzstan	3306.7
Albania	3507.8	Albania	3482.5
Panama	3581.7	Tanzania	3786.4
Jordan	3693.8	Peru	3950.1
Peru	3740.1	Nepal	4109.2
Mongolia	3861.8	Jamaica	4276.2
Jamaica	4074.1	Burundi	4324.8
Tanzania	4196.8	Rwanda	4440.9
Burundi	4314.9	Mongolia	4585.4
Kenya	4358.5	Kenya	4624.2
Nicaragua	4548	Nicaragua	4768.2
Ghana	4959	Panama	4774.4
El Salvador	5157.4	Ghana	4996.1
Senegal	5223.8	Senegal	5036.4
Benin	5226.2	Gambia	5147.1
Honduras	5349.7	Cote d'Ivoire	5430.7
Guatemala	5372.9	Honduras	5476.3
Cote d'Ivoire	5564.9	Togo	5586.2
Gambia	5624.9	Guatemala	5716.6
Togo	6364.7	El Salvador	5732.7

Source: Author's calculation based on the BACI database.

Appendix C. Descriptive Statistics

Table C1. Descriptive statistics (62-country panel)

Variables	Obs.	Mean	Std.	Min	Max
S/N Dummy 1	1,240	0.72	0.45	0	1
S/N Dummy 2	1,240	0.71	0.45	0	1
S-N Difference 1 (ln)	1,240	0.22	0.4	-1.27	2.01
S-N Difference 2 (ln)	1,240	0.21	0.4	-2.08	1.69
Total GDP (ln)	1,240	22.79	1.28	18.58	25.83
Overall Export Sophistication (ln)	1,240	9.04	0.34	7.55	9.78
FDI Inflow p.c. (ln)	1,204	2.82	1.7	-4.62	6.86
Resource Rents (% of GDP)	1,206	9.95	11.56	0	92.02
Distance to North 1 (ln)	1,240	8.95	0.2	8.53	9.39
Distance to North 2 (ln)	1,240	8.95	0.21	8.47	9.38
Distance to South (ln)	1,240	8.94	0.18	8.75	9.44
GDP p.c. Growth Rate (North 1)	1,240	0.02	0.01	-0.03	0.03
GDP p.c. Growth Rate (North 2)	1,240	0.02	0.02	-0.04	0.04
GDP p.c. Growth Rate (South)	1,240	0.03	0.01	0.01	0.05

Source: Author's elaboration.

Chapter 5. Recent Trends of Developing Countries' Terms of Trade under the New Global Economic Hierarchy

5.1. Introduction

The Prebisch-Singer hypothesis (Prebisch, 1950; Singer, 1950) on the long-term decline in the relative prices of primary commodities may be the most debated topic in development economics (Sarkar, 2001). Sapsford, Sarkar, and Singer (1992) even argue that almost all development economists have written on the Prebisch-Singer hypothesis[76]. Although it has been examined more extensively than any other hypotheses in development economics, the Prebisch-Singer hypothesis remains contentious (Cuddington, 1992; Cashin and McDermott, 2002). In particular, in the 1980s and the early 1990s, the Prebisch-Singer hypothesis evoked intensive debates in terms of statistical methodology. Around one-third of empirical examinations find evidence in support of the secular deterioration in primary commodity prices and one-fourth reject it (Zanias, 2005). As argued by Sarkar (2001), the Prebisch-Singer hypothesis has still been widely seen as "a reality" rather than "a myth"[77].

As manufactures have accounted for increasing share in many developing countries' export basket over the recent decades, the focus of terms of trade research has been shifted from commodity terms of trade of primary commodities *vis-à-vis*

[76] It must be noted that since the paradigm shift in development economics in the 1980s, the research focus has been mostly shifted to micro-level issues, such as health, nutrition, education, migration, aids, and policy evaluation. Macro-level issues (e.g., terms of trade) have been somewhat marginalised in the mainstream development economics. Thus, the argument by Sapsford *et al*. (1992) holds true for development economists until the 1980s or at latest the 1990s.

[77] An extended version of the Prebisch-Singer hypothesis is termed as the Prebisch-Singer thesis. The Prebisch-Singer hypothesis concerns the statistical behaviour of terms of trade of primary commodities or developing countries, while the Prebisch-Singer thesis is concerned with the relationship of the behaviour of terms of trade with growth and development through the role of export as a source of a country's capacity to import capital goods, which are of essential importance for development (Ziesemer, 2010). Actually, it does not make much sense to practically distinguish between the Prebisch-Singer hypothesis and the Prebisch-Singer thesis, because studies that statistically examine the behaviour of terms of trade can hardly avoid involving the underlying developmental implications.

manufactures to country terms of trade of developing countries *vis-à-vis* developed countries (Singer, 1958; Singer, 1975a; Sarkar and Singer, 1991). This seemingly favourable change in export composition, however, fails to reverse or mitigate the unequal exchange encountering developing countries, because the relevance has been shifted from the distribution of gains between primary commodity producers and manufacturers to that between non-innovation-intensive producers and innovation-intensive producers or between producers of low-income economy goods and producers of high-income economy goods (Kaplinsky, 2006). In the post-war global market, developed countries almost exclusively capture the Schumpeterian rents from innovation-intensive manufactures, and developing countries as producers of standardised manufactures are excluded from such opportunities (Singer, 1975a; Sarkar and Singer, 1991; Singer, 1998). Just as argued by Emmanuel (1969), what matters is not the deterioration in terms of trade of products, but that of countries. In other words, which hierarchy a country belongs to (e.g., the North or the South) is more important than what it exports (e.g., primary commodities or manufactures).

Since the 1990s, the global economic hierarchy has witnessed major changes. Some previous developing countries have formed a new group between developed and developing countries, namely, emerging countries, such as China and South Africa[78]. Accordingly, the traditional dichotomous global hierarchy of developed countries and developing countries has been replaced by a trichotomous hierarchy. Although the majority of developing countries' exports still go to developed countries, emerging countries, particularly China, have become growingly important trade partners for developing countries. Moreover, Chapter 2 shows the contrast in composition between developing countries' exports to emerging countries and to developed countries. While the former is dominated by mineral fuels and reflects

[78] Those more advanced ex-developing countries, such as the first-generation NICs (the Asian Tigers), have already transformed into developed countries.

the pattern considered by the original Prebisch-Singer hypothesis, the latter has a significant share of manufactures and reflects the pattern concerned by the revisited Prebisch-Singer hypothesis. This contrast has significant implication for developing countries' terms of trade, because export composition, especially the shift towards a manufacture-dominant export basket, largely affects a country's terms of trade (Bidarkota and Crucini, 2000).

Nguyen (1981) suggests that terms of trade studies should consider changes in the composition of country groups over time. The new global economic hierarchy, especially the rise of emerging countries, urges the updates of research on the Prebisch-Singer hypothesis, which is based on the dichotomous vision on country grouping. Considering this research gap, this chapter aims to examine the trends of terms of trade of various groups of developing countries *vis-à-vis* developed countries, China, and other emerging countries[79] from 1995 to 2014. It serves as an examination on the Prebisch-Singer hypothesis under the new global economic hierarchy and provides the latest empirical evidence. Such exploration will reveal the distribution of gains from trade under the new global economic hierarchy.

As another highlight, this chapter concerns the distinct behaviours of terms of trade of developing countries with distinct export specialisation (i.e., those specialising in agricultural products, in manufactures, non-fuel minerals, and mineral fuels). In the current global market, different groups of products follow different demand-destination nexuses. Emerging countries' resource-intensive modernisation has driven the current commodity boom, especially in minerals and fuels (Radetzki, 2006; Jerrett and Cuddington, 2008; Farooki, 2009; Erdem and Ünalmış, 2016). However, developing countries specialising in other primary commodities may not benefit from the commodity boom. Although common macroeconomic factors (e.g.,

[79] China is singled out from the group of emerging countries and is examined separately in the following empirical analyses, but, for the sake of convenience, China is included in the group of emerging countries in the general discussion of Section 4.1.

the expansion of major economies) may drive the supply and demand for a wide range of unrelated primary commodities (Pindyck and Rotemberg, 1987), Erten and Ocampo (2013) find that the recent rise in prices of some agricultural products is limited and is largely a reverse of the previous downward trend.

The influence of the commodity boom on developing countries' terms of trade may be either strengthened or mitigated by cheap manufactures from emerging countries. As China and some other emerging countries with rich labour reserve enter the global market, the global competition in labour-intensive and low skill-intensive manufactures has become tougher and manufacture prices have turned down. As argued by Kaplinsky (2006), the commodity boom along with the entry of cheap manufactures from China may reverse the long-term decline in the relative prices of some commodities. Accordingly, developing countries exporting "hard commodities" (e.g., fuels and minerals) are more likely to benefit from China's entry into the global market in terms of both the demand and the supply side, while those specialising in agricultural products ("soft commodities") may tend to gain less, if any. For developing countries that specialise in manufactures, the trends of terms of trade may even experience deterioration.

Time series analyses show significant differences between developing countries' net barter terms of trade (henceforth, NBTOT) *vis-à-vis* developed countries and *vis-à-vis* China and other emerging countries on the one hand, and differences between the behaviours of NBTOT of different groups of developing countries on the other. Developing countries tend to have positive trends of NBTOT *vis-à-vis* developed countries, especially those specialising in fuels or minerals. This trend may be jointly explained by the increasing importance of manufactures in developing countries' exports to developed countries, developed countries' demand for a wide range of primary commodities from developing countries, and the commodity boom of fuels and minerals led by emerging countries, especially China.

However, it should be noted that the improvement in developing countries' NBTOT *vis-à-vis* developed countries may not be seen as a rejection to the Prebisch-Singer hypothesis. The very core of the Prebisch-Singer hypothesis, despite always being neglected, is actually the behaviour of double factoral terms of trade rather than net barter terms of trade. It is the factoral terms of trade that ultimately determines whether a country is at an advantageous position in the bilateral trade relationship. Singer (1991) argues that the gap in manufacturing productivity between developed and developing countries, especially those poorest ones, has been increasing. Data on total factor productivity (TFP) shows that the gap in productivity and technology between developed and developing countries is great and has persisted over the recent two decades[80][81]. If this persistent North-South gap in productivity and technology is taken into account, then the improvement in developing countries' NBTOT *vis-à-vis* developed countries may not deliver a positive outcome in real terms.

On the other hand, developing countries' NBTOT *vis-à-vis* China tends to show negative trend or to be trendless, except those specialising in fuels. In particular, developing countries specialising in manufactures have experienced the greatest deterioration. This finding indicates these countries' disadvantageous position in the trade relationship with China, perhaps because they have to directly compete with China in manufactures and tend not to benefit from China's commodity boom. More generally speaking, because China's demand for primary commodities concentrates in fuels and minerals, developing countries that do not specialise in these "hard

[80] Figure A1 and A2 in Appendix A show the trends of TFP for developed countries, emerging countries, China, and various groups of developing countries between 1995 and 2010. Due to unavailability of data on the productivity of exporting sectors in developing countries, double factoral terms of trade cannot be calculated. However, the rough picture from TFP trends should provide sufficient information. Data on TFP are from the UNIDO database, which are available until 2010.

[81] It should be noted that TFP emphasises the technological and organisational aspect of productivity, and does not reflect the capital and labour aspect of productivity and does not take into account the efficiency of the utilisation of resource and employment issues.

commodities" tend not to benefit from their trade with China in relative terms. This is actually also the case on a global scale, instead of only in developing countries' trade relationship with China. Developing countries specialising in fuels or minerals are at a relatively favourable position in the global economy in terms of terms of trade, whereas those specialising in agricultural products or manufactures are at a less favourable or even unfavourable position. The trend of developing countries' NBTOT *vis-à-vis* other emerging countries lies between that *vis-à-vis* developed countries and *vis-à-vis* China.

Despite unfavourable trends of net barter terms of trade, all groups of developing countries have experienced significant improvement in their income terms of trade *vis-à-vis* the rest of the world, regardless of developed countries, China or other emerging countries. In particular, the improvement in income terms of trade *vis-à-vis* China is the greatest. This improvement is due to great growth in export volume, indicating developing countries' absolute gains from trade, in spite of perhaps loss in relative gains from trade. However, the rest of the world has comparable improvement in their income terms of trade *vis-à-vis* developing countries. Therefore, despite the favourable income terms of trade facing developing countries, the condition for global (North-South) convergence does not hold. As a consequence, developing countries have to mobilise more resources to maintain the favourable income terms of trade, which impedes their domestic consumption and investment, and the unequal global exchange has remained. In particular, this global inequality is further magnified by the persistent North-South gap in productivity and technology and by developing countries' high population growth. Since the global inequality is rooted in the competitive nature of the markets for primary commodities and simple manufactures and the oligopolistic nature of the markets for sophisticated manufactures, the findings are in line with the Prebisch-Singer hypothesis.

This chapter is organised as follows. Section 5.2 reviews the Prebisch-Singer hypothesis and thesis, their evolution and criticism, and previous empirical studies. Section 5.3 discusses the impact of the new global economic hierarchy on developing countries' terms of trade. Section 5.4 firstly introduces data and provides descriptive analyses on developing countries' terms of trade by country group from 1995 to 2014, and then presents empirical strategy for the time series analysis on developing countries' terms of trade and gives the results. Section 5.5 concludes this chapter.

5.2. The Prebisch-Singer Hypothesis: Theory and Criticism

5.2.1. The Prebisch-Singer Hypothesis and Its Underlying Mechanism

Classical economists from Adam Smith to Maynard Keynes argue that prices of agricultural products relative to those of industrial products tend to increase in the long run. That is to say, a positive trend of terms of trade for primary commodities *vis-à-vis* manufactures should be observed. The rationale underlying this argument falls in the law of diminishing returns to land and other natural resources and the law of increasing returns in industrial sectors. In the late 1940s and the early 1950s, however, Raúl Prebisch and Hans Singer respectively found a declining trend in prices of primary commodities relative to prices of manufactures based on the British terms of trade data in the nineteenth century recorded in two UN reports in 1949 (Sarkar, 2001). They argued that the declining relative prices of primary commodities imply a secular deterioration of developing countries' net barter terms of trade *vis-à-vis* developed countries. This is the Prebisch-Singer hypothesis.

The Prebisch-Singer hypothesis can be explained by several factors. First, the income elasticity of demand for primary commodities is lower than that for manufactures. Engel's law suggests that the share of income that is spent on food decreases in income level, and the demand for food is relatively rigid. In other words, income growth moves outwards the demand curve of primary commodities to a lesser extent in comparison to the movement of the demand curve of manufactures (Grilli and Yang, 1988). Moreover, some primary commodities have been gradually replaced by synthetic materials (e.g., natural rubber versus synthetic rubber). This reduces the demand for primary commodities by industrial sectors and then reduces wage in exporting countries of these primary commodities, which is one of the reasons for why technological progress tends to benefit developed countries by increasing profits but hurt developing countries by reducing wages (Singer, 1950). In contrast to primary commodities, the demand for manufactures tends to increase in income and to be more flexible. However, it should be noted that fuels and metals are exceptional primary commodities, because the demand for them is positively associated with industrialisation and income.

Second, in the Prebisch-Singer hypothesis, primary commodities are assumed to be traded in a competitive market and the prices are competitively determined, while manufactures are assumed to be traded in an oligopolistic market and the prices are determined by mark-up over costs and the bargaining between employers and employees under the strong presence of trade union (Thirlwall and Bergevin, 1985; Grilli and Yang, 1988). This is the structural difference between primary commodity production and manufacturing production (Bloch and Sapsford, 2000). In this regard, while manufacturers benefit from technological progress in the form of higher price and wage, technological progress and productivity growth in primary commodity sectors generate downward pressure on prices and the benefits mostly accrue to consumers in developed countries rather than to producers in developing countries. This can be demonstrated by a larger (productivity growth-driven) outward movement of the supply curve of primary commodities than that of manufactures on the supply-demand graph (Grilli and Yang, 1988).

A third explanation arises as a response to the new scenario that many developing countries have become exporters of manufactures. Despite the awareness of country terms of trade between developing and developed countries, unavailability of country-level trade data constrained Raúl Prebisch and Hans Singer to use commodity terms of trade of primary commodities *vis-à-vis* manufactures as a proxy for the country terms of trade of developing countries *vis-à-vis* developed countries. Alternatively, developing countries' country terms of trade can be inferred from country terms of trade of developed countries (Grilli and Yang, 1988). Prior to the 1950s, primary commodities dominated the export basket of developing countries, and thus such proxy basically held water. However, because industrialisation was in operation in many developing countries, manufactures have increased their share in developing countries' exports. As a result, the correlation between commodity terms of trade of primary commodities *vis-à-vis* manufactures and country terms of trade of developing countries *vis-à-vis* developed countries has become weaker, and only part of the movement of commodity terms of trade of primary commodities translates into the movement of developing countries' country terms of trade (Bleaney and Greenaway, 1993; Lutz, 2009). Therefore, the spotlight has been shifted to country terms of trade between developing and developed countries (Singer, 1975b; Sarkar, 1986; Grilli and Yang, 1988; Sarkar and Singer, 1991; Bleaney and Greenaway, 1993). As a response to the change in developing countries' export composition, Singer (1975a and 1998) revisits the conceptual basis of the Prebisch-Singer hypothesis by introducing the concept of Schumpeterian creative destruction. Schumpeterian rents disappear as a product passes its life cycle from an innovative product to a standardised product. Innovative activities, which generate Schumpeterian rents, concentrate in developed countries, whereas developing countries, in spite of their recent industrialisation achievement, only export standardised products with exhausted rents. In this regard, the unequal distribution of gains accruing to developing countries as primary commodity producers and to developed countries as manufacturers, which underlies the classical Prebisch-Singer hypothesis, has been re-conceptualised as the unequal distribution of gains accruing to developing countries as standardised manufacturers and to developed countries as innovative manufacturers. In other words, developing countries' deteriorating terms of trade *vis-à-vis* developed countries reflects the unequal distribution of Schumpeterian rents between standardised manufacturers in the periphery and innovative manufacturers in the centre.

The secular deterioration in both commodity terms of trade and country terms of trade facing developing countries has two important policy implications: de-linking with the free-trade world market and/or transforming into manufacturing. Myrdal (1956), following Raúl Prebisch and Hans Singer, discusses the unfavourable commodity prices facing developing countries and the unequal world market system. This line of discussion generated the Prebisch-Singer-Myrdal thesis of inward-looking industrialisation, which acted as the theoretical grounding of import substitution industrialisation (ISI) and economic nationalism in the Third World from the 1950s to the 1970s (Sapsford *et al*., 1992)[82]. The Prebisch-Singer thesis is also the origin of the Latin American structuralist economics, which attributes inequality and backwardness to the unequal structure of the global economy. Moreover, the Prebisch-Singer thesis inspired neo-Marxist theories of underdevelopment, such as dependency theory (represented by Andre Gunder Frank), world-system theory (represented by Emmanuel Wallerstein and Samir Amin), and unequal exchange theory (represented by Arghiri Emmanuel).

[82] It should be borne in mind that the failure of the ISI model in Latin America is largely due to problematic interpretation and implementation rather than the model *per se*. The original proposal of the United Nations Economic Commission for Latin America and the Caribbean (ECLAC), represented by Raúl Prebisch, was not a complete autarky development path, as misunderstood by many policy makers in Latin America. Instead, they suggested to promote regional integration and upgrade Latin America's position in the global labour division (Toye, 2003; Ocampo and Ros, 2011). Despite criticisms from ECLAC, policy makers did not effectively correct their biased implementation of import substitution industrialisation (Love, 2005).

5.2.2. Two Criticisms of the Prebisch-Singer Hypothesis

An important but often neglected issue is that the very core of the Prebisch-Singer hypothesis lies in the deterioration in double factoral terms of trade (DFTOT)[83] of developing countries rather than simply their net barter terms of trade (Singer, 1991; Sapsford *et al*., 1992; Sarkar, 1994). Actually, as mentioned by Singer (1982 and 1991), the proposition in his work in 1950 does not point to the conclusion that deteriorating net barter terms of trade necessarily implies welfare loss, but that only factoral terms of trade can reflect welfare gain or loss. This is because that decline in net barter terms of trade may be due to improvement in productivity and reduction in production cost (Sarkar, 1986). However, the unavailability of productivity data makes it difficult to directly examine the behaviour of factoral terms of trade (Rostow, 1950). This restriction leads to the use of the trend of net barter terms of trade to infer the behaviour of double factoral terms of trade. However, it is safe and reasonable to argue that productivity growth is slower in developing countries than in developed countries. Thus, developing countries' deteriorating or even just trendless net barter terms of trade indicates a greater deterioration in their double factoral terms of trade (Sarkar and Singer, 1991; Singer, 1991). This is actually in line with the argument of dynamic benefits from industrialisation highlighted in Adam Smith's *The Wealth of Nations* that the greater productivity and technological progress in manufacturing in comparison to primary commodity sector can implicitly turn the favourable net barter terms of trade for primary commodity producers to the unfavourable double factoral terms of trade against them (Singer, 1991; Sapsford *et al*., 1992).

Another criticism of the Prebisch-Singer hypothesis is concerned with the real welfare conclusion of terms of trade, because deterioration in net barter terms of

[83] Double factoral terms of trade (DFTOT) is defined by Jacob Viner as net barter terms of trade multiplied by the ratio of the productivity index of a country's exporting sectors to that of its trade partner's exporting sectors.

trade may be offset by increase in export volume (Imlah, 1950; Baldwin, 1955). Grilli and Yang (1988) suggest to distinguish between the trend of net barter terms of trade and the real income effect of trade. Net barter terms of trade does not take into consideration the volume of a country's exports and thus measures gains from one unit of trade rather than from total trade (Sarkar, 1986). Therefore, some suggest to use income terms of trade (ITOT), which is defined as net barter terms of trade multiplied by export volume index, as a measure of absolute gains from trade or the purchasing power of exports in terms of imports. Erten (2011) envisages three scenarios of the relationship between absolute gains from trade and net barter terms of trade. First, improvement in net barter terms of trade produces gains if the price elasticity of exports is not high enough to generate large downward pressure on export volume. Second, declining net barter terms of trade still produces gains if the increase in export volume does not outnumber the reduction in unit price of exports by a sufficiently large margin. Third, declining net barter terms of trade generates pure losses if the decline in unit price of exports offsets the increase in export volume. The first scenario corresponds to increasing net barter terms of trade and increasing income terms of trade, the second corresponds to decreasing net barter terms of trade but increasing income terms of trade, and the last corresponds to decreasing net barter terms of trade and decreasing income terms of trade.

Opponents of the policy implication of the Prebisch-Singer hypothesis argue that deterioration in net barter terms of trade may generate welfare gains by increasing income terms of trade, because lower export prices lead to higher export volume. Sarkar (2001) makes a response to this criticism. He ascribes the increase in income terms of trade to two factors: reduction in unit price of exports and increase in global income. He argues that increase in export volume tends to be due to increase in global income rather than reduction in unit price. Thus, taking the global income as given, deterioration in unit price of exports implies loss in income terms of trade, in comparison with the situation of unchanged unit price.

Net barter terms of trade of the exporting country and of the importing country moves in opposite directions, which implies that improvement of one country runs at the expense of deterioration of the other. In contrast, income terms of trade may increase in both countries, provided that there is sufficient increase in export volume on both sides. Therefore, net barter terms of trade should be understood as the distribution of relative gains from trade between two trade partners, which determines which country captures more benefits from the bilateral trade. The country that captures more benefits holds a superior position in the bilateral trade relationship. In comparison, income terms of trade should be interpreted as a country's absolute gains from trade, which determines whether both the two countries have any real gains from the bilateral trade. As pointed out by some critics of the Prebisch-Singer hypothesis, improvement in income terms of trade indeed implies real gains from trade, even if net barter terms of trade deteriorates. However, what these critics neglect is that such real gains run under an unequal bilateral exchange relationship at the cost that the disadvantageous country has to export more in exchange for a given level of imports.

5.3. The New Global Economic Hierarchy and Developing Countries' Terms of Trade

The recent two decades have witnessed the transformation of some previous developing countries into a new group of emerging countries, especially China. The rise of emerging countries has at least three major implications for developing countries' terms of trade. First, the high growth rate of trade between emerging and developing countries has made emerging countries an important trade partner for developing countries. This is shown in Table 5.1 for the period of 1995 to 2014. In particular, exports from developing countries, both the UNIDO group of Other Developing Economies (ODEs) and the group of LDCs, to China and exports from

China to developing countries have grown at a disproportionately high rate, which is much higher than the growth rate of bilateral trade between developing and developed countries.

Table 5.1. Bilateral trade between developing countries and the rest of the world*

Exporter \ Importer		**Developed Countries**	**Emerging Countries (excl. China)**	**China**
ODEs	1995	181.9 (352.8)	33.7 (66.4)	3.7 (9.8)
	2014	488.7 (679.1)	172.1 (251.6)	115.1 (216.6)
	Growth Rate	6.5% (5.3%)	10.7% (9.2%)	20.5% (18.7)
LDCs	1995	25.7 (38.3)	5.2 (12.8)	1.2 (3.4)
	2014	83.8 (96.1)	28.1 (66.1)	53.9 (58.4)
	Growth Rate	8.2% (6.7%)	12.1% (10.6%)	22.6% (17.5%)

Source: Author's own calculation based on the UNCTAD database.

* In billions of 2010 constant US Dollars. Import values are shown in brackets, and export values are shown outside of brackets.

Second, the product composition of exports from developing countries to emerging countries significantly differs from that of their exports to developed countries. Table 5.2 compares the composition of developing countries' exports to developed countries, emerging countries (excl. China), and China. Since 1995, manufactures and fuels have increased their shares in both ODEs' and LDCs' exports to developed countries, each of which accounted for approximately 40% in 2014, and the share of non-fuel primary commodities has largely decreased. This phenomenon deviates from the classical North-South trade pattern underlying the original Prebisch-Singer hypothesis, but is in line with the scenario underlying the revisited Prebisch-Singer hypothesis that a shift to a manufacture-dominant export basket has undergone in many developing countries. By contrast, the share of manufactures has always stuck at a low level in developing countries' exports to China and other emerging countries (around 20% and even less than 5% for exports from LDCs to China), whereas the share of fuels has sharply amounted to more than half.

Table 5.2. Composition of ODEs' and LDCs' exports to the rest of the world[84]

Product Category (Percentage)	1995		2014	
Exports to Developed Countries	ODEs	LDCs	ODEs	LDCs
Non-Fuel Primary Commodities	30.3	37.2	18.7	18.2
Fuels	38.0	26.1	42.1	36.4
All Manufactures	28.2	24.9	34.9	40.1
Product Category (Percentage)	1995		2014	
Exports to Emerging Countries	ODEs	LDCs	ODEs	LDCs
Non-Fuel Primary Commodities	32.7	71.3	17.5	24.6
Fuels	42.7	15.0	57.2	53.2
All Manufactures	24.1	13.4	23.3	16.2
Product Category (Percentage)	1995		2014	
Exports to China	ODEs	LDCs	ODEs	LDCs
Non-Fuel Primary Commodities	68.3	26.8	24.8	29.6
Fuels	20.7	64.8	56.0	64.8
All Manufactures	11.0	4.6	19.1	2.5

Source: Author's own calculation based on the UNCTAD database.

The dominance of fuels in developing countries' exports to emerging countries entails the third implication, which is concerned with the commodity boom and the super cycle led by emerging countries, especially China. Commodity boom is defined as a peak of commodity prices within a cycle that is significantly higher than the peak in the previous cycle (Farooki, 2009), and super cycle can be defined as a prolonged (e.g., decades-long) increase in primary commodity prices, which is driven by major economies' expansion (Heap, 2005; Jerrett and Cuddington, 2008; Zellou and Cuddington, 2012a; Zellou and Cuddington, 2012b). A super cycle typically lasts 20 to 70 years, which are equally divided by an upswing and a downswing (Erten and Ocampo, 2013). Emerging countries, especially China, are currently passing through a stage of resource-intensive industrialisation and

[84] Total exports refer to the category of "All Allocated Products (SITC 0 to 8+961+971)" in the UNCTAD database, non-fuel commodities refer to "Primary Commodities, excluding Fuels (SITC 0+1+2+4+68)" in the UNCTAD database, fuels refer to "Fuels (SITC 3)" in the UNCTAD database, and all manufactures refer to "Manufactured Goods (SITC 5 to 8 less 667 and 68)" in the UNCTAD database. The sum of the shares of non-fuel commodities, fuels, and all manufactures in total exports is smaller than 100%, because products of SITC 667 (pearls and precious stones), 961 (coin), and 971 (non-monetary gold) are not covered by the above three product categories but they are included in "All Allocated Goods".

urbanisation, which drives the current super cycle of commodity prices since the middle 1990s and the commodity boom since the early 2000s (Heap, 2005; Cuddington and Jerrett, 2008; Farooki, 2009; Erten and Ocampo, 2013). Fuels and metal minerals are the primary beneficiaries of the boom, but co-movement in commodity prices has spread the benefits to some other primary commodities. This positive trend in commodity prices has been going along with the entry of China and some other emerging countries into the global market as major suppliers of cheap manufactures. As suggested by Kaplinsky (2006), this may reverse the long-term deterioration in terms of trade of some primary commodities. However, developing countries specialising in primary commodities that are not highly demanded by China and other emerging countries, the so-called "soft commodities" (e.g., agricultural products), may not benefit much from the commodity boom. The situation may be even worse for those specialising in manufactures, which directly compete with China. Thus, terms of trade of developing countries as a whole may not make much sense. Instead, disaggregated analysis specifically for each distinct group of developing countries can deliver more useful information.

5.4. Developing Countries' Terms of Trade from 1995 to 2014: A Disaggregated Empirical Analysis

5.4.1. Data and Country Classification

Export data are from the BACI database at the 1992-version Harmonised System (HS 92) 6-digit disaggregation level from 1995 to 2014. Following Chapter 4, this chapter uses the modified 2013 UNIDO country grouping. Developed countries are defined as Industrialised Economies (IEs) in the UNIDO grouping. Emerging countries are defined as Emerging Industrial Economies (EIEs) less China. China is separately listed. Developing countries are defined as Other Developing Economies (ODEs) and Least Developed Countries (LDCs) in the UNIDO grouping. Moreover, developing countries are further divided based on development status and export specialisation, respectively. First, by development status, developing countries are divided into Other Developing Economies (ODEs), which are the richer half of the developing world, and Least Developed Countries (LDCs), which are the poorer half. Second, by export specialisation, developing countries are classified into major exporting countries of agricultural products (AGRIs), major exporting countries of non-fuel minerals (MINEs), major exporting countries of mineral fuels (FUELs), and major exporting countries of manufactures (MANUs). A country is defined as a major exporting country of a particular product category if this product category accounts for at least 40% in this country's total exports (the average of the shares in 1995, 2005, and 2014). Agricultural products are defined as products of SITC 0+1+2+4-27-28 [85]; non-fuel minerals are defined as products of SITC 27+28+667+68+971; mineral fuels are defined as products of SITC 3 [86]; and manufactures are defined as products of SITC 5+6+7+8-667-68. A country may be a major exporter of two product categories. For instance, Moldova is major exporting country of both agricultural products and manufactures. Among the total of 101 developing countries, only five countries do not have any product categories that account for no less than 40% of total exports (i.e., Bolivia[87], Kyrgyzstan, Papua New Guinea, Saint Lucia, and Togo). These five countries are included in empirical analyses with respect to development level, but are excluded in empirical analyses

[85] Agricultural products are defined in a broad-sense way. In addition to conventional agricultural products, this category also includes hide and skin (SITC 21), crude rubber (SITC 23), wood product (SITC 24), pulp (SITC 25), and textile fibre (SITC 26).

[86] The sub-group of SITC 35 under SITC 3 refers to electric current, which is not mineral fuel, but in the database there is no developing country that exports electric current. Thus, the inclusion of SITC 35 in SITC 3 does not distort the result.

[87] Bolivia is an important exporting country of non-fuel minerals, especially trace element minerals (e.g., silver, zinc, bismuth, antimony, and tungsten), and an important exporting country of natural gas. However, the share of mineral fuels in Bolivia's total exports did not outnumber 40% until 2005. In 1995, the share was only 12.3%, and the share was 51.1% in 2014. This is because the major reserve of natural gas in Bolivia had not been discovered until 1997. For another thing, the share of non-fuel minerals in total exports declined from 46.9% in 1995 to 19.5% in 2005. By 2014, the share had rebounded to 30.2%. As a result, the 1995-2014 average of neither the share of mineral fuels nor the share of non-fuel minerals outnumbers the threshold of 40%. Thus, Bolivia is not classified under either major exporting countries of mineral fuels or those of non-fuel minerals.

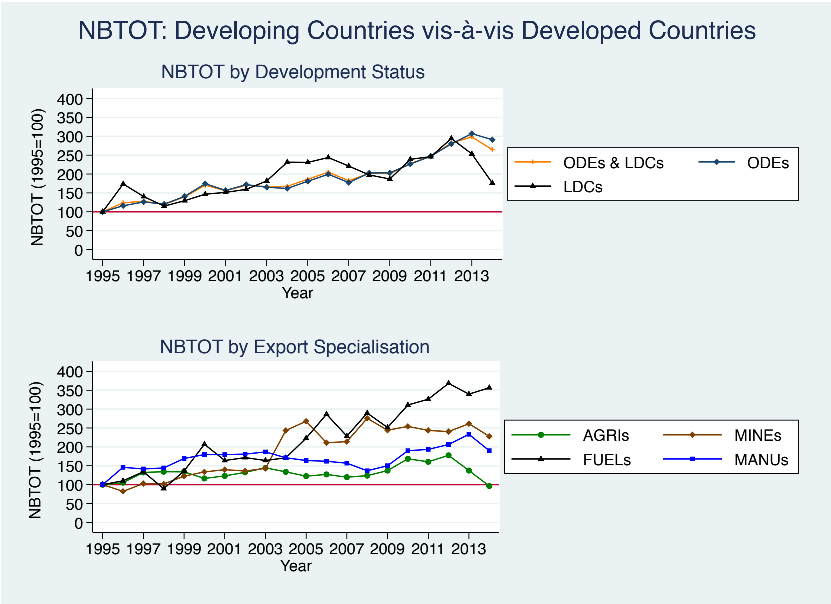
with respect to export specialisation pattern.

5.4.2. Descriptive Evidence

Figure 5.1 shows the evolution of net barter terms of trade (NBTOT) of developing countries *vis-à-vis* developed countries between 1995 and 2014. NBTOT is defined as the ratio of the unit price of a country's exports to the unit price of its imports. The choice of time period has major impact on observed trend of terms of trade (Erten, 2011). Using 1995 as the base year is due to the availability of the HS 6-digit-level BACI database. However, this choice has its empirical relevance, because the current super cycle of commodity prices started in the middle 1990s. For instance, Zellou and Cuddington (2012a) and Erdem and Ünalmış (2016) identify 1996 as the starting year of the super cycle, and Jerrett and Cuddington (2008) suggest that the starting time point of the current super cycle lies between 1995 and 2000. Using 2014 as the ending year, despite the reason of data availability, also has its empirical support. Erdem and Ünalmış (2016) suggest 2014 as the end of the upswing phase of the current super cycle since the middle 1990s.

The upper half of the figure shows NBTOT of developing countries by development status. A visual inspection clearly shows positive trends of NBTOT *vis-à-vis* developed countries for both ODEs and LDCs as well as developing countries as a whole (ODEs+LDCs). All observations lie above the base level in 1995. There is a rough pattern of co-movement in the behaviour of ODEs' and LDCs' NBTOT *vis-à-vis* developed countries, but LDCs' NBTOT shows greater fluctuation. NBTOT does not show peculiar behaviour in the crisis years of 2007 and 2008, except for a temporary reduction for LDCs. The lower half of the figure gives NBTOT of developing countries by export specialisation. FUELs countries (henceforth FUELs) and MINEs countries (henceforth MINEs) show significant upward trends, while AGRIs countries (henceforth AGRIs) and MANUs countries (henceforth MANUs) have rather stable NBTOT. FUELs and MINEs show a peak of NBTOT in 2008 and decline in 2007 and 2009. However, it is hard to make a judgement on whether this is due to the crisis, because similar fluctuation is observed before 2007 as well. AGRIs and MANUs still show positive trends of NBTOT between 2007 and 2009.

Figure 5.1. Developing countries' NBTOT *vis-à-vis* developed countries

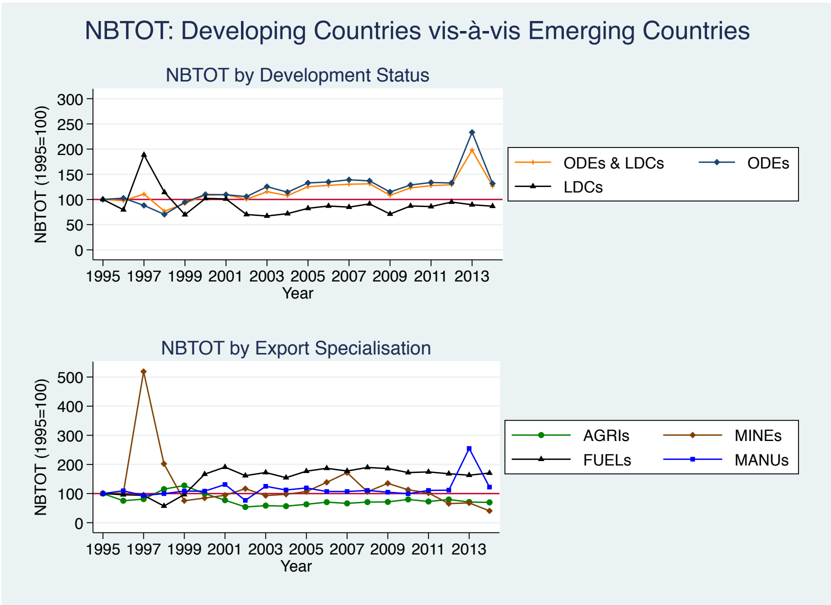


Source: Author's own calculation based on BACI database.

Figure 5.2. presents developing countries' NBTOT *vis-à-vis* emerging countries (excl. China). Unlike the case for their NBTOT *vis-à-vis* developed countries, developing countries' NBTOT *vis-à-vis* emerging countries does not show clear upward trend. Rather, the behaviour of various series of NBTOT is quite invariant. ODEs' NBTOT has always been higher than the 1995 base level since 2000, whereas the opposite is true for LDCs. In terms of export specialisation, MINEs' and MANUs' NBTOT tends to slightly fluctuate surrounding the base level. An outlier value of MINEs' NBTOT is recorded in 1997, which cannot be explained. FUELs' NBTOT shows a jump between 1998 and 2001 and then maintains at a stable level, which may indicate a structural break in intercept. AGRIs' NBTOT experiences a downswing between 1999 and 2002, and then remains at a stable level lower than the 1995 base value. The

impact of the crisis is unclear. If developing countries are classified based on development status, their NBTOT deteriorates between 2008 and 2009 and then rebounds. However, if they are classified based on export specialisation, there is no peculiar behaviour during the crisis period, except the downturn in 2008 for MINEs.

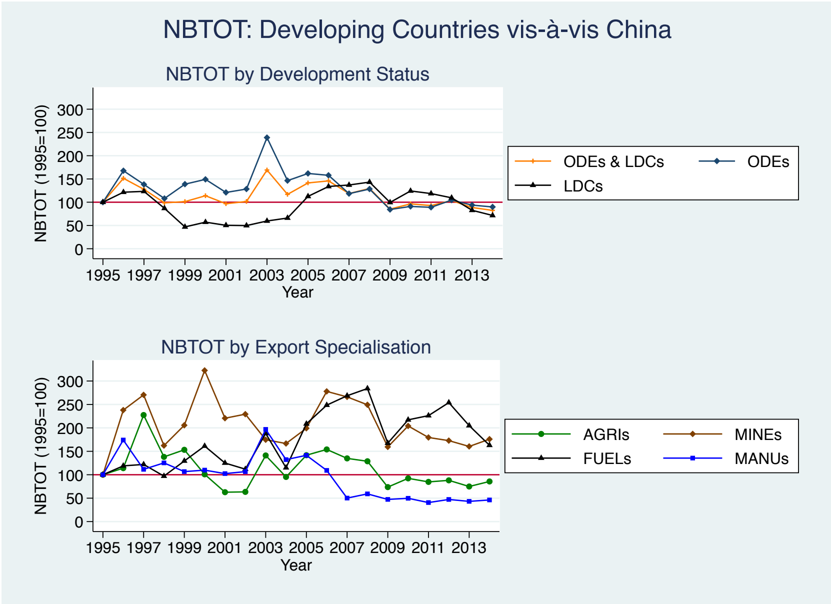
Figure 5.2. Developing countries' NBTOT *vis-à-vis* emerging countries



Source: Author's own calculation based on BACI database.

Figure 5.3 presents developing countries' NBTOT *vis-à-vis* China. Visual inspection fails to detect clear trend for the whole period, but all country groups seem to have negative trends in general after 2005. ODEs' NBTOT diverges from that of LDCs between 1998 and 2007. FUELs and MINEs always have quite high NBTOT in comparison with the base level. AGRIs' and MANUs' NBTOT is much lower than that of FUELs and MINEs. All country groups (to a much lesser extent MANUs) show decline in NBTOT between 2008 and 2009. Then, a rebound occurs immediately. This evidence supports that the recent boom is persistent due to the strong resilience of emerging countries towards the global economic downturn. After the global financial crisis, commodity prices immediately recovered (Erten and Ocampo, 2013).

Figure 5.3. Developing countries' NBTOT *vis-à-vis* China



Source: Author's own calculation based on BACI database.

To sum up, visual inspection shows that only developing countries' NBTOT *vis-à-vis* developed countries shows clear (upward) trend. Their NBTOT *vis-à-vis* emerging countries and China does not show clear improvement. Despite similar performance in NBTOT *vis-à-vis* developed countries, LDCs' NBTOT *vis-à-vis* emerging countries and China performs obviously worse than that of ODEs. This pattern may be explained by the higher commodity dependence and lower diversification of LDCs' export basket. FUELs and MINEs obviously outperform AGRIs and MANUs in NBTOT. This is easy to be understood, because the commodity boom, which is led by emerging countries' industrialisation and urbanisation, benefits "hard commodities" more than "soft commodities" and manufactures. For another thing, AGRIs' and MANUs' NBTOT *vis-à-vis* developed countries outperforms their NBTOT *vis-à-vis* emerging countries and China. Developing countries' agricultural exports to developed countries are much more diverse than their agricultural exports to China. In 2005, developed countries imported 730 varieties of agricultural products from AGRIs at the HS 92 6-digit level, while the number is 598 for emerging countries and even only 203 for China. This contrast in diversification may explain the better performance of AGRIs' NBTOT *vis-à-vis* developed countries than that *vis-à-vis* emerging countries and China. The more favourable trend of MANUs' NBTOT *vis-à-vis* developed countries than that *vis-à-vis* emerging countries and China may be attributed to the much higher share of manufactures in developing countries' exports to developed countries than to emerging countries and China.

5.4.3. Empirical Strategy of Time Series Analysis

Visual inspections in the last section provide preliminary and rough evidence on the behaviour of developing countries' net barter terms of trade *vis-à-vis* different trade partners from 1995 to 2014. Despite the quite short time series of only 20 observations, rigorous time series analysis on the trend of developing countries' terms of trade is still interesting and necessary. Amongst empirical studies on terms of trade, only a few exceptions examine a time period less than 40 years, such as 21 years (1965-1985) in Sarkar and Singer (1991) and 30 years (1970-1999) in Ram (2004). Small time dimension inevitably weakens the robustness and validity of time series analysis and constrains model specifications. This limitation, however, may not be a major problem here, because the aim of this chapter is concerned with the comparison between the behaviours of developing countries' terms of trade *vis-à-vis* different trade partners and the comparison between the behaviours of terms of trade for different groups of developing countries, rather than estimating the exact trend in each individual series of terms of trade.

In the 1980s and the early 1990s, there were extensive statistical examinations on the trend of terms of trade or commodity prices. The classical time series method is to fit a simple log-linear exponential trend equation (i.e., $lny = a + rt + u$) by OLS. This semi-log model is derived from taking natural logarithm with respect to the exponential trend equation $y_t = y_1 exp(rt)$, where y_1 is the terms of trade at the initial time point. It has been a common view that this log-linear trend equation is the best empirical strategy to test the Prebisch-Singer hypothesis. Almost all rigorous statistical analyses on the Prebisch-Singer hypothesis, including those seminal works, are based on this method or its variants (von Hagen, 1989), such as Spraos (1980), Chu and Morrison (1984), Sapsford (1985), Sarkar (1986), Grilli and Yang (1988), Sarkar and Singer (1991), and Ram (2004). More generally speaking, this simple log-linear model is also the most commonly-used method in calculating the growth rate of a given economic variable (Kakwani, 2007). This model is based on a kind of trend stationarity (TS) by assuming that the behaviour of $lny(t)$ follows a deterministic trend and the error process is stationary (Nelson and Plosser, 1982). That is to say, all shocks are either temporary or cyclical and do not have permanent impacts on the secular deterministic trend. Cuddington (1992) suggests that actually all studies on the trend of commodity prices take the implicit assumption of trend stationarity. However, as a doubt regarding this assumption, Cuddington and Urzúa (1989) initiate a so-called "hi-tech" debate on statistical problems for terms of trade studies, centring on the stationarity of terms of trade series (Sarkar, 2001). The authors also introduce new statistical techniques to terms of trade studies. Afterwards, some authors contribute to this debate, such as Ardeni and Wright (1992), Bleaney and Greenaway (1993), Lutz (1999), and Bloch and Sapsford (2000). Cuddington and Urzúa (1989) argue that some shocks, such as new resource discovery and technological progress, have permanent, rather than temporary, impacts on commodity prices. In this sense, the behaviour of commodity prices follows a stochastic process with permanent shocks, instead of a deterministic process with temporary shocks (Zanias, 2005). Given this, Cuddington and Urzúa (1989) suggest to use the difference-stationary model (DS), $dlny = r + u$, which is the first-differenced form of the classical log-linear trend equation. With this DS model, Cuddington and Urzúa (1989) reject the secular deterioration in primary commodity prices and indicate a one-off permanent drop in the prices in 1920. A similar one-off drop is also found by Powell (1991) and Bleaney and Greenaway

(1993) on different time points. However, Sapsford *et al*. (1992) criticise that the results of Cuddington and Urzúa (1989) are subject to the interpolated outlier observations between 1914 and 1921, and they find that primary commodity prices follow trend stationarity and the price deterioration holds true.

If the behaviour of a time series is not stationary, then OLS estimation produces spurious regression and wrongly identifies a trend that is actually absent (Nelson and Kang, 1984; Cuddington and Wei, 1992; Athukorala, 2000). On the other hand, first differencing a time series in the absence of unit root will artificially create a unit root in the error process of the first-differenced model, known as the "over-differencing" problem, which is as problematic as failing to identify the unit root (Cuddington, 1992). In other words, both wrongly neglecting a unit root and wrongly identifying a unit root are harmful. Therefore, an appropriate unit root test is crucial. However, given the very small time dimension in this chapter (only 20 observations), unit root test is subject to size distortion (Johansen, 2004). Moreover, the validity and power of unit root test are quite low for very short time series (e.g., less than 25 time points), regardless of the type of test, such as Phillips-Perron (PP) test, Augmented Dickey-Fuller (ADF) test or others (Fedorová, 2016). Thus, for such short time series of only 20 observations, it is not reliable to identify unit root based conventional tests. In order to overcome this limitation, following Cuddington and Urzúa (1989), both the classical trend-stationary model (TS) and the alternative difference-stationary model (DS) are used. However, in order to be consistent with the majority of previous terms of trade studies, the trend-stationary log-linear model is the major method and the difference-stationary model serves as a supplement. The trend-stationary model is specified as:

$$lnTOT = a + rt + u$$

where TOT refers to either NBTOT or ITOT (income terms of trade), a is the constant, t is the time variable, r is the time trend, and u is the error term. This model allows for change in slope or intercept by introducing structural break dummy for particular time period. Thus, in the case of structural break, the model is augmented by an intercept dummy (D_t) for structural break in intercept and a slope dummy ($D_t \times year$) for structural break in slope, taking one for pre-structural break years and zero for other years. However, test for structural break points may be unreliable and inconclusive for short time series. Thus, results of the test should be interpreted together with visual inspections of the behaviour of terms of trade (i.e., Figure 5.1 to 5.3). However, even if so, the results of structural break analysis should still be treated cautiously. Another concern is autocorrelation in error term, which is prevalent in time series data. Autocorrelation leads to less efficient estimator and inconsistent standard errors. In the case of first order autocorrelation, the Prais-Winsten correction and the Cochrane-Orcutt correction are used, respectively. Moreover, in the case of non-stationary trend, Cochrane-Orcutt correction can also partly avoid wrongly identifying a time trend that is actually absent (Nelson and Kang, 1984).

For a terms of trade series with unit root, Cuddington and Urzúa (1989) suggest the following difference-stationary model, which is the first-differenced form of the trend-stationary equation:

$$dlnTOT = r + u$$

where $dlnTOT$ is in effect the growth rate of TOT, and r is the time trend, which is conceptually identical to that in the trend-stationary log-linear equation. The growth rate of terms of trade is regressed on a constant and the error term, which is fitted by ARMA model.

Furthermore, the autoregressive model by Bleaney and Greenaway (1993) and Ziesemer (2010) is used as a robustness check. The model is specified as:

$$\Delta lnTOT_t = a + rt + \gamma lnTOT_{t-1} + u$$

This model includes the lagged dependent variable as regressor. If the coefficient of this variable is significantly negative, then the lagged terms of trade serves as a "gravitational pull" on the behaviour of terms of trade (Bleaney and Greenaway, 1993). If the coefficient of this variable is equal to zero, then the terms of trade follows a random walk with increasing variance. Bleaney and Greenaway (1993) list four combinations of the estimates on r and γ, which is elaborated in Table 5.3. According to Bleaney and Greenaway (1993), the estimation can indicate the future trend of a time series, only if the coefficient of the lagged terms of trade is significantly negative. Adding lagged dependent variable may also alleviate autocorrelation in error terms and avoid the omitted variable bias (Ziesemer, 2010).

Table 5.3. Parameter combinations in autoregressive model

Gravitational Pull / Time Trend		γ = 0	γ < 0
r	= 0	random walk with zero mean (no trend estimated)	Convergence to past mean
	≠ 0	random walk with drift (no trend estimated)	non-zero long-term trend

Source: Author's own elaboration based on Bleaney and Greenaway (1993).

5.4.4. Results

Table 5.4 gives the results for developing countries' NBTOT *vis-à-vis* developed countries. Trend-stationary model confirms the positive trend found by visual inspection. Developing countries as a whole (ODEs+LDCs) and each sub-group show highly significant positive trend. An exception is AGRIs, which are trendless after correcting for autocorrelation. ODEs have greater positive trend (5.1% per annum) than LDCs (3.9% per annum). FUELs show the greatest growth rate of 7% per annum and therefore a cumulative increase in NBTOT of 140% from 1995 to 2014. MINEs have the second greatest positive trend, around 6% per annum. By contrast, MANUs' NBTOT increases at only 2% per annum. Difference-stationary model (shown in the last column) gives similar results, but LDCs lose statistical significance. Data on FUELs and MANUs are subject to convergence problem and thus fail to generate results in the DS model.

Table 5.4. Trends of NBTOT of developing countries *vis-à-vis* developed countries by country group 1995-2014 (log-linear model)

Country Group	r (TS)	$Adj\ R^2$	DW Statistics	r (DS)
ODEs+LDCs	0.048***	0.93	1.63	0.049***
ODEs	0.051***	0.93	1.33	0.051***
	(0.051***, 0.048***)	(0.91, 0.86)	(1.91, 1.96)	
LDCs	0.039***	0.6	1.25	0.032
	(0.038***, 0.03**)	(0.47, 0.27)	(1.53, 1.12)	
AGRIs	0.01*	0.1	0.95	0.004
	(0.007, -0.008)	(0.88, 0.02)	(1.1, 1.24)	
MINEs	0.061***	0.79	0.93	0.055***
	(0.056***, 0.054***)	(0.84, 0.39)	(1.8, 1.67)	
FUELs	0.07***	0.89	2.17	-
MANUs	0.02***	0.38	0.84	-
	(0.023**, 0.009)	(0.86, 0.02)	(1.72, 1.42)	

Source: Author's calculation based on BACI database at HS 92 6-digit level.
Note: Trend rate is estimated by fitting the trend equation: Log(*NBTOT)=a+rt+u*, where *t* is the time (year) variable and *r* is the trend rate. *** p<0.01, ** p<0.05, * p<0.1. In the case of 1st-order autocorrelation, trend rate, R^2, and transformed Durbin-Watson statistics under Prais-Winsten estimation and Cochrane-Orcutt estimation are shown respectively in brackets. The first number in the bracket refers to Prais-Winsten estimate, and the second number refers to Cochrane-Orcutt estimate. 5% significance level is used for Durbin-Watson critical value (1.411).

Table 5.5 presents the robustness check by autoregressive model for developing countries' NBTOT *vis-à-vis* developed countries. Except AGRIs, all other country groups show significant negative estimates on γ, which shows the effect of gravitational pull. Thus, the paths of these country groups' NBTOT *vis-à-vis* developed countries are predictable. Developing countries as a whole and ODEs have positive trend, whereas LDCs are trendless with a tendency to converge to its past mean level, as shown by the insignificant coefficient of *r*. FUELs show very high positive trend of 7.7% per annum, very close to the result from the above exponential trend equation, while MINEs and MANUs are trendless with convergence to past means. Overall, autoregressive model generates similar results with exponential TS and DS models.

Table 5.5. Trends of NBTOT of developing countries *vis-à-vis* developed countries by country group 1995-2014 (autoregressive model)

Country Group	r	γ	$Adj\ R^2$	DW Statistics
ODEs+LDCs	0.041***	-0.89***	0.43	1.81

ODEs	0.034**	-0.7***	0.31	1.96
LDCs	0.02 (0.02, 0.025)	-0.69** (-0.96**, -0.69**)	0.26 (0.49, 0.22)	1.12 (1.24, 1.07)
AGRIs	-0.003 (-0.004, -0.008)	-0.39 (-0.45, -0.57)	0.13 (0.12, 0.16)	1.24 (1.62, 1.44)
MINEs	0.024	-0.44*	0.092	1.67
FUELs	0.077***	-1.1***	0.49	2.05
MANUs	0.005	-0.56***	0.38	1.42

Source: Author's calculation based on BACI database at HS 92 6-digit level.
Note: Trend rate is estimated by fitting the autoregressive model with time trend: $\Delta Log(NBTOT_t) = a + rt + \gamma Log(NBTOT_{t-1}) + u$, where t is the time (year) variable and r is the trend rate. *** p<0.01, ** p<0.05, * p<0.1. In the case of 1st-order autocorrelation, trend rate, R^2, and transformed Durbin-Watson statistics under Prais-Winsten estimation and Cochrane-Orcutt estimation are shown respectively in brackets. The first number in the bracket refers to Prais-Winsten estimate, and the second number refers to Cochrane-Orcutt estimate. 5% significance level is used for Durbin-Watson critical value (1.411).

Table 5.6 gives results for exponential trend model for developing countries' NBTOT *vis-à-vis* emerging countries. TS model generates significant time trends for all country groups except LDCs and AGRIs, but DS model produces significant (positive) trend only for developing countries as a whole, ODEs, and MANUs. However, the magnitude of the estimated time trend coefficients is quite similar between the two models. Developing countries as a whole, ODEs, FUELs (insignificant in DS model), and MANUs show positive trends with small magnitude. MINEs (insignificant in DS model) show negative trends. Autoregressive model in Table 5.7 gives similar results as the DS model. Despite significant negative lagged terms of trade for all country groups, only developing countries as a whole, ODEs, MINEs, and MANUs show significant trends (all positive except MINEs). LDCs, AGRIs, and FUELs are trendless by converging to their past means.

Table 5.6. Trends of NBTOT of developing countries *vis-à-vis* emerging countries by country group 1995-2014 (log-linear model)

Country Group	r (TS)	$Adj\ R^2$	DW Statistics	r (DS)
ODEs+LDCs	0.024***	0.53	2.33	0.024***
ODEs	0.031***	0.56	2.11	0.031***
LDCs	-0.011	0.027	1.88	-0.011

AGRIs	-0.016* (-0.017, -0.008)	0.13 (0.89, 0.01)	0.7 (1.44, 1.27)	-0.022
MINEs	-0.038**	0.16	1.43	-0.039
FUELs	0.038*** (0.035**, 0.032)	0.43 (0.78, 0.06)	0.82 (1.62, 1.62)	0.034
MANUs	0.016*	0.13	2.39	0.016*

Source: Author's calculation based on BACI database at HS 92 6-digit level.
Note: Trend rate is estimated by fitting the trend equation: Log(*NBTOT*)=*a*+*rt*+*u*, where *t* is the time (year) variable and *r* is the trend rate. *** p<0.01, ** p<0.05, * p<0.1. In the case of 1st-order autocorrelation, trend rate, R^2, and transformed Durbin-Watson statistics under Prais-Winsten estimation and Cochrane-Orcutt estimation are shown respectively in brackets. The first number in the bracket refers to Prais-Winsten estimate, and the second number refers to Cochrane-Orcutt estimate. 5% significance level is used for Durbin-Watson critical value (1.411).

Table 5.7. Trends of NBTOT of developing countries *vis-à-vis* emerging countries by country group 1995-2014 (autoregressive model)

Country Group	r	γ	$Adj\ R^2$	DW Statistics
ODEs+LDCs	0.031***	-1.23***	0.55	2.06
ODEs	0.037***	-1.13***	0.49	2.02
LDCs	-0.01	-0.94***	0.4	1.92
AGRIs	-0.003 (-0.005, -0.012)	-0.36* (-0.64**, -0.55**)	0.09 (0.28, 0.21)	1.27 (1.66, 1.65)
MINEs	-0.039*	-0.75***	0.3	1.85
FUELs	0.013	-0.4*	0.1	1.62
MANUs	0.02*	-1.2***	0.55	1.99

Source: Author's calculation based on BACI database at HS 92 6-digit level.
Note: Trend rate is estimated by fitting the autoregressive model with time trend: $\Delta Log(NBTOT_t) = a + rt + \gamma Log(NBTOT_{t-1}) + u$, where *t* is the time (year) variable and *r* is the trend rate. *** p<0.01, ** p<0.05, * p<0.1. In the case of 1st-order autocorrelation, trend rate, R^2 and transformed Durbin-Watson statistics under Prais-Winsten estimation and Cochrane-Orcutt estimation are shown respectively in bracket. The first number in the bracket refers to Prais-Winsten estimation, and the second number refers to Cochrane-Orcutt estimation. 5% significance level is used for Durbin-Watson critical value (1.411).

Figure 5.2 shows that several country groups' NBTOT *vis-à-vis* emerging countries shows large sudden jump in particular years, for example MINEs in 1997. In order to control for these peculiar movements, point dummy, D_j, is included, which pulls the peculiar point back to the estimate of a normal year (Erten, 2011). The dummy takes zero for the year of sudden jump and one for other years. Thus, *r* refers to the trend of normal years. Table 5.8 shows the results with point dummy. In comparison with the TS model in Table 5.6, MINEs and MANUs lose their significance, but other country groups do not show qualitative differences.

Table 5.8. Trends of NBTOT of developing countries *vis-à-vis* emerging countries 1995-2014: robustness check for sudden jump (log-linear model)

Country Group	r (TS)	$Sharp\ Jump\ Dummy$	$Adj\ R^2$	DW Statistics
ODEs+LDCs	0.019***	0.403***	0.73	1.94
ODEs	0.024***	0.495***	0.75	1.26
	(0.022***, 0.025***)	(0.547***, 0.552***)	(0.90, 0.70)	(1.79, 1.82)
LDCs	-0.002	0.777***	0.56	2.06
MINEs	-0.022	1.476***	0.54	1.15
	(-0.028, -0.042)	(1.336***, 1.292***)	(0.70, 0.56)	(1.79, 1.90)
MANUs	0.005	0.813***	0.73	2.87

Source: Author's calculation based on BACI database at HS 92 6-digit level.
Note: Trend rate is estimated by fitting the trend equation: Log($NBTOT$)=a+rt+bD_j+u, where t is the time (year) variable and r is the trend rate. *** p<0.01, ** p<0.05, * p<0.1. In the case of 1st-order autocorrelation, trend rate, R^2, and transformed Durbin-Watson statistics under Prais-Winsten estimation and Cochrane-Orcutt estimation are shown respectively in brackets. The first number in the bracket refers to Prais-Winsten estimate, and the second number refers to Cochrane-Orcutt estimate. 5% significance level is used for Durbin-Watson critical value (1.411). The sudden jump year is 2013 for ODEs+LDCs, ODEs, and MANUs, and is 1997 for LDCs and MINEs.

Table 5.9 presents results from exponential trend equation for developing countries' NBTOT *vis-à-vis* China. Developing countries as a whole and LDCs do not show significant trend, but ODEs show significant negative trend (2% to 3% per annum). MANUs show great negative trend (around 7% per annum). By contrast, FUELs show significant positive trend of 4% per annum. AGRIs (after correcting for autocorrelation) and MINEs have negative but insignificant trend. DS model confirms the positive trend for FUELs, but gives insignificant trend for MANUs. The DS model fails to converge for ODEs and LDCs.

Table 5.9. Trends of NBTOT of developing countries *vis-à-vis* China by country group 1995-2014 (log-linear model)

Country Group	r (TS)	R^2	DW Statistics	r (DS)
ODEs+LDCs	-0.013	0.1	1.53	-0.013
ODEs	-0.02**	0.2	1.37	-
	(-0.02*, -0.03**)	(0.4, 0.27)	(1.91, 1.91)	
LDCs	0.015	0.01	0.5	-
	(-0.004, 0.015)	(0.74, 0.01)	(1.5, 1.47)	
AGRIs	-0.02*	0.11	1.4	-0.02
	(-0.02, -0.03)	(0.4, 0.09)	(1.91, 1.98)	
MINEs	-0.003	0.006	1.47	-0.0008

FUELs	0.04***	0.52	1.56	0.042***
MANUs	-0.07*** (-0.06***, -0.08***)	0.61 (0.7, 0.49)	1.04 (2.1, 1.96)	-0.052

Source: Author's calculation based on BACI database at HS 92 6-digit level.
Note: Trend rate is estimated by fitting the trend equation: Log($NBTOT$)=a+rt+u, where t is the time (year) variable and r is the trend rate. *** p<0.01, ** p<0.05, * p<0.1. In the case of 1st-order autocorrelation, trend rate, R^2, and transformed Durbin-Watson statistics under Prais-Winsten estimation and Cochrane-Orcutt estimation are shown respectively in brackets. The first number in the bracket refers to Prais-Winsten estimate, and the second number refers to Cochrane-Orcutt estimate. 5% significance level is used for Durbin-Watson critical value (1.411).

Table 5.10 shows results from autoregressive model. Except LDCs, all country groups have significant negative lagged terms of trade, which shows gravitational pull. Developing countries as a whole and ODEs have negative trends of NBTOT *vis-à-vis* China. MANUs show an even larger negative trend of 4.8% per annum, whereas FUELs show a positive trend of 3.3% per annum. MINEs show negative trend of 1.6% per annum and AGRIs are trendless with convergence to the past mean.

Table 5.10. Trends of NBTOT of developing countries *vis-à-vis* China by country group 1995-2014 (autoregressive model)

Country Group	r	γ	$Adj\ R^2$	DW Statistics
ODEs+LDCs	-0.015*	-0.81***	0.36	1.78
ODEs	-0.025**	-0.77***	0.39	1.91
LDCs	0.004	-0.25	0.01	1.47
AGRIs	-0.021	-0.72***	0.3	1.98
MINEs	-0.016*	-0.93***	0.61	1.82
FUELs	0.033*	-0.83***	0.3	1.85
MANUs	-0.048**	-0.58**	0.27	1.96

Source: Author's calculation based on BACI database at HS 92 6-digit level.
Note: Trend rate is estimated by fitting the autoregressive model with time trend: $\Delta Log(NBTOT_t) = a + rt + \gamma Log(NBTOT_{t-1}) + u$, where t is the time (year) variable and r is the trend rate. *** p<0.01, ** p<0.05, * p<0.1. In the case of 1st-order autocorrelation, trend rate, R^2, and transformed Durbin-Watson statistics under Prais-Winsten estimation and Cochrane-Orcutt estimation are shown respectively in brackets. The first number in the bracket refers to Prais-Winsten estimate, and the second number refers to Cochrane-Orcutt estimate. 5% significance level is used for Durbin-Watson critical value (1.411).

A concern for the behaviour of NBTOT is structural break. As discussed in Section 5.4.3, structural break test and analysis may be unreliable and inconclusive for very short time series. Thus, the test for structural break has to be interpreted in combination with visual inspections of the behaviour of NBTOT. Structural break test shows estimated structural break points for AGRIs', MINEs', and MANUs'

NBTOT *vis-à-vis* developed countries in 2010, 2004, and 2004, respectively. Structural break points for AGRIs' and FUELs' NBTOT *vis-à-vis* emerging countries are in 2001 and 2000. Structural break points for ODEs+LDCs', ODEs', LDCs', FUELs', and MANUs' NBTOT *vis-à-vis* China are in 2003, 2003, 2005, 2005, and 2004, respectively. Other terms of trade series do not show structural break. These estimated structural break points do not obviously contradict visual inspections. Intercept dummy, D_t, and slope dummy, $D_t \times year$, are used for controlling for structural break in intercept and slope. The dummy takes the value of one before the estimated structural break point and zero for other years. The two dummies give the impact of structural break on time trend, which serve as robustness check.

Table 5.11 shows the robustness check with structural break dummy. The intercept dummy and slope dummy are found to be statistically significant in most cases. AGRIs' NBTOT *vis-à-vis* developed countries shows negative trend (around -0.13). After the structural break in 2010, the negative trend is reversed to a slight positive trend, as shown by the slope dummy. The opposite trends before and after the structural break may explain the trendless estimation in the model without controlling for structural break. However, this post-structural break positive trend is established on a considerable one-off drop during the structural break as shown by the intercept dummy. MINEs' NBTOT *vis-à-vis* developed countries loses significant trend after controlling for structural break. MANUs' NBTOT *vis-à-vis* developed countries has a slightly greater positive trend in comparison to that in model without structural break dummy, and the positive trend is further accentuated after structural break. AGRIs' NBTOT *vis-à-vis* emerging countries has positive trend, which is opposite to previous result. FUELs' NBTOT *vis-à-vis* emerging countries loses its significance. The negative trend of NBTOT *vis-à-vis* China for developing countries as a whole turns to be significant and stronger, in comparison with the result from regression without structural break dummy. ODE's negative trend of NBTOT *vis-à-vis* China becomes stronger, and LDCs' trend in

NBTOT is reversed to be negative, in comparison to previous results. FUELs show positive trend after structural break in 2005, despite the substantial one-off drop during the structural break. MANUs' negative trend becomes stronger relative to previous result, but turns to be slightly positive after structural break. However, this positive post-structural break trend is based on large one-off drop during the structural break as well. Generally speaking, structural break analysis does not lead to large qualitative differences to the overall scenario of developing countries' trends of NBTOT derived from previous baseline regressions.

Table 5.11. Trends of NBTOT of developing countries 1995-2014: robustness check for structural break (log-linear model)

Country Group	r	D_t	$D_t \times year$	$Adj\ R^2$	DW Statistics
NBTOT *vis-à-vis* Developed Countries					
AGRIs	-0.127***	-2.509***	0.137***	0.5	1.33
	(-0.13***, -0.127***)	(-2.558***, -2.419***)	(0.143***, 0.131***)	(0.84, 0.42)	(1.47, 1.76)
MINEs	0.001	1.038***	0.062***	0.95	2.35
MANUs	0.031**	0.026	0.033*	0.61	1.54
NBTOT *vis-à-vis* Emerging Countries					
AGRIs	0.016*	0.393**	0.039	0.65	2.26
FUELs	-0.0004	-0.521***	-0.058	0.86	2.93
NBTOT *vis-à-vis* China					
ODEs+LDCs	-0.056***	-0.685*	0.026	0.54	2.41
ODEs	-0.077***	-1.057***	0.084**	0.57	2.12
LDCs	-0.054**	-0.788*	-0.035	0.64	1.53
FUELs	-0.026	-1.143***	0.056*	0.72	2.36
MANUs	-0.119***	-1.192**	0.135**	0.73	1.52

Source: Author's calculation based on BACI database at HS 92 6-digit level.
Note: Trend rate is estimated by fitting the trend equation: Log($NBTOT$)=a+rt+bD_t+$b'D_t t$+u, where t is the time (year) variable and r is the trend rate. *** p<0.01, ** p<0.05, * p<0.1. In the case of 1st-order autocorrelation, trend rate, R^2, and transformed Durbin-Watson statistics under Prais-Winsten estimation and Cochrane-Orcutt estimation are shown respectively in brackets. The first number in the bracket refers to Prais-Winsten estimate, and the second number refers to Cochrane-Orcutt estimate. 5% significance level is used for Durbin-Watson critical value (1.411).

NBTOT reflects a country's relative gains from bilateral trade, say, gains from one unit of trade. However, in order to see a country's gains from its total trade, it is necessary to examine its income terms of trade (ITOT). ITOT, which is defined as NBTOT multiplied by export volume, measures the purchasing power of a country's exports in terms of the capacity to import. If a country's export volume increases, its ITOT may increase even in the presence of NBTOT deterioration. Table 5.12 shows estimates on developing countries' ITOT *vis-à-vis* developed countries. Exponential log-linear trend model gives highly significant and quite large positive trends for all country groups. This is confirmed by DS model, except LDCs, which are trendless in DS model. FUELs and MINEs have particularly high growth rate of around 7% per annum, whereas AGRIs and MANUs have lower growth rate of around 4% and 5.5% per annum, respectively. Correcting for autocorrelation does not qualitatively change the results.

Table 5.12. Trends of ITOT of developing countries *vis-à-vis* developed countries by country group 1995-2014 (log-linear model)

Country Group	*r* (TS)	$Adj\ R^2$	DW Statistics	*r* (DS)
ODEs+LDCs	0.063***	0.89	1.14	0.063***
	(0.063***, 0.054***)	(0.98, 0.78)	(1.66, 1.96)	
ODEs	0.061***	0.87	1.06	0.062***
	(0.061***, 0.051***)	(0.99, 0.68)	(1.71, 2.12)	
LDCs	0.075***	0.91	1.37	0.078
	(0.075***, 0.07***)	(0.97, 0.82)	(1.79, 1.01)	
AGRIs	0.039***	0.88	1.36	0.04***
	(0.04***, 0.036***)	(0.99, 0.81)	(1.78, 1.99)	
MINEs	0.07***	0.87	1.28	0.063**
	(0.069***, 0.068***)	(0.98, 0.75)	(2.06, 1.97)	
FUELs	0.076***	0.74	1.12	0.073***
	(0.074***, 0.062***)	(0.97, 0.39)	(1.82, 1.98)	
MANUs	0.056***	0.89	1.32	0.058***
	(0.056***, 0.049***)	(0.89, 0.91)	(1.55, 1.72)	

Source: Author's calculation based on BACI database at HS 92 6-digit level.
Note: Trend rate is estimated by fitting the trend equation: Log(*ITOT*)=*a*+*rt*+*u*, where *t* is the time (year) variable and *r* is the trend rate. *** p<0.01, ** p<0.05, * p<0.1. In the case of 1st-order autocorrelation, trend rate, R^2, and transformed Durbin-Watson statistics under Prais-Winsten estimation and Cochrane-Orcutt estimation are shown respectively in brackets. The first number in the bracket refers to Prais-Winsten estimate, and the second number refers to Cochrane-Orcutt estimate. 5% significance level is used for Durbin-Watson critical value (1.411).

Table 5.13 presents the trends of developing countries' ITOT *vis-à-vis* emerging countries. TS model and DS model give highly similar results, except that the trend of FUELs turns to be insignificant in DS model (*p*-value=0.128). All country groups but MINEs show positive and considerable growth rate of more than 8.5% per annum. The growth rates of developing countries' ITOT *vis-à-vis* emerging countries tend to be obviously greater than the growth rates of their ITOT *vis-à-vis* developed countries.

Table 5.13. Trends of ITOT of developing countries *vis-à-vis* emerging countries by country group 1995-2014 (log-linear model)

Country Group	r (TS)	$Adj\ R^2$	DW Statistics	r (DS)
ODEs+LDCs	0.086***	0.93	1.96	0.086***
ODEs	0.086***	0.91	2.18	0.086***
LDCs	0.095***	0.84	2.07	0.095***
AGRIs	0.086***	0.97	2.01	0.086***
MINEs	0.025 (0.024, 0.025)	0.036 (0.79, 0.039)	1.32 (1.86, 1.86)	0.024
FUELs	0.092*** (0.091***, 0.074***)	0.85 (0.98, 0.47)	0.86 (1.73, 1.75)	0.089
MANUs	0.086***	0.9	2.43	0.086***

Source: Author's calculation based on BACI database at HS 92 6-digit level.
Note: Trend rate is estimated by fitting the trend equation: Log($ITOT$)=a+rt+u, where t is the time (year) variable and r is the trend rate. *** p<0.01, ** p<0.05, * p<0.1. In the case of 1st-order autocorrelation, trend rate, R^2, and transformed Durbin-Watson statistics under Prais-Winsten estimation and Cochrane-Orcutt estimation are shown respectively in brackets. The first number in the bracket refers to Prais-Winsten estimate, and the second number refers to Cochrane-Orcutt estimate. 5% significance level is used for Durbin-Watson critical value (1.411).

Finally, Table 5.14 gives the trends of developing countries' ITOT *vis-à-vis* China. The positive growth rates (on average 17% per annum) are substantially greater than the growth rates of their ITOT *vis-à-vis* developed countries (around 6% per annum) and emerging countries (between 8.5% and 9% per annum). The positive trend is highly significant for all country groups in both TS model and DS model. FUELs have the highest growth rate of around 20% per annum, which indicates a cumulative improvement of 400% from 1995 to 2014. MANUs have the lowest growth rate of around 13% per annum.

Table 5.14. Trends of ITOT of developing countries *vis-à-vis* China by country group 1995-2014 (log-linear model)

Country Group	r (TS)	$Adj\ R^2$	DW Statistics	r (DS)
ODEs+LDCs	0.16*** (0.16***, 0.15***)	0.93 (0.94, 0.82)	1.24 (1.84, 1.76)	0.16***
ODEs	0.16*** (0.16***, 0.15***)	0.92 (0.95, 0.78)	1.11 (1.84, 1.8)	0.16***
LDCs	0.18*** (0.17***, 0.18***)	0.82 (0.92, 0.44)	0.72 (1.75, 1.7)	0.16***
AGRIs	0.18*** (0.17***, 0.21***)	0.83 (0.92, 0.62)	0.69 (1.94, 2.15)	0.17**
MINEs	0.17*** (0.17***, 0.18***)	0.94 (0.96, 0.83)	1.1 (1.81, 1.72)	0.17***
FUELs	0.21*** (0.21***, 0.19***)	0.92 (0.86, 0.82)	1.27 (1.76, 1.9)	0.2***

MANUs	0.13*** (0.13***, 0.11***)	0.84 (0.97, 0.33)	0.6 (1.71, 1.66)	0.13***

Source: Author's calculation based on BACI database at HS 92 6-digit level.
Note: Trend rate is estimated by fitting the trend equation: Log($ITOT$)=a+rt+u, where t is the time (year) variable and r is the trend rate. *** p<0.01, ** p<0.05, * p<0.1. In the case of 1st-order autocorrelation, trend rate, R^2, and transformed Durbin-Watson statistics under Prais-Winsten estimation and Cochrane-Orcutt estimation are shown respectively in brackets. The first number in the bracket refers to Prais-Winsten estimate, and the second number refers to Cochrane-Orcutt estimate. 5% significance level is used for Durbin-Watson critical value (1.411).

Another question of interest is whether the absolute gains from bilateral trade accruing to developing countries rise relative to the absolute gains accruing to their trade partners. Following Sarkar and Singer (1991), this question is examined by the trends of Relative ITOT of developing countries *vis-à-vis* their trade partners. Relative ITOT (RITOT) is defined as:

$$RITOT_{developing\ countries} = \frac{ITOT_{developing\ countries}}{ITOT_{trade\ partner}}$$

A statistically significant positive Relative ITOT implies that in the bilateral trade, developing countries' absolute gains rise relative to their trade partner's. A negative Relative ITOT indicates that developing countries' absolute gains decline relative to their trade partner's absolute gains.

Table 5.15 shows the case of developing countries' RITOT *vis-à-vis* developed countries. According to TS model, except for AGRIs, all country groups show significant positive but quite small trends. This implies that in the bilateral trade between developing and developed countries, developing countries' absolute gains rise relative to developed countries' absolute gains. However, the quite small coefficients may not have economic significance. In particular, if the substantially greater growth rate of population in developing countries is taken into account, then it is safe to argue that such negligible advantage in Relative ITOT will be reversed to disadvantage in per capita terms. RITOT of LDCs, MINEs, and MANUs turns to be insignificant in DS model. Table 5.16 shows the case of RITOT *vis-à-vis* emerging countries. TS model shows that developing countries as a whole, ODEs, FUELs, and MANUs have significant positive but very small trends. However, FUELs and

MANUs turn to be insignificant in DS model. AGRIs and MINEs show negative but insignificant trends in both TS and DS model. Insignificant result implies that these developing countries do not hold advantage over emerging countries in absolute gains from bilateral trade. Table 5.17 gives the case for RITOT *vis-à-vis* China. In TS model, only MINEs (negative) and FUELs (positive) show significant trend, and in DS model none of the country groups shows significant trend. In brief, developing countries' Relative ITOT *vis-à-vis* emerging countries and China show much less significant trend in comparison with that *vis-à-vis* developed countries.

Table 5.15. Trends of Relative ITOT of developing countries *vis-à-vis* developed countries by country group 1995-2014 (log-linear model)

Country Group	r (TS)	$Adj\ R^2$	DW Statistics	r (DS)
ODEs+LDCs	0.003***	0.83	1.5	0.003***
ODEs	0.03***	0.84	1.53	0.003***
LDCs	0.003*** (0.003***, 0.02*)	0.59 (0.95, 0.13)	1.05 (1.54, 1.24)	0.003
AGRIs	0.0001 (-0.00001, -0.0009)	0.01 (0.99, 0.02)	0.93 (1.11, 1.2)	-0.0008
MINEs	0.005*** (0.003**, 0.001)	0.67 (0.98, 0.008)	0.48 (1.63, 1.62)	0.003
FUELs	0.005***	0.66	1.87	0.005***
MANUs	0.002*** (0.002**, 0.0005)	0.34 (0.99, 0.03)	0.69 (1.77, 1.47)	0.003

Source: Author's calculation based on BACI database at HS 92 6-digit level.
Note: Trend rate is estimated by fitting the trend equation: Log(*RITOT*)=*a*+*rt*+*u*, where *t* is the time (year) variable and *r* is the trend rate. *** p<0.01, ** p<0.05, * p<0.1. In the case of 1st-order autocorrelation, trend rate, R^2, and transformed Durbin-Watson statistics under Prais-Winsten estimation and Cochrane-Orcutt estimation are shown respectively in brackets. The first number in the bracket refers to Prais-Winsten estimate, and the second number refers to Cochrane-Orcutt estimate. 5% significance level is used for Durbin-Watson critical value (1.411).

Table 5.16. Trends of Relative ITOT of developing countries *vis-à-vis* emerging countries by country group 1995-2014 (log-linear model)

Country Group	r (TS)	$Adj\ R^2$	DW Statistics	r (DS)
ODEs+LDCs	0.002***	0.61	2.13	0.002***
ODEs	0.002***	0.63	2.1	0.002***
LDCs	0.0005	0.03	1.66	0.0005
AGRIs	-0.0001 (-0.0004, 0.0006)	0.01 (0.99, 0.01)	0.64 (1.64, 1.59)	-0.0002
MINEs	-0.002 (-0.002, -0.003)	0.07 (0.77, 0.04)	1.35 (1.76, 1.78)	-0.002
FUELs	0.002*	0.098	2.18	0.002

MANUs	0.001**	0.29	2.12	0.002

Source: Author's calculation based on BACI database at HS 92 6-digit level.
Note: Trend rate is estimated by fitting the trend equation: Log(*RITOT*)=*a*+*rt*+*u*, where *t* is the time (year) variable and *r* is the trend rate. *** p<0.01, ** p<0.05, * p<0.1. In the case of 1st-order autocorrelation, trend rate, R^2, and transformed Durbin-Watson statistics under Prais-Winsten estimation and Cochrane-Orcutt estimation are shown respectively in brackets. The first number in the bracket refers to Prais-Winsten estimate, and the second number refers to Cochrane-Orcutt estimate. 5% significance level is used for Durbin-Watson critical value (1.411).

Table 5.17. Trends of Relative ITOT of developing countries *vis-à-vis* China by country group 1995-2014 (log-linear model)

Country Group	*r* (TS)	$Adj\ R^2$	DW Statistics	*r* (DS)
ODEs+LDCs	0.0006	0.03	1.28	0.0006
	(0.0006, -0.0003)	(0.86, 0.005)	(1.85, 1.75)	
ODEs	-0.0006	0.02	1.13	-0.0003
	(-0.0004, -0.002)	(0.88, 0.03)	(1.87, 1.78)	
LDCs	0.004**	0.27	0.83	0.003
	(0.003, 0.003)	(0.89, 0.03)	(1.83, 1.78)	
AGRIs	-0.0007	0.01	1.07	-0.0006
	(-0.0006, -0.0006)	(0.8, 0.003)	(1.93, 1.89)	
MINEs	-0.003**	0.16	1.84	-0.003
FUELs	0.02*	0.14	1.71	0.002
MANUs	-0.002	0.06	0.64	-0.001
	(-0.001, -0.005)	(0.91, 0.08)	(2.01, 1.92)	

Source: Author's calculation based on BACI database at HS 92 6-digit level.
Note: Trend rate is estimated by fitting the trend equation: Log(*RITOT*)=*a*+*rt*+*u*, where *t* is the time (year) variable and *r* is the trend rate. *** p<0.01, ** p<0.05, * p<0.1. In the case of 1st-order autocorrelation, trend rate, R^2, and transformed Durbin-Watson statistics under Prais-Winsten estimation and Cochrane-Orcutt estimation are shown respectively in brackets. The first number in the bracket refers to Prais-Winsten estimate, and the second number refers to Cochrane-Orcutt estimate. 5% significance level is used for Durbin-Watson critical value (1.411).

To sum up, developing countries' terms of trade, both NBTOT and ITOT, *vis-à-vis* different trade partners tends to follow different behaviours. Generally speaking, developing countries as a whole show positive trends of NBTOT *vis-à-vis* developed and, to a lesser extent, emerging countries, but their NBTOT *vis-à-vis* China has unfavourable trend. NBTOT of different sub-groups of developing countries *vis-à-vis* developed countries tends to have positive trend, whereas their NBTOT *vis-à-vis* emerging countries and China, especially the latter, tends to show negative trend or to be trendless, except FUELs. The time series estimates on developing countries' NBTOT are consistent with the previous visual inspection. Developing countries' ITOT shows positive trend in the majority of cases and has quite high growth rate.

This suggests developing countries' absolute gains from trade. In particular, their ITOT *vis-à-vis* China shows considerably greater growth rate than that of their ITOT *vis-à-vis* developed countries and, to a lesser extent, emerging countries. This indicates that developing countries' trendless or even deteriorating NBTOT *vis-à-vis* China is compensated by their increasing export volume to China. However, developing countries' trade partners have comparable absolute gains from trade with developing countries, which is shown by developing countries' trivial positive or even insignificant Relative ITOT. For another thing, different groups of developing countries show different behaviours of terms of trade. In terms of development status, ODEs outperform LDCs in trade with developed and emerging countries, but not in trade with China. In terms of export specialisation pattern, FUELs outperform other developing countries in both NBTOT and ITOT. On the other hand, AGRIs and MANUs show the weakest trends in NBTOT and ITOT. AGRIs' and MANUs' NBTOT *vis-à-vis* developed countries outperforms their NBTOT *vis-à-vis* emerging countries and China. The former tends to be trendless or slightly positive, whereas the latter tends to be trendless or negative. Finally, results from trend-stationary model, difference-stationary model, and autoregressive model do not show large qualitative differences. As anticipated, significant trends are more easily detected under trend-stationary model.

5.5. Conclusion

The Prebisch-Singer hypothesis on the secular deterioration of terms of trade of primary commodities and developing countries may be the most important but perhaps also the most contentious topic in development economics, especially prior to the 1990s. This deterioration reflects the unequal distribution of gains from trade between primary commodity producers in the periphery and manufacturers in the centre, and thus reflects the unequal structure of the global economy. Over the last decades, however, manufactures have accounted for an increasingly important share in many developing countries' export basket. Thus, the early empirical basis of the Prebisch-Singer hypothesis on commodity terms of trade of primary commodities *vis-à-vis* manufactures has been revised to country terms of trade of developing countries *vis-à-vis* developed countries.

However, the rise of emerging countries, especially China, as new global players in addition to developed and developing countries, has largely changed the global economic hierarchy. It is not only interesting but also important to examine the behaviour of developing countries' terms of trade *vis-à-vis* emerging countries, besides that *vis-à-vis* developed countries, for at least three reasons. First, emerging countries, especially China, have disproportionately increased their trade with developing countries, in comparison with the growth of trade between developing and developed countries. This makes emerging countries a major trade partner for developing countries. Second, the composition of developing countries' exports to emerging countries, in particular China, significantly differs from that of their exports to developed countries. While the former is dominated by fuels with a low share of manufactures, the latter is dominated more or less equally by fuels and manufactures. Since export composition largely determines the trend of terms of trade, differences in composition between developing countries' exports to developed countries and to emerging countries make difference for their terms of trade. Third, the resource-intensive industrialisation and urbanisation of emerging countries, especially China, have led to a super cycle of commodity prices since the middle 1990s and a commodity boom since the early 2000s. This has raised the prices of fuels, minerals, and some other primary commodities. This trend together with cheap manufactured exports from some emerging countries, in particular China, may reverse the long-term decline in terms of trade of some developing countries. However, for countries that do not specialise in "hard commodities" and countries that compete with emerging countries in manufactures, their terms of trade may encounter unfavourable shocks.

This chapter aims at providing the latest evidence on the Prebisch-Singer hypothesis under the new global economic hierarchy. It examines the trends of terms of trade of various groups of developing countries *vis-à-vis* developed countries, China, and other emerging countries between 1995 and 2014. Time series analyses show significant differences between developing countries' terms of trade *vis-à-vis* developed countries and *vis-à-vis* China and other emerging countries on the one hand, and differences between the behaviours of terms of trade of different groups of developing countries on the other. Developing countries' net barter terms of trade *vis-à-vis* developed countries tends to show significant positive trends, which is stronger for those specialising in fuels or minerals and weaker for those specialising in agricultural products or manufactures. This positive trend seemingly contradicts with the Prebisch-Singer hypothesis and the findings of several recent studies (e.g., Sarkar and Singer, 1991; Ram, 2004; Erten, 2011). A possible reason may be the exclusion of emerging countries from the group of developing countries. Previous studies tend to treat emerging countries as part of developing countries. Another reason may be the selection of time period. Sarkar and Singer (1991) examine the period of 1965 to 1985, Ram (2004) examines the period of 1970 to 1999, and Erten (2011) examines the period of 1960 to 2006. Instead, this chapter examines the period of 1995 to 2014. This period has special characteristics, such as the super cycle and boom of commodity prices, the entry of emerging countries into the global market as major suppliers of low-end manufactures, and the shift to a manufacture-dominant composition in developing countries' exports to developed countries, all of which, in theory, greatly impact on developing countries' terms of trade. Moreover, developed countries have diverse demand for primary commodities from developing countries. The diverse export composition is expected to be beneficial to developing countries.

On the other hand, developing countries' net barter terms of trade *vis-à-vis* China tends to show negative trends or to be trendless, except those specialising in fuels. In the bilateral trade between developing and developed countries, besides the commodity boom, two factors may explain the improving terms of trade: increasing manufactured exports from developing countries to developed countries and developed countries' diverse demand for primary commodities from developing countries, especially agricultural products. For the case of China, however, the first factor does not exist, because developing countries' manufactured exports to China have declined to a minor or even marginal share. The second factor does not exist either, because China's demand for primary commodities from developing countries is much more concentrated than the counterpart demand by developed countries. Three factors may account for developing countries' declining net barter terms of trade *vis-à-vis* China: the concentration of China's fast-growing primary commodity demand on fuels and minerals, cheap manufactures from China, and the marginalisation of manufactures in developing countries' exports to China. Since China's demand for primary commodities concentrates on fuels and minerals, developing countries that do not specialise in these "hard commodities" tend not to benefit from the commodity boom. This is shown by the weak terms of trade performance of countries specialising in agricultural products. Meanwhile, cheap manufactures from China seem not to reverse the negative impact of specialisation in "soft commodities" on these countries' terms of trade *vis-à-vis* China. Developing countries specialising in manufactures have experienced the greatest deterioration in their net barter terms of trade *vis-à-vis* China. This phenomenon indicates these countries' relatively disadvantageous position in the trade relationship with China, because they may directly compete with China in manufactures and tend not to benefit from China's commodity boom. Actually, even with respect to developed countries, developing countries specialising in agricultural products or manufactures still show weaker net barter terms of trade than those specialising in fuels or minerals as well. This implies that developing countries specialising in agricultural products or manufactures are at a weak position in the current global market, whereas those specialising in fuels or minerals are at a relatively favourable position.

Developing countries' income terms of trade, however, shows positive trends with quite high growth rate, regardless of trade partners. This finding implies that relative losses from unfavourable net barter terms of trade can be compensated by growth in export volume, and that developing countries have absolute gains from their trade with the rest of the world. In particular, their income terms of trade *vis-à-vis* China shows much greater growth rate than that *vis-à-vis* developed and other emerging countries. This is a result of the strong growth of developing countries' exports to China. However, developing countries do not have advantage over the rest of the world in absolute gains from trade, because the rest of the world has comparable absolute gains from their trade with developing countries. Because developing countries have considerably higher population growth rate than the rest of the world, especially developed countries and China, their absolute gains from trade in per capita terms are definitely much lower than those accruing to their trade partners.

Can developing countries' improving income terms of trade lead to global (North-South) convergence? The answer seems negative. One may question that, without considerations about factoral productivity, whether net barter terms of trade or income terms of trade can shed light on the convergence vs. divergence debate. For one thing, the persistent North-South gap in productivity has been shown. For another thing, the global divergence can be revealed by comparing income terms of trade facing both the North and the South. Developing countries have improved income terms of trade, but developed and emerging countries (including China) have comparable improvement as well, needless to say developing countries' falling net barter terms of trade *vis-à-vis* emerging countries (including China). Thus, according to Singer and Raffer (2001), the condition for global convergence does not hold. On the contrary, developing countries have to mobilise more resources to maintain the favourable income terms of trade, impeding domestic consumption and investment, and thus unequal exchange has remained (Singer and Raffer, 2001). In particular, this inequality is magnified by the persistent North-South gap in productivity and technology and by the fallacy of composition due to developing countries' efforts in maintaining income terms of trade through expanding exports[88]. More deeply speaking, the origin of the global inequality lies in the competitive nature of the markets for primary commodities and simple manufactures and the oligopolistic nature of the markets for sophisticated manufactures. In this sense, the findings here do not contradict with the Prebisch-Singer hypothesis.

It should be borne in mind that the trends of terms of trade found in this chapter, regardless of positive, negative, or trendless, may be a period-specific phenomenon largely due to the, perhaps temporary, changes brought by China and other emerging countries into the global economy. The priority for developing countries, regardless of the type of export specialisation, is still the stimulation of production upgrading, or more generally speaking, industrialisation and structural transformation, through, as shown in Chapter 3, accumulating human and physical capital. Importantly, as suggested by Singer and Raffer (2001), the policy implication of the Prebisch-Singer hypothesis has been shifted from simple industrialisation to continuous production upgrading. Only by ascending the ladder of product sophistication, can developing countries get rid of the highly competitive markets for primary commodities and simple manufactures. The persistent North-South gap in technology and productivity points out developing countries' failure in this regard and the hardship of achieving this goal. However, in spite of the relatively unfavourable net barter terms of trade facing developing countries specialising in

[88] The development of global value chains tends to strengthen the fallacy of composition. The global value chains feature oligopoly at the top tier but great competition at the bottom tier. Therefore, integration into the global value chains may intensify the competition between developing countries at the bottom end of the value chains. Moreover, the intensification of competition at the bottom tier may also be a kind of strategy wielded by the MNEs.

manufactures and agricultural products, the significant improvement in their income terms of trade implies that they have absolute gains from trade with the rest of the world through which they can promote industrialisation, just as their counterparts specialising in fuels and minerals. Then, we return to the issue discussed in Chapter 3 that appropriate use of revenues from exports is of the central importance and the developmentalist model with a strong and accountable state in place may serve as a reference for developing countries. Otherwise, developing countries may have to face resource curse and/or various problems led by rentier state, and they may lose more than what they have gained if the current commodity boom comes to an end.

Finally, this chapter is just an exploratory study, because China and other emerging countries are still at a relatively early or middle phase of their modernisation process and the current super cycle of the global economy is still at an early to middle stage (Cuddington and Jerrett, 2008; Erten and Ocampo, 2013). In order to obtain more robust empirical evidence on developing countries' position in the global market under the new global economic hierarchy, studies based on a longer term are necessary. This may be undertaken in the future.

References

Ardeni, P. G., & Wright, B. (1992). The Prebisch-Singer hypothesis: A reappraisal independent of stationarity hypotheses. *The Economic Journal*, *102*(413), 803-812.

Athukorala, P. C. (2000). Manufactured exports and terms of trade of developing countries: evidence from Sri Lanka. *The Journal of Development Studies*, *36*(5), 89-104.

Bidarkota, P., & Crucini, M. J. (2000). Commodity prices and the terms of trade. *Review of International Economics*, *8*(4), 647-666.

Bleaney, M., & Greenaway, D. (1993). Long-run trends in the relative price of primary commodities and in the terms of trade of developing countries. *Oxford Economic Papers*, 349-363.

Bloch, H., & Sapsford, D. (2000). Whither the terms of trade? An elaboration of the Prebisch-Singer hypothesis. *Cambridge Journal of Economics*, *24*(4), 461-481.

Cashin, P., & McDermott, C. J. (2002). The long-run behavior of commodity prices: small trends and big variability. *IMF Staff Papers*, *49*(2), 175-199.

Chu, K. Y., & Morrison, T. K. (1984). The 1981-82 recession and non-oil primary commodity prices. *Staff Papers*, *31*(1), 93-140.

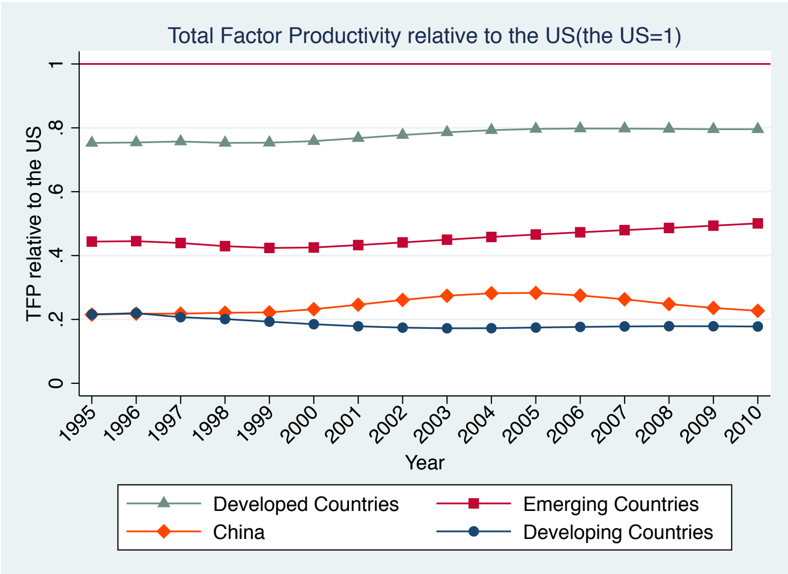
Cuddington, J. T., & Urzúa, C. M. (1989). Trends and cycles in the net barter terms of trade: a

new approach. *The Economic Journal*, *99*(396), 426-442.
Cuddington, J. T., & Wei, H. (1992). An empirical analysis of real commodity price trends: Aggregation, model selection and implications. *Estudios Economicos*, 159-179.
Cuddington, J. T., & Jerrett, D. (2008). Super cycles in real metals prices?. *IMF staff Papers*, *55*(4), 541-565.
Cypher, J. (2007). Back to the 19th Century? The Current Commodities Boom and the Primarization Process in Latin America. In *Latin American Studies Association*. Montreal, Canada.
Emmanuel, A. (1969): *Unequal exchange*. New York: Monthly Review Press (English translation, 1972).
Erdem, F. P., & Ünalmış, İ. (2016). Revisiting super-cycles in commodity prices. *Central Bank Review*, *16*(4), 137-142.
Erten, B. (2011). North–South terms-of-trade trends from 1960 to 2006. *International Review of Applied Economics*, *25*(2), 171-184.
Erten, B., & Ocampo, J. A. (2013). Super cycles of commodity prices since the mid-nineteenth century. *World Development*, *44*, 14-30.
Farooki, M. (2009). China's structural demand and the commodity super cycle: Implications for Africa.
Fedorová, D. (2016). Selection of unit root test on the basis of length of the time series and value of ar (1) parameter. *STATISTIKA*, *96*(3), 3.
Grilli, E. R., & Yang, M. C. (1988). Primary commodity prices, manufactured goods prices, and the terms of trade of developing countries: what the long run shows. *The World Bank Economic Review*, *2*(1), 1-47.
Hagen, J. V. (1989). Relative commodity prices and cointegration. *Journal of Business & Economic Statistics*, *7*(4), 497-503.
Heap, A. (2005). China-the engine of a commodities super cycle. *City Group Global Markets Inc., Smith Barney*, *67*, 8-9.
Imlah, A. H. (1950). The terms of trade of the United Kingdom, 1798–1913. *The Journal of Economic History*, *10*(2), 170-194.
Jerrett, D., & Cuddington, J. T. (2008). Broadening the statistical search for metal price super cycles to steel and related metals. *Resources Policy*, *33*(4), 188-195.
Johansen, S. (2004). A small sample correction of the Dickey–Fuller test. *Contributions to Economic Analysis*, *269*, 49-68.
Kakwani, N. (1997). Growth rates of per-capita income and aggregate welfare: An international comparison. *Review of Economics and Statistics*, *79*(2), 201-211.
Kaplinsky, R. (2006). Revisiting the revisited terms of trade: will China make a difference?. *World Development*, *34*(6), 981-995.
Love, J. L. (2005). The rise and fall of structuralism. in Fitzgerald, E. V. K., Fitzgerald, V., & Thorp, R. (Eds.). (2005). *Economic doctrines in Latin America: origins, embedding and evolution*. St. Antony's. 157-181.
Lutz, M. G. (1999). A general test of the Prebisch–Singer hypothesis. *Review of Development Economics*, *3*(1), 44-57.
Myrdal, G. (1956). *An International Economy, Problems and Prospects, by Gunnar Myrdal*. Routledge and Kegan Paul.
Nelson, C. R., & Plosser, C. R. (1982). Trends and random walks in macroeconomic time series: some evidence and implications. *Journal of Monetary Economics*, *10*(2), 139-162.
Nelson, C. R., & Kang, H. (1984). Pitfalls in the Use of Time as an Explanatory Variable in Regression. *Journal of Business & Economic Statistics*, *2*(1), 73-82.
Nguyen, T. H. (1981). Trends in terms of trade of LDCs. *Journal of Economic Studies*, *8*(2), 46-56.
Ocampo, J. A., & Ros, J. (Eds.). (2011). *The Oxford Handbook of Latin American Economics*. Oxford University Press.
Pindyck, R. S., & Rotemberg, J. J. (1988). The excess co-movement of commodity prices.
Powell, A. (1991). Commodity and Developing Country Terms of Trade: What does the long run show?. *The Economic Journal*, *101*(409), 1485-1496.
Prebisch, R. (1950). The Economic Development of Latin America and Its Principal Problems. New York: United Nations.
Radetzki, M. (2006). The anatomy of three commodity booms. *Resources Policy*, *31*(1), 56-64.

Ram, R. (2004). Trends in developing countries' commodity terms-of-trade since 1970. *Review of Radical Political Economics*, *36*(2), 241-253.
Rostow, W. W. (1950). The terms of trade in theory and practice. *The Economic History Review*, *3*(1), 1-20.
Sapsford, D. (1985). The statistical debate on the net barter terms of trade between primary commodities and manufactures: a comment and some additional evidence. *The Economic Journal*, *95*(379), 781-788.
Sapsford, D., Sarkar, P., & Singer, H. W. (1992). The Prebisch-Singer terms of trade controversy revisited. *Journal of International Development*, *4*(3), 315-332.
Sarkar, P. (1986). The Singer–Prebisch hypothesis: a statistical evaluation. *Cambridge Journal of Economics*, *10*(4), 355-371.
Sarkar, P. (1994). Long-term behaviour of terms of trade of primary products vis-a-vis manufactures: a critical review of recent debate. *Economic and Political Weekly*, 1612-1614.
Sarkar, P. (2001). Technical progress and the North–South terms of trade. *Review of Development Economics*, *5*(3), 433-443.
Singer, H. W. (1950). The distribution of gains between investing and borrowing countries. *The American Economic Review*, *40*(2), 473-485.
Singer, H. W., & Meier, G. M. (1958). The terms of trade and economic development: Comment. *The Review of Economics and Statistics*, 85-90.
Singer, H. W. (1975a). The distribution of gains from trade and investment-revisited. *The Journal of Development Studies*, *11*(4), 376-382.
Singer, H. W. (1975b). The distribution of gains revisited. In *The strategy of international development* (pp. 58-66). Palgrave Macmillan, London.
Singer, H. W. (1982). Terms of trade controversy and the evolution of soft financing: early years in the UN: 1947-1951.
Singer, H. W. (1991). Terms of trade: new wine and new bottles?. *Development Policy Review*, *9*(4), 339-352.
Singer, H. W. (1998). *Growth, Development and Trade*. Edward Elgar Publishing.
Spraos, J. (1980). The statistical debate on the net barter terms of trade between primary commodities and manufactures. *The Economic Journal*, *90*(357), 107-128.
Szirmai, A. (2012). Industrialisation as an engine of growth in developing countries, 1950-2005. *Structural Change and Economic Dynamics*, *23*(4), 406-420.
Thirlwall, A. P., & Bergevin, J. (1985). Trends, cycles and asymmetries in the terms of trade of primary commodities from developed and less developed countries. *World Development*, *13*(7), 805-817.
Toye, J. (2003). Changing perspectives in development economics. *Rethinking Development Economics*, *1*, 21.
Zanias, G. P. (2005). Testing for trends in the terms of trade between primary commodities and manufactured goods. *Journal of Development Economics*, *78*(1), 49-59.
Zellou, A. M., & Cuddington, J. T. (2012a). Trends and Super Cycles in Crude Oil and Coal Prices. *Colorado School of Mines: Golden, CO, USA*.
Zellou, A. M., & Cuddington, J. T. (2012b). Is There Evidence of Super Cycles in Oil Prices?. *SPE Economics & Management*, *4*(03), 171-181.
Ziesemer, T. H. (2010). From trends in commodities and manufactures to country terms of trade.

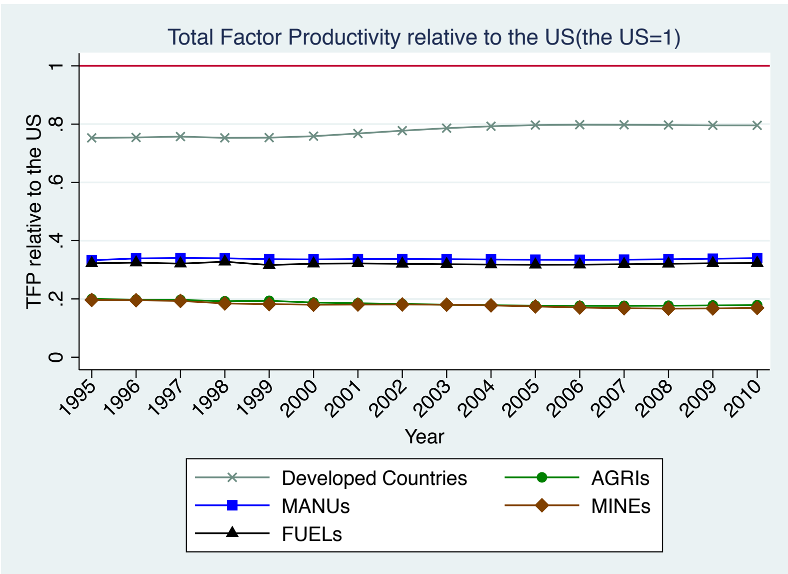
Appendix A. Gaps in Total Factor Productivity (TFP) between Country Groups

Figure A1. Trends of TFP by country group



Source: Author's calculation based on the UNIDO database.

Figure A2. Trends of TFP by sub-group of developing countries



Source: Author's calculation based on the UNIDO database.

Chapter 6. Conclusion

Industrialisation and trade have essential roles to play in development process. The economic and social effects of industrialisation have been well documented by the development literature in both economics and sociology. In the classical development theories and development economics, industrialisation is seen as a synonym for development. Almost all today's developed countries have experienced industrialisation in history. The transformation of the Asian Tigers from developing countries to developed countries further demonstrates the importance of manufactured exports in the process of industrialisation and development. Manufactured exports are also the key to success for those second-generation Newly Industrialised Countries (NICs) and emerging countries over the recent three decades.

Since the end of the Second World War, there have been two major changes in the pattern of developing countries' industrialisation and trade. First, manufactures have accounted for increasing share in developing countries' exports, especially from the 1980s onwards. However, this seemingly positive trend fails to reverse or mitigate developing countries' disadvantageous position in the global market, because the logic of the global market has been shifted from the advantage of exporters of manufactures over exporters of primary commodities to the advantage of exporters of innovative products over exporters of standardised products. Developing countries, despite being increasingly industrialised, still stick at the bottom of the global production chain as low-end manufacturers. This leads to the shift in the challenge facing developing countries from simple industrialisation to continuous upgrading of production and export structure. Second, the fast-growing trade between developing countries, namely, South-South trade, has been highlighted in the literature. The early development economics literature focuses on the political-economic benefits of South-South trade as a way to reduce the dependence of the South on the North. The recent literature has shifted the focus to the greater intensity of capital and skill embodied in South-South trade than in North-South trade. This raises the issue of export directionality. Provided that more sophisticated export direction has greater developmental effect, South-South trade is believed to be more growth-enhancing than North-South trade.

This thesis aims at contributing to knowledge on the evidence, mechanism, and determinants of developing countries' trade and industrialisation, centring on South-South trade, export upgrading, export directionality, and terms of trade. Chapter 2 to 5 address each of the four issues. The descriptive analysis in Chapter 2 highlights the "illusion" of the size and growth of South-South trade, which is a result of inappropriate country classification in the existing literature. The "illusion" has two sources. First, the inclusion of *de facto* advanced countries (i.e., the Asian Tigers and advanced former European socialist countries) in the group of developing countries strongly inflates the size of South-South trade by more than doubling it. This inflation effect particularly comes from the strong performance of the Asian Tigers in skill- and technology-intensive manufactures. Thus, the inappropriate country classification prevalent in the existing South-South trade studies generates not only an illusion of South-South trade, but also an illusion of the manufacturing and technological capabilities of the real Global South. The second source of the "illusion" is the inappropriate treatment of emerging countries and China in the South-South trade literature. If China and emerging countries, especially the former, are excluded from South-South trade statistics and South-South trade is defined exclusively as trade between real developing countries, then the growth rate of South-South trade significantly decreases and its size becomes quite small. In brief, the delightful picture of a fast-growing South-South trade, which is highlighted in the literature, is no more than a gloss of success.

Moreover, developing countries' export composition reveals some major changes over the recent two decades. Manufactures have increased their share in developing countries' exports to developed countries and have become a dominant part in this export direction, which is comparable to the share of fuels. This phenomenon corresponds to the observation in the literature since the 1960s that developing countries have undergone a shift from a primary-dominant export composition to a manufacture-dominant export composition (Sarkar and Singer, 1991; Szirmai, 2012). In contrast, fuels have become the absolutely dominant part in developing countries' exports to emerging countries and China and manufactures only account for a minor share in this export direction, which somewhat resembles the traditional North-South trade relationship. This is a result of the resource-intensive industrialisation and urbanisation of emerging countries and China, reflecting the super cycle of commodity prices since the middle 1990s and the commodity boom since the early 2000s. Moreover, trade potential analysis shows that developed and emerging countries show high trade complementarity with developing countries, whereas developing countries' trade complementarity with developed and emerging countries is low. In other words, the needs of developing countries for the rest of the world is larger than the needs of the rest of the world for developing countries, which implies the disadvantageous position of developing countries in the global market.

Chapter 3 examines the determinants of developing countries' export upgrading with a particular interest in the impact of China and productive investment. Amongst general contributors, this chapter highlights the role of access to sea, human capital, productive investment, and trade openness. Landlocked countries are doomed to be at a disadvantageous position of export upgrading, a "curse of geography". However, efforts in improving education, accumulating productive investment, and promoting openness are definite ways to stimulate export upgrading. By contrast, FDI inflow, population, and institutional quality, which have been found or argued to matter for export upgrading in several previous studies, are not found to matter here. The first reason may be the developing countries-only sample in this chapter. FDI going to many developing countries concentrates on extractive sectors or, more generally speaking, natural resource sectors, and thus tends not to enhance export sophistication. Moreover, developing countries tend to have excessive but low-skilled labour force, and thus larger population or richer labour endowment is not necessarily a cost advantage for the cost discovery of new productive activities as suggested in the cost discovery model (Hausmann and Rodrik, 2003; Hausmann, Hwang, and Rodrik, 2007). The absence of the effect of institutions on export upgrading supports the argument that institutional quality in the mainstream terms is like a black box with a vague role to play. Institutions can be regarded as an input into productive activities and production upgrading, but the mechanism underlying the functioning of institutions is unclear. It may take effect through either a better planning of production or a better functioning of the market. Perhaps more importantly, because industrialisation is socially determined, it reflects the motivations and interests of various political and social agents, from the state to entrepreneurs. Moore (1966) points out that all industrialisations in history are intrinsically up-to-down revolutions led by minority group. That is to say, industrialisation is a profit- or interest-driven process initiated by those from the upper social class, such as entrepreneurs and politicians, in order to fulfil their own interests, rather than to fulfil the needs of the average people (Kiely, 1998). Thus, agents' motivations may play a more important role than the so-called "institutional quality" in the industrialisation process. This accords with the centrality of strong and developmentally-oriented elites in the developmentalist model of industrialisation and development (Leftwich, 1995). In this sense, it should not be surprising that institutional quality in the mainstream terms is not found to be relevant for developing countries' export upgrading.

In turn, the influence of the motivations of political and social agents or, alternatively speaking, the social determinants of export upgrading are captured by the robust positive role of productive investment. Productive investment is a proxy for the political-economic embeddedness that shapes the motivations of political and social agents. Higher productive investment reflects greater motivations of agents to promote industrial production, either for economic profits or for political interests. Moreover, developing countries' absolute gains from trade with China, measured by income terms of trade, are an important source of their productive investment. Trade with China contributes to developing countries' export upgrading through their enhancing effect on productive investment. The absolute gains from trade with China can be largely explained by the rising prices of primary commodities due to China's great demand, decreasing prices of manufactures due to China's considerable supply, and the great growth in developing countries' exports to China. This effect is particularly strong and robust for the period of 2002-2014, during which China rapidly strengthened its role in the global economy.

This finding provides an alternative perspective to view the influence of China on developing countries' industrialisation. Previous studies tend to consider the direct channel through which exports to China or imports from China may crowd out developing countries' manufacturing and risk their re-primarisation. However, they neglect the indirect channel through which trade with China may contribute to local manufacturing as a source of productive investment. The finding here suggests that, for developing countries, China serves more as a stimulator of capital accumulation than a competitor in manufacturing market or a predator of natural resources. Therefore, the priority for developing countries is the appropriate use of gains from trade for productive purpose.

Chapter 4 presents the evidence on the directionality of developing countries' export sophistication and examines the determinants of this directionality. International trade theories predict that South-South exports should be more sophisticated than South-North exports. However, the latest evidence between 1995 and 2014 shows that while more than half of developing countries tend to have more sophisticated Southbound exports than Northbound exports on average, the opposite is true for the others. This phenomenon reflects the heterogeneity within developing countries. A country's productive capabilities are found to be a major and robust determinant of export directionality. Developing countries that have greater productive capabilities are less likely to have more sophisticated Southbound exports than Northbound exports. By contrast, lower productive capabilities lead to lower Northbound export sophistication or higher Southbound export sophistication. The mechanism underlying this finding may be related to technological and productive gap between exporting countries and importing countries. Greater technological and productive gap weakens developing countries' competitive advantages in relatively sophisticated products in developed and emerging countries' markets, which reduces or even impedes their sophisticated exports to these countries. In contrast, smaller gap makes it easier to export relatively sophisticated products to other developing countries with similar technological and productive level. Developing countries that have lower productive capabilities are not able to enter more advanced markets and/or the downstream value chains with their relatively sophisticated products. Instead, they have to access more advanced markets with less sophisticated products, and markets of other developing countries are a natural outlet for their relatively sophisticated products. However, for developing countries that have greater productive capabilities, the technological and productive gap with developed and emerging countries is smaller and they are able to export relatively sophisticated products to these markets. The implication of export directionality is clear. Promoting the more sophisticated export direction should be, in theory, more beneficial to export upgrading. A potential way to achieve this goal is to develop trade agreement with countries in the more sophisticated direction. However, policy makers should also take into account the absolute sophistication level of the more sophisticated export direction, because the sophistication of both Southbound and Northbound exports may be low in absolute terms.

Finally, Chapter 5 examines the recent trends of developing countries' terms of trade, which provides the latest evidence to the Prebisch-Singer hypothesis. Time series analyses show significant differences between developing countries' net barter terms of trade *vis-à-vis* developed countries and *vis-à-vis* China and other emerging countries on the one hand, and differences between the behaviours of net barter terms of trade of different groups of developing countries on the other. Developing countries' net barter terms of trade *vis-à-vis* developed countries tends to show significant positive trends, which is stronger for those specialising in fuels or minerals and weaker for those specialising in agricultural products or manufactures. Three factors may explain this positive trend: the great share of manufactures in developing countries' exports to developed countries, developed countries' diverse demand for primary commodities from developing countries, and a by-product of the commodity boom led by emerging countries. Thus, this positive trend is likely to be a period-specific phenomenon. Importantly, this finding may not intrinsically contradict the Prebisch-Singer hypothesis, because the very core of the welfare conclusion of the Prebisch-Singer hypothesis lies in double factoral terms of trade, rather than net barter terms of trade, of developing countries *vis-à-vis* developed countries. Given the much greater technological and productive progress of developed countries, developing countries' positive net barter terms of trade is likely to be weakened or even turn to be unfavourable factoral terms of trade.

On the other hand, developing countries' net barter terms of trade *vis-à-vis* China tends to show negative trend or to be trendless, except those specialising in fuels. Three factors may account for this phenomenon: the concentration of China's fast-growing primary commodity demand on fuels and minerals, cheap manufactures from China, and the marginalisation of manufactures in developing countries' exports to China. Developing countries that specialise in "soft commodities", rather than those "hard commodities", tend not to benefit from China's commodity boom, even if cheap manufactured imports from China may act as a countervailing force to some extent. In contrast, since developed countries tend to import a wider range of primary commodities (e.g., agricultural products) from developing countries, developing countries specialising in "soft commodities" may still benefit from their trade with developed countries in relative terms. The greatest deterioration in net barter terms of trade is recorded for developing countries specialising in manufactures. This indicates these countries' relatively disadvantageous position in the trade relationship with China, because they may directly compete with China in manufactures and tend not to benefit from China's commodity boom. Developing countries' net barter terms of trade *vis-à-vis* other emerging countries shares a somewhat similar situation with that *vis-à-vis* China, but being less unfavourable. In brief, on a global scale, developing countries specialising in agricultural products or manufactures are at a weak position in the global market, whereas those specialising in fuels or minerals are at a relatively favourable position. However, unfavourable or less favourable situation in net barter terms of trade can be compensated by growth in export volume. All groups of developing countries show substantial improvement in their income terms of trade *vis-à-vis* the rest of the world, especially China, implying great absolute gains from trade.

The findings on terms of trade and export upgrading can corroborate each other, pointing to the central concerns of this thesis that whether developing countries need to industrialise and how they can industrialise through trade. Developing countries' necessity to industrialise can be basically ascribed to the role of the special properties of industry in promoting economic and social development and the unequal exchange embedded in the unequal and unbalanced world economy. The former concerns the internal motivations of industrialisation and the latter is concerned with the external constraints that push developing countries to industrialise. Chapter 5 on developing countries' terms of trade demonstrates how developing countries still face unequal exchange in the new global economic hierarchy even if the growth in the volume of trade with developed and emerging countries has generated absolute gains for them. This corroborates the argument that the growth in trade volume and improvement in income terms of trade tend not to generate global (North-South) convergence (Raffer and Singer, 2001). In order to achieve development under this global inequality, developing countries need to upgrade their production structure, which relates to Chapter 3 on the determinants of export upgrading. Although trade growth and improvement in income terms of trade tend not to generate global convergence, absolute gains from the trade growth provide the material conditions for developing countries to upgrade their production structure and eventually give the opportunity to reduce the global inequality.

As found in Chapter 3, absolute gains from trade promote export upgrading through their enhancing effects on productive investment. Therefore, the challenge faced by developing countries is whether and how they can channel these gains to productive investment. According to the social account of industrialisation, social and political agents and the context in which they are embedded play the central role in this process. With both external constraints on a global scale and the lack of development-conducive social and political context, developing countries should have developmentally-oriented agents (e.g., developmental states and entrepreneurs) in place to promote industrialisation. However, the question to development theory is how such agents can be generated. Provided that particular social and political conditions should be in place prior to the inauguration of industrial take-off, economic growth *per se* might not be the cause but the outcome of the emergence of such agents. Then, the concern lies in whether developing countries have the endogenous mechanism to generate developmentally-oriented agents.

This question should be considered by taking into account different types of export specialisation, because country with a particular export specialisation may need distinct agents to realise industrial development. For developing countries specialising in agricultural products, industrialisation should not be understood only as the development of manufacturing, but also as the industrialisation of agricultural production, as suggested by Chang (1949). More importantly, the industrial-agricultural relations should be treated as a complementary one (Karshenas, 1995). Without the increase in agricultural productivity and the resulting outflow of agricultural surplus, countries specialising in agricultural products tend not to have necessary sources of investment to inaugurate and sustain industrial development. Moreover, agricultural development can also stimulate agricultural exports and then increase the capacity to import capital goods. In order to boost agricultural development and channel agricultural surplus into industry, a group of development-conducive rural agents (e.g., the landowning class and the peasants) who will not refuse changes in technology and production organisation should be in place. For developing countries specialising in manufactures, the primary concern lies in the accumulation of investment for expanding production and upgrading technology. To this end, a strong state that can autonomously implement industrial policy and a group of active entrepreneurs that engages in exploring new productive activities are of central importance. Moreover, a healthy relationship between the state and the business, say state-business relations, is also a must. Finally, for developing countries specialising in minerals and fuels, the key issue is the appropriate use of resource rents. Importantly, both rentier and predator states, which are not uncommon in this group of countries, must be avoided. However, this issue relates to power relations within the bureaucracy and between the state and the mining and fuel business, which are deeply embedded in social and political contexts.

References

Chang, P. K. (1949). *Agriculture and industrialization*. Harvard University Press, Cambridge.

Hausmann, R., & Rodrik, D. (2003). Economic development as self-discovery. *Journal of Development Economics*, *72*(2), 603-633.

Hausmann, R., Hwang, J., & Rodrik, D. (2007). What you export matters. *Journal of Economic Growth*, *12*(1), 1-25.

Karshenas, M. (1995). *Industrialization and Agricultural Surplus*. Cambridge: Cambridge University Press.

Kiely, R. (1998). *Industrialization and Development: An Introduction*. Taylor & Francis Limited.

Leftwich, A. (1995). Bringing politics back in: Towards a model of the developmental state. *The Journal of Development Studies*, *31*(3), 400-427.

Lo, D. (2016). Developing or Under-developing? Implications of China's "Going out" for Late Development (SOAS Working Paper No. 198).

Moore, B. (1966). Social origins of democracy and dictatorship. *Boston: Beacon*.

Sarkar, P., & Singer, H. W. (1991). Manufactured exports of developing countries and their terms of trade since 1965. *World Development*, *19*(4), 333-340.

Szirmai, A. (2012). Industrialisation as an engine of growth in developing countries, 1950-2005. *Structural Change and Economic Dynamics*, *23*(4), 406-420.