The State Again

PhD Research Thesis of
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Trento, 30th of April 2019

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"And today we see how utterly mistaken was the Milton Friedman notion that a market system can regulate itself. We see how silly the Ronald Reagan slogan was that government is the problem, not the solution. This prevailing ideology of the last few decades has now been reversed.

Everyone understands now, on the contrary, that there can be no solution without government. The Keynesian idea is once again accepted that fiscal policy and deficit spending has a major role to play in guiding a market economy. I wish Friedman were still alive so he could witness how his extremism led to the defeat of his own ideas."

- Paul Samuelson -
(Samuelson, 2009)

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To my parents, to my brothers and to my sisters,
because thanks to them and to their different spirits, I have always heard different bells,
and despite they were often different to mine, I have always had their support.

To the critical thinking teachers of my life,
because thanks to them I came across to a broader way of approaching reality and life
and I had their example in fighting for a more social equitable world.

To the State,
because directly and indirectly it has always supported my education path,
my health care needs and, ultimately,
my whole freedom as a citizen.

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To maintain accordance inside every chapter, the figures and tables in Chapters II-IV are kept with the same format to the original papers submitted to the different journals.

- Chapter I -
The State again, an overview

February 14, 2019

The overall goal of this work is to study the effect of a crisis on the distribution and employment and the space of manoeuvre of the government for supporting and reverting the negative shock produced by such a crisis. Every chapter of this work and the related models are supported by both a theoretical background analysis and by numerical dynamic simulations.

Stylized facts show that the income and wealth inequality in all the OECD countries has been constantly increasing after the 1960s. Piketty has been one of the most important authors that highlighted the rising inequality issue, mainly in the OECD countries. For example, Piketty (2014) shows that the income share held by the top percentile in countries such as US, Canada and UK increased from 8%-10% in the 1960s up to 14%-18% in the current decade. Similar figures are now provided by the World Inequality Lab[1] that has updated data for almost every country up to 2016. At the same time, the wage share for the majority of the OECD countries substantially decreased. For example, countries such as Italy and Spain experienced a decrease in wage share from about 73% in the 1970s to about 63% in the current decade (Hein, 2014).

Taking into account such a stylized fact, we will consider a model with two social classes, workers and capitalists. These social classes differ in terms of their initial endowment, their consumption behaviour, the different loans repayment conditions required to them by the banks and in terms of the ways in which they can use their financeable wealth. This is a very important departure hypothesis from the mainstream point of view models that generally consider a population made up of "*a representative agent*" of the whole society.

Considering the inequality levels that the OECD countries are experiencing, we took the Post-Keynesians school of thought as a very good reference point since it always focused its attention on the relation between the level of employment, the aggregate demand and the distribution between social classes. In line with the post-Keynesians tradition, we believe that a theory cannot be correct unless it starts from realist or realistic hypotheses, although it is recognized that assumptions are always abstractions and simplifications (Lavoie, 2014).

[1] https://wid.world/world/#sptinc_p99p100_z/US;FR;DE;CN;ZA;GB;WO/last/eu/k/p/yearly/s/false/4.8255/30/curve/false/country

Therefore, we developed a step by step model with the analysis of an economy based on some well-known stylized facts. Beyond the social classes distinction, we take into consideration the temporal lag between production and sales of products by firms and the one between income received by the social classes and their expenditure. Those two temporal lags are the very key aspects we focus our attention on in the model presented in *Chapter II* named "Keynes, Kalecki and Metzler in a Dynamic Distribution Model".

In that chapter, we merge the hints of Keynes and Kalecki about the distribution of social classes and the intervention of the government in supporting the aggregate demand together with Metzler's hint about the mismatching process between aggregate demand and aggregate production. Metzler's mismatching process would finally generate inventories of consumption goods. More specifically, it is argued that even if Post-Keynesians models focused their attention on output growth, employment and income distribution relating those issues with a stronger intervention of the state, they all (even the canonical Kaleckian model) overlooked the adjustment - or non-adjustment - dynamics from the ultra-short run to the short run period upon which the short run and long run models are then constructed.

In fact, even if the Kaleckian models completely reject the standard neoclassical production function (rejecting diminishing returns and rejecting the substitution between capital and labour) they also very strongly rely on a final equilibrium between aggregate demand and aggregate production. The canonical Kaleckian short run models are constructed upon the consideration of the effective labour demand curve defined as "the locus of combinations between real wages and levels of employment which ensure that all produced goods are sold at the price set by firms" (Lavoie, 2014). As argued by Lavoie (2014), this construction assures that an increase of real wage leads to an increase in the employment level. That has been and still is definitely one of the cornerstones for the Post-Keynesian authors.

We argue that the equilibrium assumption between the aggregate demand and the aggregate production plays a key role in obtaining the standard Kaleckian conclusions regarding the relation between effective demand, employment levels and the distribution of surplus product between the social classes. The main question arising from the previous enquiring exercise about adjustment dynamics in the Kaleckian framework is that, because of the overlooking on that adjustment process between aggregate production and aggregate demand, also its conclusions might be consequentially affected. More precisely the main Post-Keynesian Kaleckian conclusions to assess are the following: would it still be true that higher real wages lead to a higher level of employment? Would it still be true that a decrease in the propensity to save will lead to an increase in output and employment? Would it still be true that in order to keep employment

from falling, whenever there is an increase in productivity there must be some increase in real wages? And finally, most importantly in terms of policies, would it still be true that in order to keep employment from falling, even when the economy faces a pari passu increase of real wage and productivity level, it would be necessary an increase in real autonomous expenditure such as a strong government one?

In this way, our model analyses under which conditions the standard Kaleckian conclusions are still valid considering a disequilibrium situation. Two scenarios are simulated: one with fixed expectations as in Metzler (1941) and another new one based on adaptive expectations and asymmetric behaviour of the wages-unemployment relation. The model questions the effective demand labour curve and suggests that an increase in real autonomous expenditures, mainly by the Government, might be even more essential than what is generally considered in the Kaleckian literature, to avoid increasing unemployment in an increasing wage world.

The model presented in *Chapter III* named "The stabilising role of the Government in a Dynamic Distribution Growth Model" builds upon the model presented in Chapter II and considers once again the effect of a crises on the relation between aggregated demand, employment and distribution between social classes adding important characteristics of realism that were absent in the previous chapter. Here, we consider the gestation period of the investments and the presence of the government investigating its margin of manoeuvre in such an economy. The first aspect takes inspiration by Kalecki (1971) himself who considers the three different Investment stages: investment order or Demand (I^D), investment Production (I^P) and investment delivery or Completion (I^C). In line with a post-Kaleckian perspective, we consider the expected profitability and the capacity utilisation as the two main variables as driving forces for the investment decisions. The second new aspect of this model compared to the one presented in Chapter II is the explicit presence of the government. In fact, even if chapter II suggested the Government as the emblematic autonomous figure able to foster expenditure in times of recession, its actual role in the economy was not analysed. Many post-Keynesian scholars have underlined how recent decades have been characterised by a strong downgrading of the fiscal policy role as a stabilisation instrument of macroeconomic policy (Arestis and Sawyer, 2003). In this way, this chapter analyses exactly the space of manoeuvre of the government and the role of the fiscal policies into a "functional finance" framework where the government "can and should be called upon as a key part of the remedy" (Fazzari, 1994) to ensure a high level of economic activity whenever the private sector is unable to do so by itself.

In the light of such a functional finance framework, the government actions should be inspired to achieve a more stable and sustainable growth path. More specifically, we here investigate the possibilities that the Government has to boost and support the economic activity with its two main tools, public investments spending and a taxation system in two scenarios. The first scenario simulates an exogenous fall of private investments while the second one relates to an exogenous increase in labour productivity and real wages. In particular, here we test the canonical Kaleckian model conclusion according to which even when the economy faces a pari passu increase of real wages and productivity level it would be necessary an increase in real autonomous expenditures - such as the one implemented by the government - in order to keep employment from falling.

At the same time, the aim of this chapter is also to explore the role of the Government in stabilising the economy exactly thanks to the previous tools. In fact, Chapter II underlined the possibility of an arising unstable path from a mismatching dynamic between aggregate demand and aggregate production. It was argued that such an unstable path might develop because of "wrong" oversensitive expectations of firms regarding the production of consumption goods. Therefore, chapter III focuses exactly on the space of manoeuvre of the government in stabilizing an unstable economic scenario caused by a crisis.

The model built in *Chapter IV* named "The distributive monetary analysis of a sustainable ecological economy" is the natural evolution of the models developed in Chapters II and III. In such a model all the previous stylized facts are contained, namely the temporal lag between production and sales of products by firms, the temporal lag between income received by the social classes and their expenditure, the gestation period of the investments and, finally, the intervention of the government. The most important difference with respect to the models presented in the previous chapters is its overall monetary and ecological framework. In fact, for simplification purposes the previous models were assuming that, in line with a horizontalist approach, commercial banks were providing funds on demand to firms for financing their investments. However, the explicit relations among all the sectors of our economy were not fully exposed. In this chapter Graziani's endogenous money theory is used and we are developing a Post-Keynesian Stock Flow Consistent (SFC) model to track all the economic relations, both the real and monetary ones. At the same time, the use of a SFC model ensures that "there are no black holes - every flow comes from somewhere and goes somewhere" (Godley W. , 1996) through a rigorous accounting framework, which guarantees a correct and comprehensive integration of all the flows and the stocks of an economy.

Such as Kalecki, Graziani and the circuitists economists introduce a preliminary distinction between producers and wage earners. The first step of the monetary circuit is always characterized

by firms' decision to activate production and, in order to do so, they take up loans by commercial banks. In this sense, commercial banks are able to create deposits ex nihilo, granting them loans and, at the same time, creating deposits. In this way, the starting logical cause of the expansion of money is exactly the firms' willingness of contracting a liability to activate production.

In the second step, firms use those loans to pay workers and in this way to obtain the amount of consumption goods desired through the production process. When such funds are transferred by firms to households they instantaneously become income paid for the work provided to firms by workers.

Finally, the last step of the Monetary Circuit is characterized by the households' spending decision to use the money balances previously obtained as income. In this step, while households use their funds to buy consumption goods, firms obtain back those money balances they initially paid to households for their work.

In this way, the previous Monetary Circuit analysis is not in contrast with the one made by Kalecki upon the way workers obtain their wages and use all of them to buy consumption goods while capitalists are able to spend just a proportion of their income.

Finally, together with its social and monetary framework, our economy is also characterized by an environmental one since we here study the impacts that the economic consumption has in terms of ecological erosion of natural resources.

In this way, the model of chapter IV questions the expenditure margins of the Government – in particular after a crisis - and uses the suggestions of the monetary circuit theory to analyse the space for fiscal policies to reduce unemployment boosting the economic activity, to obtain a more equitable distribution between social classes in a sustainable ecological way. Our understanding is that despite many contributions focused on the topics of recovery, distribution and ecological sustainability, few of them tried to tackle them all in a comprehensive way considering the rediscovery of the endogenous money phenomena as one of the most important breakthroughs in the last decades. Here we argue that exactly the endogenous money feature is the essential fil rouge to better understand and connect the three previous important aspects. It is so when we analyse the sectors connections and the policies ones devoted to recovery, and also if we consider how the different incomes and wealth are captured and distributed by the different social classes and finally when we point out the ways of financing long term ecological path to preserve a sustainable environment.

Indeed, our overall work in Chapter II, Chapter III and Chapter IV is a step by step construction of an organic and consistent model. It starts with a more theoretical and simplified approach through Chapter II which investigates the (in)stability conditions of the Kaleckian approach while

suggesting the presence of an autonomous figure such as the government one. Chapter III adds more real base features through endogenous investments and government presence while Chapter IV finally concludes considering all the real and monetary links of the sectors into a social and ecological framework.

- Chapter II -
Keynes, Kalecki and Metzler in a Dynamic Distribution Model

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November 21, 2018*

This paper focuses on the dynamics analysis from the ultra-short to the short period from a Post-Keynesian perspective. It is argued that the construction of both the short run and the long run models are based on the critical assumption of an equilibrium between aggregate demand and aggregate supply. Starting from the work by Metzler (1941), the issue of equilibrium and stability is investigated inside a Keynesian-Kaleckian perspective. The suggested model analyses under which conditions the standard Kaleckian conclusions are still valid considering a disequilibrium situation. Two scenarios are simulated: one with fixed expectations as in Metzler (1941) and another based on adaptive expectations and asymmetric behaviour of the wages-unemployment relation. The model questions the effective demand labour curve and suggests that an increase in real autonomous expenditures, mainly by the Government, might be even more essential than what is generally considered in the Kaleckian literature, to avoid increasing unemployment a world with increasing wages.

Key words: Kalecki, Post-Keynesian Economics, Disequilibrium, Adjustment dynamics
JEL classifications: B5, E11, E12, E32

> *"It is necessary to "think dynamically". The static system of equations is set not only for its own beauty, but also to enable the economist to train his mind upon special problems when they arise. A new method of approach – indeed, a mental revolution - is needed."*
>
> (Harrod, R.F., 1939: 15)

2.1 Introduction

The Post-Keynesians have always focused on issues such as output growth, employment and income distribution and, in the last decade, Kaleckian models were developed to show the

* This paper has been submitted to the ***Cambridge Journal of Economics*** in the date indicated and accepted.
I am grateful to my PhD Supervisors, Malcolm Sawyer and Stefano Zambelli, for their suggestions and comments to the present work. I am also grateful to Marc Lavoie, Stephen Kinsella and Marco Veronese Passarella for the inspiring discussions we had about the development of this paper that allowed me to deeply shape and improve it. Any remaining errors or omissions are strictly my own.

relevance of the previous issues in justifying a stronger intervention of the state and stronger public policies. It is argued that while those models reject Say's law, even the canonical Kaleckian one overlooked the adjustment - or non-adjustment - dynamics from the ultra-short run to the short run period upon which the short run and long run models are constructed. Lavoie (1996) is one of the most audacious attempts to focus on the traverse from one equilibrium position to another, tackling the adjustment dynamics and considering the effect of hysteresis. However, in general, all disequilibrium ultra-short-period states are left aside, assuming that "the period under consideration is long enough for firms to adjust their production to actual demand, and hence that the economy always operates on the effective labour demand curve" (Lavoie, 2014).

The main question arising from the previous exercise about adjustment dynamics in the Kaleckian framework is that, because of overlooking that adjustment process, conclusions are affected consequentially. More precisely, would it still be true that higher real wages lead to a higher level of employment? Would it still be true that a decrease in the propensity to save will lead to an increase in output and employment? Would it still be true that in order to keep employment from falling, whenever there is an increase in productivity there must be some increase in real wages? And finally, most importantly in terms of policies, would it still be true that in order to keep employment from falling, even when the economy faces a pari passu increase of real wage and productivity level, it would be necessary an increase in real autonomous expenditures such as a strong government one?

This paper proceeds as follows. Section 2 retraces the Post-Keynesians models of short run and long run focusing on the Kaleckian one. Section 3 suggests a reconsideration of the dynamics process including some of Metzler's suggestions in a Keynesian-Kaleckian framework. Section 4 develops a set of preliminary simulations to assess the robustness of the standard Kaleckian conclusions. Section 5 draws together the conclusions.

2.2 The canonical Short Run and the Long Run Post-Keynesian Kaleckian models

To analyse the relation among the level of employment, the aggregate demand and the distribution between classes of an economy within a Post-Keynesian framework Kaleckian models are generally proposed. These are based on the analysis of the effective demand constraint – the consideration that aggregate supply needs to be equal to aggregate demand.

Kaleckian models reject standard neoclassical production function. They reject diminishing returns (assuming constant marginal costs -up to full capacity - and therefore constant or increasing returns) and substitution between capital and labour. Lavoie (2014) summaries

brilliantly the labour peculiarities with respect to capital and the consequent need to reject the neoclassical production function.

We will focus our attention on retracing the canonical Kaleckian model of short period and after that on the related adjustment process from the short to the long period as presented "by textbook" up to this day. We will briefly go back over the previous path as it is presented by Lavoie (2014) - one of the most important as well as accurate and widely used Post-Keynesian economics textbooks.

2.2.1 Retracing the canonical Short Run Kaleckian model

The Kaleckian model is generally presented considering a closed economy without any Government presence where, therefore, the components of the aggregate demand are consumption and investment. From the consideration of GDP on the expenditure and distribution side, at the end of each economic period, we can rely on the following identity:

$$Y = Consumption + Investment = Wages + Profits \quad (1)$$

In a Keynesian and Kaleckian view, some of the components of the aggregate demand are autonomous and some of them are induced. Consumption is made of consumption from wages C_w - and consumption from profits - C_π.

Taking the basic version of the model (and the original assumption by Kalecki), it is assumed for simplicity that workers consume entirely their wages with a marginal propensity to consume equal to one (c_w = 1) not being able to save. The aggregate demand is then composed of an endogenous component related to the wages obtained by workers and an autonomous component made of consumption out of capitalists and of investment expenditure.

$$AD = wL + A = wL + ap \quad (2)$$

being w the nominal wage rate, L the amount of employment, a the real autonomous expenditure, p the price level (and therefore A being the nominal autonomous expenditure).

On the supply side, the Kaleckian model does not have a proper production function. It is replaced by a "utilization function". Assuming only direct labour use (the labour proportional to production), the aggregate supply equation would be the following one:

$$AS = pq^s = pLy \quad (3)$$

In (3) the quantity obtained in the production process is a direct function of the labour employed (L) and of the labour productivity (y, here assumed constant). Here production and supply periods are implicitly considered overlapping, meaning that what is supplied in a certain period is considered produced in the same one. This obviously may not always be the case, since production

takes time and a mismatch of the production-supply periods might occur. An implicit simplification is therefore used making them exactly overlap.

Equating aggregate demand and aggregate supply – (2) and (3) – into (4), we find the effective demand constraint - equation (5) -, or the effective labour demand curve. That is defined as "the locus of combinations between the real wage and the level of employment that ensure that whatever is being produced is sold… such that the goods market is in equilibrium" (Lavoie, 2014).

$$AD = AS \tag{4}$$

$$(w/p)_{eff} = y - \frac{a}{L} \tag{5}$$

Equation (5) can be reversed and written as an employment function (6):

$$L^{D}_{eff} = \frac{a}{y - \left(\frac{w}{p}\right)} \tag{6}$$

Obviously, equations (5) and (6) describe the same scenario. As figure 2.1 shows, the Kaleckian labour demand curve is reflecting an upward sloping labour demand curve - until full capacity utilization.

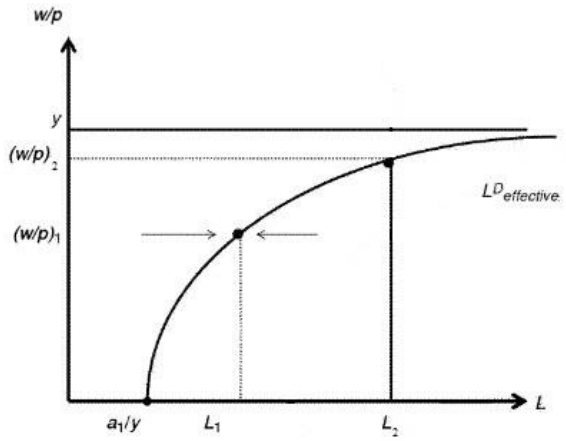

Figure 2.1. The Kaleckian post-Keynesian model of employment.
Source: Adapted from Lavoie, 2014, p. 293

Once the Kaleckian model structure has been presented, the adjustment process of production to demand is explained as follows:

> As long as firms react to a situation of excess supply (demand) on the goods market by reducing (increasing) production, rather than changing the mark-up and hence prices, the economy will move horizontally towards the locus of equilibria, that is, towards the effective labour demand curve. In other words, the model exhibits stability under these conditions. Henceforth we will presume when doing comparative analysis, that the period under consideration is long enough for firms to adjust their production to actual demand, and hence that the economy always operates on the effective labour demand curve (emphasis added).
>
> (Lavoie, 214, p.293)

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As a consequence of the previous argument, some fundamental conclusions have been proposed (Lavoie, 2014, p.295-297):

1) "Higher real wages will generate more employment". This could be so for different reasons such as a higher nominal wage claim by workers not followed by the same increase in prices. In a different way, the increase of real wages could be due to a decreasing mark-up applied by the firms (due, for example, to higher competition in the market) not followed by the same speed in the reduction of prices. Whatever the trigger of the real wage increase, that would lead to a higher level of employment thanks to the employment multiplier effect, as explained in Lavoie (2014).
2) An increase in the propensity to save out of profit will lead to a reduction in output and employment.
3) In order to keep employment from falling, whenever there is an increase in productivity there must be some increase in real wages.
4) In order to keep employment from falling and avoid technological unemployment, even when the economy faces a pari passu increase of real wage and productivity level, there should be an increase in real autonomous expenditure such as a strong government expenditure.

"The canonical Kaleckian model of growth and distribution" is then presented by considering the dynamic version of the principle of effective demand that is the "equilibrium locus on the goods market, by equating aggregate supply with aggregate demand" (Lavoie, 2014). Exactly equating aggregate supply with aggregate demand will imply investments are equal to savings.

$$I = S \tag{7}$$

The canonical Kaleckian long run model is then based on the dynamic version of equation (7):

$$g^i = g^s \tag{8}$$

where g^i is the rate of growth of investment and g^s is the rate of growth of savings.

It is therefore evident how both the canonical short run as well as the long run Kaleckian models are constructed on the equalization between aggregate demand and aggregate supply. That, in turn, is based on an adjustment mechanism that leads the economy exactly on its effective demand curve. In short, everything must ultimately converge.

Although this convergence process could possibly and eventually take place, to assume that is far from obvious, straightforward and innocuous. In this sense, if even Kaleckians have often omitted references to the inventories issue, our goal here is to contribute by filling this gap through

the stability and adjustment analysis by studying under which circumstances some of the usual corollaries may be nuanced.

2.2.2 Questioning the canonical Kaleckian short run and long run models

The last part of Lavoie (2014) sentence quoted in Section 2.1 shows how, in general, Post-Keynesian economists leave aside a computational analysis of the adjustment process in the ultra-short period. Lavoie (1996) is one of the most audacious attempt to focus on the traverse from one equilibrium position to another, tackling the adjustment dynamics and considering the effect of hysteresis. However, in general, the assumption of the economy being already in the short period in the Kaleckian model explanation is made. Lavoie (2014) suggests that "ideally, a formal model would take into account changes in inventories" and the aim of Section 3 will be exactly to build a computational model analysing the adjustment (or non-adjustment) process in a Kaleckian framework by considering the time lags in more detail.

Our analysis starts with the equilibrium condition between the aggregate actual demand and the aggregate supply (4). Now, simply by substitution, from (4), equation (6) can be easily derived through the following steps:

If and When $$AD = AS \tag{4}$$

$$wL + ap = pLy \tag{9}$$

$$\frac{w}{p}L + a = Ly \tag{10}$$

$$L\left(y - \frac{w}{p}\right) = a \tag{11}$$

Then $$L_{eff}^{D} = \frac{a}{y - \frac{w}{p}} \tag{6}$$

Following the previous steps, it could be argued that iff aggregate demand is equal to aggregate supply (4) we would obtain the effective labour demand curve as described in figure 1. In fact, when (4) is not assured, the economy could be oscillating with stability around it (in a sort of mismatching situation between aggregate supply and aggregate demand), fluctuating with an implosive or explosive behaviour, or even without an increasing curve at all. The potential indeterminability of such an effective labour demand curve could undermine not only the theoretical aspect of the Post-Kaleckian analysis but also the policies deriving from it. For

example, not having an effective demand curve with the shape of figure 1 could mean undermining the conclusion 1 previously cited according to which higher real wages will generate more employment.

Although we consider the presentation of the canonical Kaleckian model extremely important in the Post-Keynesian literature, further helpful insights could be gained by using an algorithmic procedure. Our first research question concerns the main canonical Kaleckian model conclusions explained excellently in Lavoie, 2014, p. 295-298. More specifically such research questions are linked to the following issues:

1) Can we be sure and assume that (already in the short run and then more in general) the economy reaches and stays on the effective labour demand curve?
2) Would it still be true that higher real wages lead to a higher employment? This point is linked to the paradox of costs.
3) Would it still be true that an increase in the propensity to save will lead to a reduction in output and employment? This point directly refers to the paradox of thrift.
4) Would it still be true that in order to keep employment from falling, whenever there is an increase in productivity, there should be some increase in real wages?
5) Would it still be true that in order to keep employment from falling, even when the economy faces a pari passu increase of real wages and productivity level, it would be necessary an increase in real autonomous expenditures such as one implemented by the government?

2.3 The ultra-short run reconsidered: an alternative dynamic analysis

To tackle the fulfilment of the effective demand constraint, we have to consider what this implies: the equality between aggregate demand and aggregate supply. The effective demand is generally defined as "the locus of combinations between real wages and levels of employment which ensure that whatever is being produced is sold at the price set by firms" (Lavoie 2014, p. 282).

As discussed above, to suppose that we already are on the effective demand curve or that "the period under consideration is long enough for firms to adjust their production to actual demand" is like considering we have hit directly upon the effective demand curve without truly computing a real reaction (and not necessarily adjustment) mechanism. Once we believe we are on the effective demand labour curve, moving along that is like considering we got stuck in a pre-determined groove: we can only remain in a certain point, move up or down along that. We are

not allowing the possibility for the economic system to constantly be off that path or to deviate once we are on it.

The keystone of inventories analysis is the work done by Metzler (1941). Metzler himself considers two types of time relations: a "Robertson or Receipt-Expenditure lag" and a "Lundberg or Sales–Output lag". The former refers to "the lag in the expenditure of income behind its receipt" (Metzler, 1941). The latter "Lundberg S-O" lag refers instead to the existing lag between the change in revenue from sales and the output of consumer goods. "In other words, businessmen were assumed to base their production in period t upon sales in period t-1" (Metzler, 1941). This lag is the one that generally produces an impact on inventories. Although Metzler himself stresses the relevance of both lags, he finally prefers to focus only on the Lundberg S-O lag.

2.3.1 The core assumptions of the model and national identities

In contrast to Metzler, we will try to merge the two types of lags, since we consider both lags are more representative of the current real world situation.

Before considering the reaction (and not necessarily adjustment) mechanisms implicit in the described lags, we will try here to disentangle the forces that lie behind the aggregate production by firms and the ones tied to aggregate demand. This would not necessarily imply that everything produced by firms is actually sold, thus giving rise to inventories through time.

Most precisely, and in the spirit of Metzler analysis too, we claim that at least three main forces might lead aggregate production to diverge from aggregate demand: the multiplier mechanism, the accelerator mechanism and the role of expectations.

Beyond the simulation itself related to the suggestions within the framework proposed by Metzler, the features merged in a Kalecki-Metzler framework are the following ones:

a. the presence of different social classes, more specifically workers and firms;
b. the fact that collective bargaining (instead of the market) forces are the ones behind the wage-profit distribution between workers and firms;
c. different marginal propensity of consumption between the two predominant social classes–workers and capitalists.
d. Finally, in accordance with both Kalecki and Metzler, we will suppose that firms react to the demand side stimulus through quantity variation and not through the price one. This is the very first assumption made by Metzler himself supposing that "entrepreneurs have

> adequate inventories so that any discrepancy between output and consumer demand may be met by inventory fluctuations rather than price changes" (Metzler, 1941).

That is why, in accepting this hypothesis made both by Kalecki and Metzler, we will assume that prices are constant. Constant prices means that a definite price level is the one at which firms are ready to sell their product in a certain period.

We will now propose the main structural and behavioural equations that represent the main relations and reaction mechanisms in this framework both in real and in nominal terms. Since the price level is here considered constant and we can assume p=1, the price variable will not appear in the following equations.

$$Y_t^P = C_t^P + I_t^P \tag{12}$$

The total production in a given period is mainly composed by the production of Consumption goods - C_t^P - and production of Investment goods - I_t^P – in a certain period. The production process is carried out by the firms that hire and pay the workers. Here the superscripts P stand for the produced side of the previous aggregate values.

$$Y_t^{NI} = W_t + \Pi_t \tag{13}$$

The National Income of a country in a period - Y_t^{NI} - is shared by the aggregate level of wages - W_t - and the aggregate level of profits - Π_t.

$$Y_t^D = C_t^D + I_t^D \tag{14}$$

The total amount of product demanded in a period - Y_t^D - is composed by the aggregate demand for Consumption goods - C_t^D- and by the aggregate demand for Investment goods - I_t^D. Here the superscripts D stand for the demanded side of the previous aggregate values. For the moment, we will consider the investment component as fixed.

$$Y_t^P = Y_t^{NI} \tag{15}$$

The total income produced in a certain period - Y_t^P - is paid out to the social classes - Y_t^{NI} considered aggregated into workers and capitalists or firms. Here, it is important to underline that we are no longer supposing that the Production obtained in one year is totally sold absorbed by the aggregate Demand. In this way, firms production - Y_t^P - might well be different from goods demanded in a period - Y_t^D - thus possibly giving rise to the inventories issue.

2.3.2 Consumption and Production relations

In this subsection the relations of consumption and production will be presented.

$$C_t^D = C_{tw}^D + C_{t\pi}^D \quad (16)$$

The aggregate Demand of Consumption goods - C_t^D - is made up of two parts: the Demand of Consumption goods by workers- C_{tw}^D - and the Demand of Consumption goods by capitalists - $C_{t\pi}^D$. In line with Hansen and Samuelson, we will firstly assume that the Demand of Consumption goods for a certain period is related to the receipts obtained in the previous one. We will assume that for both consumers and for capitalists.

$$C_{t\pi}^D = C_{0\pi} + c_\pi \Pi_{t-1} \quad (17)$$

Hence, the Demand of Consumption goods by capitalists includes an exogenous component - $C_{0\pi}$ - and a part - $c_\pi \Pi_{t-1}$ - linked to the profits obtained in the previous period by the capitalists through their specific marginal propensity (c_π).

$$C_{tw}^D = C_{0w} + c_w W_{t-1} \quad (18)$$

In turn, the Demand of Consumption goods by workers is also partly composed by an exogenous component - C_{0w} - and a part - $c_w W_{t-1}$ - linked to the wages obtained by the workers in the previous period through their specific marginal propensity (c_w).

$$C_t^P = E_{t-1}(C_t^D) + s_t^* \quad (19)$$

Equation (19) represents the basic Lundberg S-O hypothesis according to which businessmen base their production in period t upon sales in period t-1. This is done through the role of expectations (E_{t-1}) upon the demand for consumption goods to be produced for the following period (C_t^D), the functional form of which will be underlined in equation (20). In addition, it is then assumed that, more than producing for what they expect to sell in the following period, firms also produce a certain desired level of inventories, $s^*(t)$. This hypothesis is in line with many post-Keynesians authors who have tackled the issue of inventories. Godley and Lavoie (2007a), for example, argue that firms do want to produce a target level of inventories because of uncertainty.

The functional form of the desired inventories (24) plays an important role in the determination of production.

$$E_{t-1}(C_t^D) = C_{t-1}^D + \eta(C_{t-1}^D - C_{t-2}^D) \quad (20)$$

$$\eta_t = \frac{C_t^D - C_{t-1}^D}{C_{t-1}^D - C_{t-2}^D} \quad (21)$$

$$E_{t-1}(C_t^D) = C_{t-1}^D + \eta'(C_{t-1}^D - C_{t-2}^D) \quad (22)$$

$$\eta'_t = \frac{C_{t-1}^D - C_{t-2}^D}{C_{t-2}^D - C_{t-3}^D} \quad (23)$$

17 The State Again

The specification of the expectation equation (20) is derived from the latest model proposed by Metzler himself. In that model, instead of considering the expected sales of the next period to be simply equal to the consumption goods demanded in the previous one, another component is added. As he says: "expectations of future sales may depend not only upon the past level of sales, but also upon the direction of change of such sales" (Metzler, 1941). We should therefore consider another component in the expectation, a "trend cycle projection" according to which firms will take into account the trend of the last two – for instance - production periods, perceiving that the same demand trend will be maintained or instead – guessing that the end phase of a cycle is arriving – reversed. Following Metzler, we called this coefficient of expectations "η". In Metzler (1941), it represents "the ratio between the expected change of sales between periods t and t-1 and the observed change of sale between period t-1 and t-2" (Metzler, 1941). It is represented by equation (23). Following the Metzler explanation, we will consider the value of η lying between -1 and 1.

Later, we will slightly change the composition of η, suggesting that it embodies the same ratio but lagged one period back, that is to say "the ratio between the observed change of sales between periods t-1 and t-2 and the observed change of sale between period t-2 and t-3". We will call "η'" (equation (23)) that modified version of η. Taking η' into account it will produce equation (22) that will then replace equation (20). In this behavioural equation, the production of demanded goods is therefore partly related to the demand of the previous year and partly assumed to be a linear function of the rate of change of the demanded goods in the last two (or further on, three) periods - this is related to the Hansen-Samuelson acceleration principle.

$$s_t^* = \alpha\, E_{t-1}(C_t^D) - Q_{t-1} \tag{24}$$

Equation (24) represents the desired level of inventories that firms intend to produce or the desired change in inventories. Instead of considering their attempt in maintaining a certain level of constant inventories, it is assumed that the latter is related to the expected level of sales. More specifically, as to inventories, we suppose that entrepreneurs try to maintain those at a constant proportion of the expected sales of the next year's demand. Following Metzler's suggestion, we will call α that proportion. The idea of a targeted or desired proportion of inventories is widely accepted in the Kaleckian literature that tackles the inventories issue and it could be associated with the Godley-Lavoie target inventories to sales ratio, σ^T (Godley & Lavoie, 2007a).

$$Q_t = s_t + Q_{t-1} = C_t^P - C_t^D + Q_{t-1} \tag{25}$$

Finally, the total amount of inventories stocked at the end of a certain period - Q_t - is simply given by the amount of inventories produced in that specific period - s_t - added to the one already

existing in the previous one Q_{t-1}. In turn, the former is the discrepancy between the Production of Consumption goods and the Demand of Consumption goods, $C_t^P - C_t^D$. It is important to underline that the actual inventories level - s_t - in a certain period might well be different from the desired one - s_t^*.

The following equations are based upon Blanchard et al. (2010) but they are different in many ways, the most important of which is that the following ones are expressed in a dynamical sense explicitly considering the timing issue. The other relevant difference refers to the exogeneity or endogeneity of some variables. Thirdly, almost all of the following equations do explicitly take into consideration both the real and the monetary aspects. This is done in line with the Post-Keynesian literature that considers monetary influences having a role in determining the level of aggregate demand and through that of the employment and economic activity. When we deal with the monetary issue, it will appear how that is true not only in the "short run" as the mainstream literature claims.

$$C_t^P = A_t N_t^C \tag{26}$$

The total production in a certain period is given by the total number of workers employed in the production process N_t^C multiplied by their productivity A_t .The first really important distinction with respect to the exogenous variable considered by Blanchard et al (2010) is the one regarding productivity (A_t). In fact, in that model, the productivity is considered exogenously given, while we claim that is not the case. We will focus on the productivity aspect later on in equations (33).

$$N_t^C = \frac{C_t^P}{A_t} \tag{27}$$

Equation (26) can obviously be converted into (27) that shows how employment in an economy is positively related to its total production.

2.3.3 Wages and Profits relations

In this subsection, the relations at the base of wages and profits determination will be presented. The following equation is also based on Blanchard et al. (2010).

However, there are important differences between (29) and the one proposed by Blanchard such as the assumption of constant prices (for the reasons given in subsection 3.1) and the fact that it is the individual (not the collective) nominal wage to be function of the expected prices, unemployment and z (workers' protection laws). For now, anyway, we are supposing fixed prices for the reasons previously exposed.

$$w_t = w_{t-1} + \gamma_z \frac{z_t - z_{t-1}}{z_{t-1}} w_{t-1} - \gamma_u (u_{t-1} - u_{t-2}) w_{t-1} \quad (28)$$

$$W_t = w_t \, N_t^T \quad (29)$$

Equation (28) assumes individual real wage claimed by workers in a certain period based on the previous one. Workers will then adjust that taking into account the variables previously considered. The parameters γ_z and γ_u reflect the sensitivity of the wage claim with respect to the protection of the workers.

It is assumed that the demanded wage is negatively related to the unemployment rate of a certain period and context, u_t

$$N_t^T = N_t^C + N_t^I \quad (30)$$

Equation (30) represents the total number of workers employed in a certain period in the economy. This is the sum of the workers employed to produce consumption goods, N_t^C, and producing Investment goods, N_t^I.

$$N_t^I = \frac{I_t^P}{A_t} \quad (31)$$

As well as equation (27), equation (31) represents the number of workers employed in producing the private Investments goods.

$$u_t = \frac{U_t}{L} = \frac{L - N_t}{L} = 1 - \frac{N_t^T}{L} = 1 - \frac{Y_t^P}{A_t \, L} \quad (32)$$

The rate of unemployment of a certain period, u_t, is simply given by the ratio between the total amount of unemployed people, U_t, and the total labour force, L, that we start considering as fixed. It is important to point out that labour productivity (A_t) should not be considered an exogenous value determined outside the economic system. In truth, many studies suggest that labour productivity is related to different features. For example, Schor (1987) found that work effort is influenced by the wage rates level, by the rate of unemployment or the average duration of unemployment, and by the presence of social security benefits. We could also recall the Webb effect that relates real wages and labour productivity. In this line, Marquetti (2004) econometrically shows the existence of a unidirectionality relation from the former to the latter. Also social influences such as work satisfaction should be taken into account. Akerlof (1982) suggests that higher wages or higher wages compared to other groups of workers stimulate satisfaction and, through that, a better work environment and higher productivity. Recent works (Kleinknecht et al. (2006), Kleinknecth, 2016 and Vergeer & Kleinknecht, 2011, 2014)

established and documented a positive relation between wage claims and labour productivity the former being the determinant of the latter.

By the same token, Kleinknecht et al. (2016) argue that the positive incidence of wage protection upon labour productivity works in different ways.

Invoking the Webb effect supported by Marquetti (2004), labour productivity is then considered as a positive function of real wage, as described by equation (33):

$$A_t = A_{t-1} + \gamma_\omega \left(\frac{\omega_t - \omega_{t-1}}{\omega_{t-1}} \right) A_{t-1}, \tag{33}$$

Finally, it is important to analyse the concept of profits more fully to underline a crucial aspect: the difference between the profit in its accountability terms and in the cash flow one. Appendix 3.3 sets out details on the inventories analysis and on its consideration in the accountability profit. According to the accountability profits aspect, the inventories from a certain period are included in the profits obtained by capitalists. This is so because the inventories will be sold in future periods and since we are considering a model where prices are fixed, the evaluation of the inventories problem should not arise: their value would not change. In this way the production obtained at the end of each period will be completely shared among the social classes – wages to workers and profits to capitalists. However, in accounting terms, the latter now includes the inventories produced. This is the way profits are considered in equation (34).

$$\Pi_t = Y_t^P - W_t \tag{34}$$

In terms of the cash flow profit, we can clearly separate the effective amount of profits obtained and spendable by capitalists from the residual inventories at the end of the process. According to this frame and since the unsold production will give rise to the inventories, the production obtained at the end of each period will not be completely shared among the social classes. The national income actually distributed will be therefore the net production value of the inventories (the term between parenthesis in equation (35)), producing the following equation.

$$Y_t^{NI} = Y_t^P - (Y_t^P - Y_t^D) \tag{35}$$

that obviously reduces to the following (36):

$$Y_t^{NI} = Y_t^D \tag{36}$$

Putting equation (36) into (13), we finally obtain the profits received by capitalists in terms of cash flow (37), Π_{cf}, underling the actual amount of resources they dispose of.

$$\Pi_{t\,cf} = Y_t^D - W_t \tag{37}$$

2.4 Preliminary Simulations

From now on, because of the issues proposed in section 3 and discussed in details in appendix 3.3, we will consider the Profits in the Cash Flow Profits meaning as defined in equation (37)2. In this model, the investments are not explained but they are simply considered as exogenously given. Furthermore, it is assumed that there is no Government presence in the economy and that, in line with a horizontalist approach, commercial banks provide funds on demand to firms for financing their investments. Prices are considered constant. We will consider a modified version of Metzler expectations (1941).

In fact, Metzler (1941) offered some strong implicit simplifications as to expectations regarding the constancy of the respective parameter and the boundaries the parameter itself assumed. In particular, despite producers' expectations being taken into account, η was finally considered as a constant value along with the traverse and dynamics, in this way attributing the same weight to the expectation of the demand in the different periods. In light of that, a slightly different coefficient of expectation - η' - will be considered, the value of which should be left free to vary between reasonable boundaries levels. The value of η' still embodies the same ratio of η but now lagged one period back, to allow the expectation parameter to vary. In this way, producers will still have expectations according to the recent past (we considered the past three periods) having η' the form considered in (23). We would allow η' to vary freely within acceptable boundaries ($\eta'_L \; and \; \eta'_U$) described by equations (23_L) - (23_U).

The second change we allow to our expectations with respect to Metzler (1941) regards the boundaries values the related parameter might take. In fact, the analysis of figures (4.0.a-4.0.n) allows us to appreciate that considering only the values proposed by Metzler (-1:1) would implicitly constrain our analysis avoiding those values that exactly describe booms and busts (for values of η higher than 1, figures 4.0.c and 4.0.f) and those ones describing strong reversing behaviours in the economic cycle (for values of η lower than -1, figures 4.0.i and 4.0).

In this sense, our model allows us to include a broader spectrum of values for the expectations by tackling the previous two aspects. We will then consider our η' free to vary between a broader range (-1,5 and 1,5), where not differently established.

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[2] It can be noted that in case we considered the *accounting profit* (34) as a main driver of the firms, an increasing level of inventories due to unsold products respect to a lower level of the demand, would not function as a sign for the firms to slow down their level of activity; quite in an opposite way, an increasing level of production (despite unsold) would determine a higher level of profits.

Eta (η) Analysis: Figures 4.0.a - 4.0.n

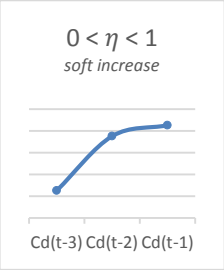


Figure 4.0.a: Soft increase

$C^D_{t-2} - C^D_{t-3} > 0$
$C^D_{t-1} - C^D_{t-2} > 0$
$C^D_{t-1} - C^D_{t-2} < C^D_{t-2} - C^D_{t-3}$

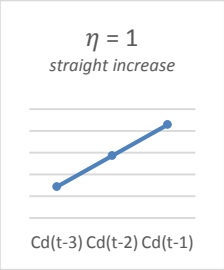


Figure 4.0.b: Straight increase

$C^D_{t-2} - C^D_{t-3} > 0$
$C^D_{t-1} - C^D_{t-2} > 0$
$C^D_{t-1} - C^D_{t-2} = C^D_{t-2} - C^D_{t-3}$

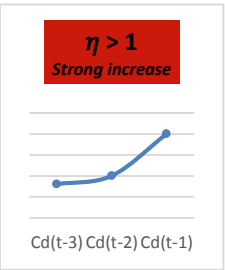


Figure 4.0.c: Strong increase

$C^D_{t-2} - C^D_{t-3} > 0$
$C^D_{t-1} - C^D_{t-2} > 0$
$C^D_{t-1} - C^D_{t-2} > C^D_{t-2} - C^D_{t-3}$

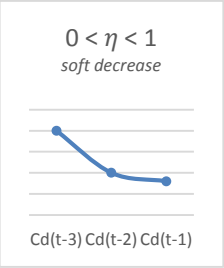


Figure 4.0.d: Soft decrease

$C^D_{t-2} - C^D_{t-3} < 0$
$C^D_{t-1} - C^D_{t-2} < 0$
$C^D_{t-1} - C^D_{t-2} > C^D_{t-2} - C^D_{t-3}$

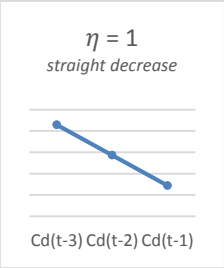


Figure 4.0.e: Straight decrease

$C^D_{t-2} - C^D_{t-3} < 0$
$C^D_{t-1} - C^D_{t-2} < 0$
$C^D_{t-1} - C^D_{t-2} = C^D_{t-2} - C^D_{t-3}$

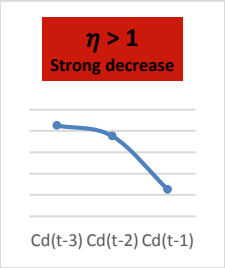


Figure 4.0.f: Strong decrease

$C^D_{t-2} - C^D_{t-3} < 0$
$C^D_{t-1} - C^D_{t-2} < 0$
$C^D_{t-1} - C^D_{t-2} < C^D_{t-2} - C^D_{t-3}$

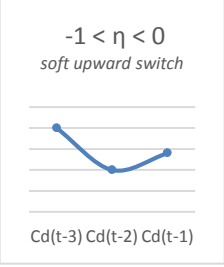


Figure 4.0.g: Soft upward switch

$C^D_{t-2} - C^D_{t-3} < 0$
$C^D_{t-1} - C^D_{t-2} > 0$
$C^D_{t-1} - C^D_{t-2} < |C^D_{t-2} - C^D_{t-3}|$

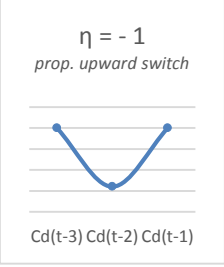


Figure 4.0.h: Prop. upward switch

$C^D_{t-2} - C^D_{t-3} < 0$
$C^D_{t-1} - C^D_{t-2} > 0$
$C^D_{t-1} - C^D_{t-2} = |C^D_{t-2} - C^D_{t-3}|$

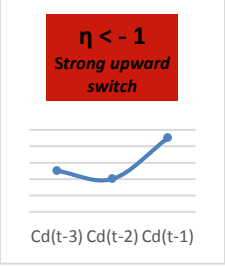


Figure 4.0.i: Strong upward switch

$C^D_{t-2} - C^D_{t-3} < 0$
$C^D_{t-1} - C^D_{t-2} > 0$
$C^D_{t-1} - C^D_{t-2} > |C^D_{t-2} - C^D_{t-3}|$

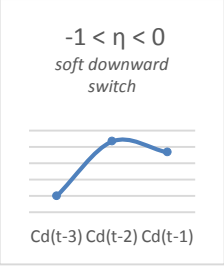


Figure 4.0.l: Soft downward switch

$C^D_{t-2} - C^D_{t-3} > 0$
$C^D_{t-1} - C^D_{t-2} < 0$
$|C^D_{t-1} - C^D_{t-2}| < C^D_{t-2} - C^D_{t-3}$

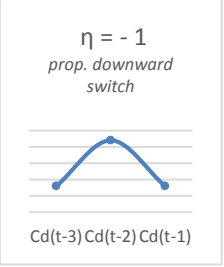


Figure 4.0.m: Prop downward switch

$C^D_{t-2} - C^D_{t-3} 0$
$C^D_{t-1} - C^D_{t-2} < 0$
$|C^D_{t-1} - C^D_{t-2}| = C^D_{t-2} - C^D_{t-3}$

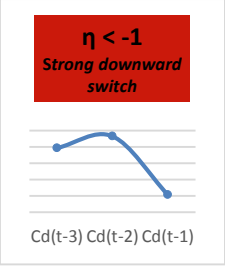


Figure 4.0.n: Strong downward switch

$C^D_{t-2} - C^D_{t-3} > 0$
$C^D_{t-1} - C^D_{t-2} < 0$
$|C^D_{t-1} - C^D_{t-2}| > C^D_{t-2} - C^D_{t-3}$

$$E_{t-1}(C_t^D) = C_{t-1}^D + \eta'(C_{t-1}^D - C_{t-2}^D) \tag{22}$$

$$\eta'_t = \frac{C_{t-1}^D - C_{t-2}^D}{C_{t-2}^D - C_{t-3}^D} \tag{23}$$

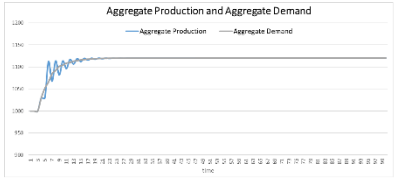
$$\eta'_t = \eta'_L \quad if \quad \eta'_t > \eta'_L \tag{23_L}$$

$$\eta'_t = 0 \quad if \quad C_{t-2}^D = C_{t-3}^D \tag{23_0}$$

$$\eta'_t = \eta'_U \quad if \quad \eta'_t < \eta'_U \tag{23_U}$$

2.4.1 Exogenous increase of the Private Investments

A scenario in which the investments exogenously increase is set out. In this case, after the shock has been introduced, the aggregate demand and production, after a brief and moderate mismatching between them, tend to come back to an equal (and stable) level again. In fact, such a positive shock in one component of the aggregate demand (C_t^D) pushes up the expectations of firms, thus increasing their production (C_t^P) through (19). However, since the push in the component of C_t^D is just an una tantum increase, the multiplier effect loses its strength and allows C_t^D to finally stabilize at a higher level. So, the reduced C_t^D increases lead to an oscillation reduction of the expectation and of C_t^P the value of which starts to implode until it stabilizes itself adjusting to the new C_t^D level.



4.1.a. Aggregate Production and Aggregate Demand

4.1.b. Wages and Profits

4.1.c. Wages and Employment level

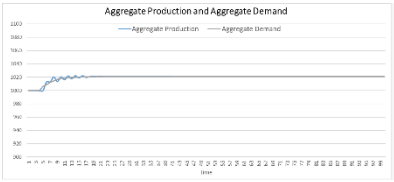
Figures 4.1.a-4.1.c The effects of an increase of the Private Investments

In the same way, Profits, Wages and Employment levels tend to stabilize again at higher levels compared to the initial ones after a brief increase in the first periods. Considering the wage-profits differential level, it is shown that an exogenous increase of investment leads to a faster increase of total wage bills compared to profits.

2.4.2 The effect of a higher workers' claims and wages

According to the Post-Keynesian literature, an exogenous increase in real wages (for example due to higher wage claims by the workers) will increase the level of activity and employment. This is linked to the famous paradox of costs, mentioned in section 2.2. It is generally claimed that such a conclusion is still valid when we consider the presence of the Webb effect and also that "the positive relationship between real wages and the level of employment will persist as long as the reaction parameter (of productivity with respect to wages - our γ_ω -) is smaller than unity" (Lavoie, 2014).The results here presented are actually not completely in line with that scenario and the paradox of costs now happens in some constellation of parameters and not in others.

In fact, despite a γ_ω lower than 1 ($\gamma_\omega = 0.5$), the employment level slightly decreases as a consequence of an increase of wages level caused by a higher EPL (see figure 4.2.c). Here, a first and "una tantum" rise in z level, the residual variable summarizing the workers' protection, causes increasing wages level claimed by workers. Such an increase has, in turn, two effects: on one side, it increases workers' productivity (through the Webb effect we reached with (33)) and as a consequence, it makes firms hire fewer employees to produce the same amount of consumption goods. The wage increase also boosts workers' consumption. If we consider the higher share of wages as a part of national income and the higher marginal propensity of consumption by workers with respect to capitalists, all that makes the total demand for consumption goods rise together with production allowing a partial employment recovery that nevertheless remains lower than the pre-shock level (figure 4.2.c).



4.2.a. Aggregate Production and Aggregate Demand

4.2.b. Wages and Profits

4.2.c. Wages and Employment level

Figures 4.2.a-4.2.c The effects of an increase of EPL (*from 80 points in period t=3 to 120 points in t=4*) with $\gamma_\omega = 0.50$ and $\eta_t = 1.50$

However, once a proper analysis of the interaction of the inventories and the mismatching between the demand and the production is considered, the causal mechanisms are not as straightforward as presented. A deeper analysis of the causal relations is presented in appendix figure 4.2.0. The conclusions of the figure presented generally do vary with respect to several factors such as the sensitivity of wages to the variation of EPL or workers' protections (γ_z), the sensitivity of wages to the variation of the unemployment level (γ_u), the sensitivity of workers' productivity to variations in wages (γ_ω) and the expectations of firms (η'_t). For example, with a null γ_ω, the same una tantum increase of worker protection parameter leads to an increase of

wages and economic activity suggesting that in such a case the paradox of costs still holds (not reported). The complexity involved in the model allows us to appreciate how the final impact of employment level depends on the constellation values of the parameters previously mentioned.

The previous scenario presented in figures 4.2.a-c takes into consideration the case in which there is an "una tantum" increase of the EPL. We could do the same exercise with a "continuous" increase in z, as if the EPL was going to increase constantly over time due to higher workers' claims. The result would not be different: in any case, we would obtain the same decreased level of employment (figures 4.2 d-f, in Appendix) even in cases of a present low Webb effect ($\gamma_\omega = 0{,}5$ as before) and an increase in employment levels -where the paradox of costs would still hold- in a case of a no Webb effect ($\gamma_\omega = 0$)(figures 4.2.g-i, in the Appendix).

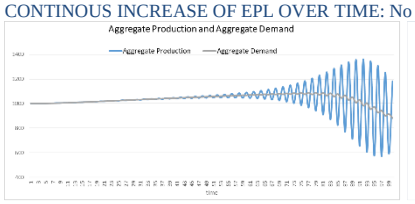
What is more, in order to show the different impact on the economic and employment levels due to the different parameters' values, figures 4.2.l-q' consider the situation of a constant high value of the expectation parameter ($\eta'_t = 4$) without any Webb effect. In such a case, the high and constant value of η'_t makes expectations take the shape and explosive dynamic that figures (4.0.c-4.0.f) suggest. Such dynamics produce growing oscillatory movements in all the other economic variables too (4.2 l-n). The key equations for grasping the following dynamics are reported below.

As long as the overall demand for consumption goods (C_t^D) keeps constantly increasing, even with oscillatory movements, the trend in the production of consumption goods (C_t^P) also increases with increasing oscillations. Since C_t^P increases at a higher rate with respect to C_t^D (4.2 l) because of the constant high value of η'_t, the trend of the actual inventories change (s_t) is constantly positive, and that, in turn, leads to an increase of inventory stock (Q_t) through (25) (4.2.q).

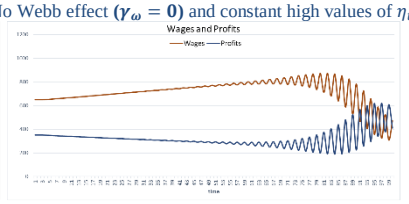
That said, when the increased demand for consumption goods by capitalists ($C_{t\,\pi}^D$) is no longer able to support the drop in consumption goods by workers ($C_{t\,w}^D$) the overall demand for consumption goods (C_t^D) stops constantly increasing and continues to explode, but with an emerging negative trend. From that moment, the contraction periods of C_t^P produce a negative variation of the unemployment component in (28) that overwhelms the positive variation of z leading the individual wage trend to start falling too (4.2 o). The previous weaker effects of C_t^D and C_t^P might also be visible in the effective demand labour curve that starts increasingly to broad, thereby losing its strong resolute trajectory (figure 4.2.p). The trend change of individual wages influences the trends of Wage Bill and employment (figure 4.2.n) and reinforces the negative aggregate demand and the production ones (figure 4.2.l).

Since the variation of C_t^P remains stronger than the variation of C_t^D in any period because of the preliminary chosen constant high level of η'_t, their explosive fluctuations with decreasing trends lead to a reduction of s_t trend (25). The reduction of s_t trend - thanks also to the size s_t achieved around period 80 (4.2.q) also leads to a reduction of Q_t trend through (25). A diminution of Q_t trend leads to an increasing trend of the desired change of inventories (s_t^*) through (24), and such a renewed trend guides C_t^P, through (19), to reverse its trend which now starts increasing once again (around period 110, figure 4.2.l'). The renewed and positive C_t^P trend reverses the employment one, the values of which start to increase continuously once again (figure 4.2.n'). Finally, the positive trend of employment pushes up the individual wage (figure 4.2.o') and therefore wage bill and aggregate demand (figure 4.2.l'). In this way the effective demand labour curve starts to converge and to increase with a more resolute trajectory once again (figure 4.2.p'). Therefore, we could claim that the paradox of costs still holds in general terms, but not as constant phenomena in every period under analysis.

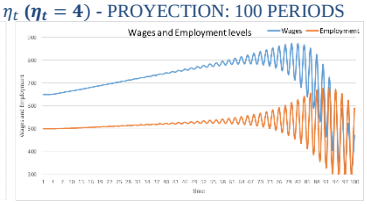
CONTINOUS INCREASE OF EPL OVER TIME: No Webb effect ($\gamma_\omega = 0$) and constant high values of η_t ($\eta_t = 4$) - PROYECTION: 100 PERIODS



4.2.l. Aggregate Production and Aggregate Demand



4.2.m. Wages and Profits

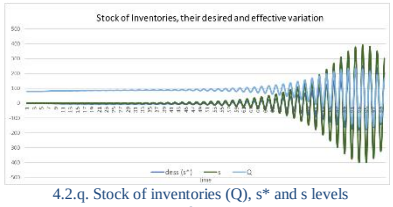


4.2.n. Wages and Employment level

Figures 4.2.l-4.2.n The effects of a continuous increase of EPL and workers' claims (by 1 point each period from t=1 to t=100) with $\gamma_\omega = 0$ and $\eta_t = 4$

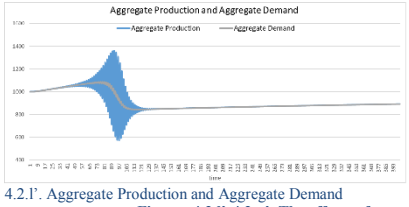
4.2.o. Individual wage

4.2.p. Individual wage and Employment levels

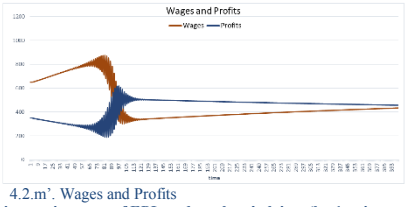


4.2.q. Stock of inventories (Q), s* and s levels

Figures 4.2.o-4.2.q The effects of a continuous increase of EPL on individual wage, employment and inventories (by 1 point each period from t=1 to t=100)



4.2.l'. Aggregate Production and Aggregate Demand

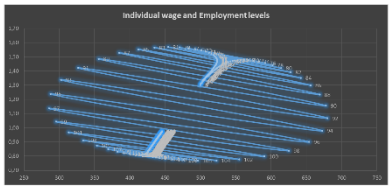


4.2.m'. Wages and Profits

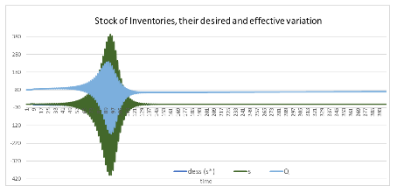
4.2.n'. Wages and Employment level

Figures 4.2.l'-4.2.n' The effects of a continuous increase of EPL and workers' claims (by 1 point each period from t=1 to t=400)

4.2.o'. Individual wage



4.2.p'. Individual wage and Employment levels



4.2.q'. Stock of inventories (Q), s* and s levels

Figures 4.2.n''' and n''' The effects of a continuous increase of EPL on individual wage, employment and inventories (by 1 point each period from t=1 to t=400)

$$C_t^P = E_{t-1}(C_t^D) + s_t^* \tag{19}$$

$$E_{t-1}(C_t^D) = C_{t-1}^D + \eta(C_{t-1}^D - C_{t-2}^D) \tag{20}$$

$$s_t^* = \alpha\, E_{t-1}(C_t^D) - Q_{t-1} \tag{24}$$

$$Q_t = s_t + Q_{t-1} = C_t^P - C_t^D + Q_{t-1} \tag{25}$$

Even if the previous scenario of a constantly high level of η'_t was just an anomaly with respect to the general cases of flexible values of η'_t under consideration, it helps to appreciate how, in our model, the paradox of costs happens in some constellations of parameters and under some conditions and not in others. One could claim the previous puzzling result compared to the standard Kaleckian model (the fact that an increase in real wage leads to a reduction of employment) might be only due to the Webb effect (where we were considering that) and to the backward effects that the variation of unemployment has on the level of real wage. A further exercise is therefore needed to test if, where there is a constant value of η'_t, a direct and continuous exogenous increase of the real wage (by 0,001 each period),without considering the backward effect of unemployment change, finally leads unambiguously to a higher level of employment. That study should include a proper parameterization analysis that could allow us to say if such a conclusion is always true, or it is constrained by a certain combination of parameters. First of all, it is possible to observe how (see table 4.2 in appendix), even with a level of η'_t boundaries restrained between -1.5 and 1.5, it is sufficient to have a value of γ_ω higher than 0.4 (quite low values compared to the standard post-Keynesian literature) to obtain those puzzling results where the employment level is explosive but with a negative trend (not reported). Also in the situation of a constantly null η'_t even with a low level of $\gamma_\omega (\gamma_\omega = 0{,}5)$, higher wages increase workers' productivity, allowing firms to maintain or increase the production of consumption goods with fewer employees (not reported).

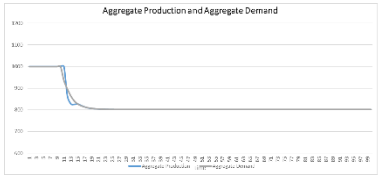
Finally, and again purely to present extreme potential scenarios, we can consider a situation with a free to vary η'_t characterized by larger boundaries values (-5 and 5, -50 and 50) under the same constant increase in individual wages. The conclusions previously obtained seem to be still valid: the total absence of the Webb effect leads to an employment increase, while even a low Webb effect presence ($\gamma_\omega = 0{,}5$) leads to a decreasing trend in employment. However, we can draw a further conclusion. In fact with broader boundaries levels of η'_t the pattern of the effective

demand labour curve becomes more volatile (see figures 4.2.r-broad - 4.2.y-broad'' vs 4.2.r-4.2.y'' in the Appendix).Obviously, such a higher level of fluctuation for employment levels represented by broader boundaries level of η'_t means we cannot say with absolute certainty that an increase of real wage leads to an increase of employment.

That supports the argument that the only rise in wages (or in one of their components) in the labour market could not produce a continuously and unambiguous employment increase. In such a case, a further increase in private or public investments might be required to achieve that objective. Moreover, government intervention might be even more essential to increase aggregate demand and to smooth the strong cyclicality that the economy would face because of potentially hypersensitive expectations as shown in the previous scenarios.

2.4.3 Decrease in marginal propensity of consumption of workers and capitalists

Now we consider the outcome of a possible negative shock, for example in a situation where consumers or capitalists, , structurally change their consumption behaviours for fear of some future possible negative event. In particular, we simulate the scenario where consumers – mostly workers – reduce their marginal propensity of consumption in trying to save more resources for an uncertain future. We assume an exogenous reduction in the marginal propensity of consumption by workers from 0,8 to 0,7 after the first 10 periods of stability.



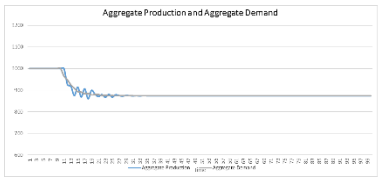
4.3.a. Aggregate Production and Aggregate Demand

4.3.b. Wages and Profits

4.3.c. Wages and Employment level

Figures 4.3.a-4.3.c The effects of a decrease in marginal propensity of consumption of workers

The reduction of capitalists' marginal propensity of consumption, as well as that of workers, gives rise to the same consequences: a reduction in economic activity, of the wage level and profits, and a reduction of the employment level. Figure 4.3 (d-f) simulates a reduction of the mpc of capitalists (c_π) from 0.6 to 0.5.



4.3.d. Aggregate Production and Aggregate Demand

4.3.e. Wages and Profits

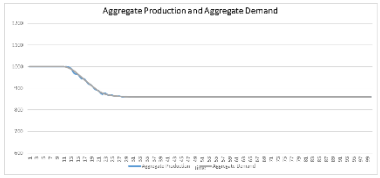
4.3.f. Wages and Employment level

Figures 4.3.d-4.3.f The effects of a decrease in marginal propensity of consumption of capitalists

In both the previous cases, the reduction of the marginal propensity of consumption leads to a reduction of aggregate demand that in turn decreases production and hence employment levels depressing individual wage and wage bill levels (figure 4.3.a-f'). After the shock, once the multiplier effect loses its effects, a new level of all the previous values is achieved and maintained. The paradox of thrift is undoubtedly still valid in our model.

2.4.4 Increase in productivity

One of the main conclusions of the Kaleckian basic model is that to keep employment from falling, whenever there is an increase in productivity, there must be some increase in real wages. To test this conclusion, we allow productivity to increase exogenously – for instance due to an important technological discovery or invention. We simulate a constant productivity increase by 3% over 10 periods (periods 11 to 20). Still, the result obtained in terms of employment is perfectly in line with the conclusion of the Kaleckian model: an increase of productivity leads to a structural and persistent reduction of the employment level over time.



4.4.a. Aggregate Production and Aggregate Demand

4.4.b. Wages and Profits

4.4.c. Wages and Employment level

Figures 4.4.a-4.4.c The effects of an increase in productivity

In fact, only an increase of productivity allows firms to produce the same amount of products using fewer workers. However, the decrease in employment levels makes the working class weaker because of the lack of their social strength, as equation (28) suggests. A higher level of unemployment and the lack of workers' social strength lower the wage level and that, almost immediately, has the impact of increasing the capitalists' profits. The lower level of wages and the higher level of profits have their own respective effects on the demand for consumption goods and since the marginal propensity of consumption of workers is higher than the marginal propensity of capitalists (and because the former's consumption level is higher than the latter's), their combined effect has a depressing effect on the total demand for consumption goods, hence on aggregate demand and finally on aggregate production. After the productivity stops increasing (period 20), a residual negative effect induced by lower aggregate demand and production leads to a reduction in economic activity and the previous variables. However, the original cause of increased productivity disappears, and a new lower variables level is soon achieved and maintained

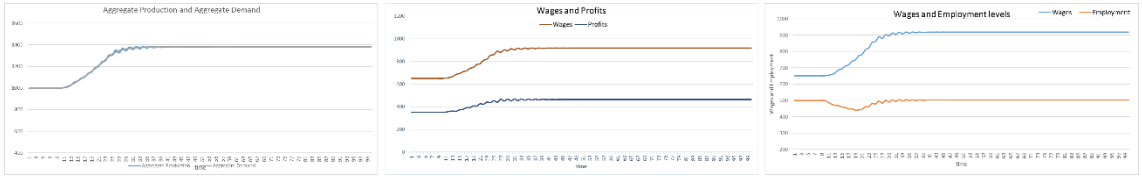
2.4.5 Simultaneous increase in productivity, in real wages and in real autonomous expenditure

A further key conclusion of the standard Kaleckian model (Lavoie (2014, p. 298)), was that in order to keep employment from falling, even when the economy faces a pari passu increase of real wage and productivity levels, there would be the need for a real autonomous expenditures increase, such as strong government expenditure. We therefore simulate a "pari passu" increase in real wages and productivity (simulating an exogenously equal increase by 3% every period over 10 periods).

4.5.a. Aggregate Production and Aggregate Demand 4.5.b. Wages and Profits 4.5.c. Wages and Employment level

Figures 4.5.a-4.5.c The effects of an increase in productivity and in real wages

The results of our model are still in line with the canonical Kaleckian model's conclusions. In fact, the simultaneous and pari passu increase in real wages and productivity leads to an imperceptible reduction of aggregate demand and aggregate production, but with a strong and persistent reduction in employment (figure 4.5.c). The effective labour demand specification by Lavoie (2014, p. 298) is the key to explain this result. Finally, we consider a combined increase in productivity, real wages and real autonomous expenditure. In line with Lavoie and the standard Kaleckian model, in presence of technological improvement, the same rate of increase in real wages would not be sufficient to avoid technical unemployment. To do so, only an increase in real autonomous expenditure would work. In the simulated case, an increase in private or public investment should be carried out by the same proportional increase of 3%, but for a longer period. It is important to notice that an "una tantum investment" would not be sufficient to avoid employment falling. In this sense, because the increase of real wages would not be sufficient to arrest the drop in aggregate demand and wages induced by a lower labour demand, an increase in real autonomous expenditure is required to maintain employment levels. Here, our conclusions are again in line with Lavoie (2014).



4.6.a. Aggregate Production and Aggregate Demand 4.6.b. Wages and Profits 4.6.c. Wages and Employment level

Figures 4.6.a-4.6.c The effects of an increase in productivity, real wages and real autonomous expenditure

2.5 Concluding remarks

This paper has reviewed and analysed the canonical Kaleckian models and its principal implications regarding equilibrium conditions. The aim has been to assess if their conclusions are still valid for a dynamic version of the Keynesian-Kaleckian model, including some suggestions by Metzler regarding the inventory cycle. Overall, our results validate the canonical Kaleckian model conclusions. They uphold the paradox of thrift, and the paradox of costs now happens in some constellations of parameters, and not in others.

More specifically, three main results have been established. First, a theoretical challenge has been raised about the convergence process toward equilibrium via a rigorous step by step computational method. It is argued that because of the interactions between potentially hypersensitive expectations and their effect on demand and production, a smooth traverse path from the ultra-short to the short run period is not guaranteed.

Secondly, also thanks to the simulation analysis, the stability of the effective demand labour curve invoked by the Kaleckians has been questioned, undermining the claim of a positive causal relation between higher real wages and higher employment levels. It is argued that to achieve the latter, the former might not be sufficient and that its achievement might be guaranteed only if supported by an adequate increase in real autonomous expenditure such as government spending. Even in the presence of a low Webb effect (much lower than the values studied in the canonical Kaleckian models), an increase of real wages or one of their components might lead to a final reduced level of employment, thereby undermining the stability of the paradox of costs.

Thirdly, the stability issue has been questioned. The interaction of desired and produced inventories, demand expectations and different marginal propensities of consumption might give rise to an unstable disequilibrium path. Even more relevant, if the goal of an economic society is to achieve a stable and sustainable growth path, the intervention of an autonomous force, moved not from expectations but from the achievement of that goal, is needed.

Obviously, these results should be treated with caution since the model does not include any proper investment dynamics or a proper government sector. These limitations underline the necessity of further exploring the conclusions suggested in the previous two paragraphs, as well as a deep monetary analysis of the economy.

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The file with which the simulation exercises have been developed might be requested to the author at samuele.bibi@gmail.com

- Chapter II - Appendix-
Keynes, Kalecki and Metzler in a Dynamic Distribution Model

Samuele Bibi
August 12, 2018

2.1.A An alternative dynamic analysis

System of Equations*:*

National Identities:

$Y_t^P = C_t^P + I_t^P$	(12)
$Y_t^{NI} = W_t + \Pi_t$	(13)
$Y_t^D = C_t^D + I_t^D$	(14)
$Y_t^P = Y_t^{NI}$	(15)

Consumption and Production relations:

$C_t^D = C_{tw}^D + C_{t\pi}^D$	(16)
$C_{t\pi}^D = C_{0\pi} + c_\pi \Pi_{t-1}$	(17)
$C_{tw}^D = C_{0w} + c_w W_{t-1}$	(18)
$C_t^P = E_{t-1}(C_t^D) + s_t^*$	(19)
$E_{t-1}(C_t^D) = C_{t-1}^D + \eta\,(C_{t-1}^D - C_{t-2}^D)$	(20)

$\eta = \frac{C_t^D - C_{t-1}^D}{C_{t-1}^D - C_{t-2}^D}$	(21)
$E_{t-1}(C_t^D) = C_{t-1}^D + \eta'_t(C_{t-1}^D - C_{t-2}^D)$	(22)
$\eta'_t = \frac{C_{t-1}^D - C_{t-2}^D}{C_{t-2}^D - C_{t-3}^D}$	(23)
$\eta'_t = \eta'_L \quad if \quad \eta'_t > \eta'_L$	(23_L)
$\eta'_t = \eta'_U \quad if \quad \eta'_t < \eta'_U$	(23_U)
$\eta'_t = 0 \quad if \quad C_{t-2}^D = C_{t-3}^D$	(23_0)
$s_t^* = \alpha E_{t-1}(C_t^D) - Q_{t-1}$	(24)
$Q_t = s_t + Q_{t-1} = C_t^P - C_t^D + Q_{t-1}$	(25)
$C_t^P = A_t N_t^C$	(26)
$N_t^C = \frac{C_t^P}{A_t}$	(27)

Wages and Profits relations:

$w_t = w_{t-1} + \gamma_z \frac{z_t - z_{t-1}}{z_{t-1}} w_{t-1} - \gamma_u(u_{t-1} - u_{t-2})w_{t-1}$	(28)
$W_t = w_t N_t^T$	(29)
$N_t^T = N_t^C + N_t^I$	(30)
$N_t^I = \frac{I_t^P}{A_t}$	(31)

$u_t = \frac{U_t}{L} = \frac{L - N_t}{L} = 1 - \frac{N_t^T}{L} = 1 - \frac{Y_t^P}{A_t\, L}$	(32)
$A_t = A_{t-1} + \gamma_\omega \left(\frac{\omega_t - \omega_{t-1}}{\omega_{t-1}} \right) A_{t-1}$	(33)
$\Pi_t = Y_t^P - W_t$	(34)
$Y_t^{NI} = Y_t^P - (Y_t^P - Y_t^D)$	(35)
$Y_t^{NI} = Y_t^D$	(36)
$\Pi_{t\,cf} = Y_t^D - W_t$	(37)

2.2.A Analysis of Initial Equilibrium State, Shocks and Parameters

Analysis of Initial Equilibrium State:

$$Y_t^P = C_t^P + I_t^P \qquad (12)$$
$$1000 = 800 + 200$$

$$Y_t^{NI} = W_t + \Pi_t \qquad (13)$$
$$1000 = 650 + 350$$

$$Y_t^D = C_t^D + I_t^D \qquad (14)$$
$$1000 = 800 + 200$$

$$Y_t^P = Y_t^{NI} \qquad (15)$$
$$1000 = 1000$$

$$C_t^D = C_{t\,w}^D + C_{t\,\pi}^D \qquad (16)$$
$$800 = 550 + 250$$

$$C_{t\,\pi}^D = C_{0\pi} + c_\pi\, \Pi_{t-1} \qquad (17)$$
$$250 = 40 + 0.6\,(350)$$

$$C_{t\,w}^D = C_{0w} + c_w\, W_{t-1} \qquad (18)$$
$$550 = 30 + 0.8\,(650)$$

2.3.A Analysis of Shocks

Fixed Prices, Fixed η (as equation 27), Exogenous Investment, No Government, linear w-u relation

4.1. Exogenous increase of the Private Investments (figures 4.1.a-4.1.c)
Period t = 3 (and previous periods): I_3^D = 200.
In t = 4:exogenous increase by 30: I_4^D = 230. The new level of I_t^D is sustained after t = 4.

4.2. The effect of a higher workers' claims and wages
4.2.a: *una tantum* increase in z (EPL) parameter (figures 4.2.a-4.2.c)
Period t = 3 (and previous periods): z_3 = 80.
In t = 4: exogenous increase in z: z_4 = 120.
The new level of z_t is sustained after t = 4.

4.2.b: *Constant* increase in z (EPL) parameter (figures 4.2.d-4.2.f), $\gamma_\omega = 0{,}5$ (Webb Effect)
Period t = 3 (and previous periods): $z_3 = 80$.
Since t = 4: exogenous increase in z_t: $z_{t-1} + 1$.

4.2.c: *Constant* increase in z (EPL) parameter (figures 4.2.g-4.2.i), $\gamma_\omega = 0$ (No Webb Effect)
Period t = 3 (and previous periods): $z_3 = 80$.
Since t = 4: exogenous increase in z_t: $z_{t-1} + 1$.

4.2.d: *Constant* increase in z (EPL) parameter (figures 4.2.l-4.2.q'), $\gamma_\omega = 0$ (No Webb Effect), constant $\eta'_t = 4$
Period t = 3 (and previous periods): $z_3 = 80$.
Since t = 4: exogenous increase in z_t: $z_{t-1} + 1$.

4.2.e: *Constant* increase in w (table 4.2), γ_ω and constant η'_t in the considered spectrum
Period t = 3 (and previous periods): $w_3 = 1{,}30$.
Since t = 4: exogenous increase in w_t: $w_{t-1} + 0{,}001$.

4.2.f: *Constant* increase in w (figures 4.2.r-4.2.y-broad'''),$\gamma_\omega = 0$ or 0,50, η'_t $boundaries = -5, 5$ and $-50, 50$
Period t = 3 (and previous periods): $w_3 = 1{,}30$.
Since t = 4: exogenous increase in w_t: $w_{t-1} + 0{,}001$.

4.3. Decrease in marginal propensity of consumption of workers and capitalists
Decrease of mpc of workers:
Period t=1:10 (and previous periods): c_w = 0.8.
In t= 11: exogenous decrease in c_w = 0.7. The new level of c_w is maintained after t = 11.

Decrease of mpc of capitalists:
Period t=1:10 (and previous periods): c_π = 0.6.
In t= 11: exogenous decrease in c_π = 0.5. The new level of c_π is maintained after t = 11.

4.4. Increase in productivity
Period t = 1:10 (and previous periods): $A_t = 2$ (with previous steady Wages A_t is fixed until t = 10).
In t = 11: exogenous increase in A_t by 3% yearly. At t = 21, A_t value comes to be calculated as before.

4.5. Simultaneous increase in productivity, in real wages and real expenditure
Period t = 1:10 (and previous periods): $A_t = 2$ (with previous steady Wages A_t and W_t until t = 10).
In t = 11, there is an exogenous and simultaneous increase in A_t and W_t by 3% yearly.
At t = 21, both A_t and W_t values comes to be calculated as before.

Period t = 1:10 (and previous periods): $A_t = 2$ (with previous steady Wages A_t and W_t until t = 10).
In t = 11, there is an exogenous and simultaneous increase in A_t, W_t and I_t^D by 3% yearly.
At t = 21, both A_t and W_t values comes to be calculated as before.
To restore the amount of employment pre-shock, the increase in I_3^D has to be prolonged at least until t=23 and after it has to be maintained at the value achieved at t=23.

2.4.A Analysis of the causal relations (Example: higher EPL and workers' claims)

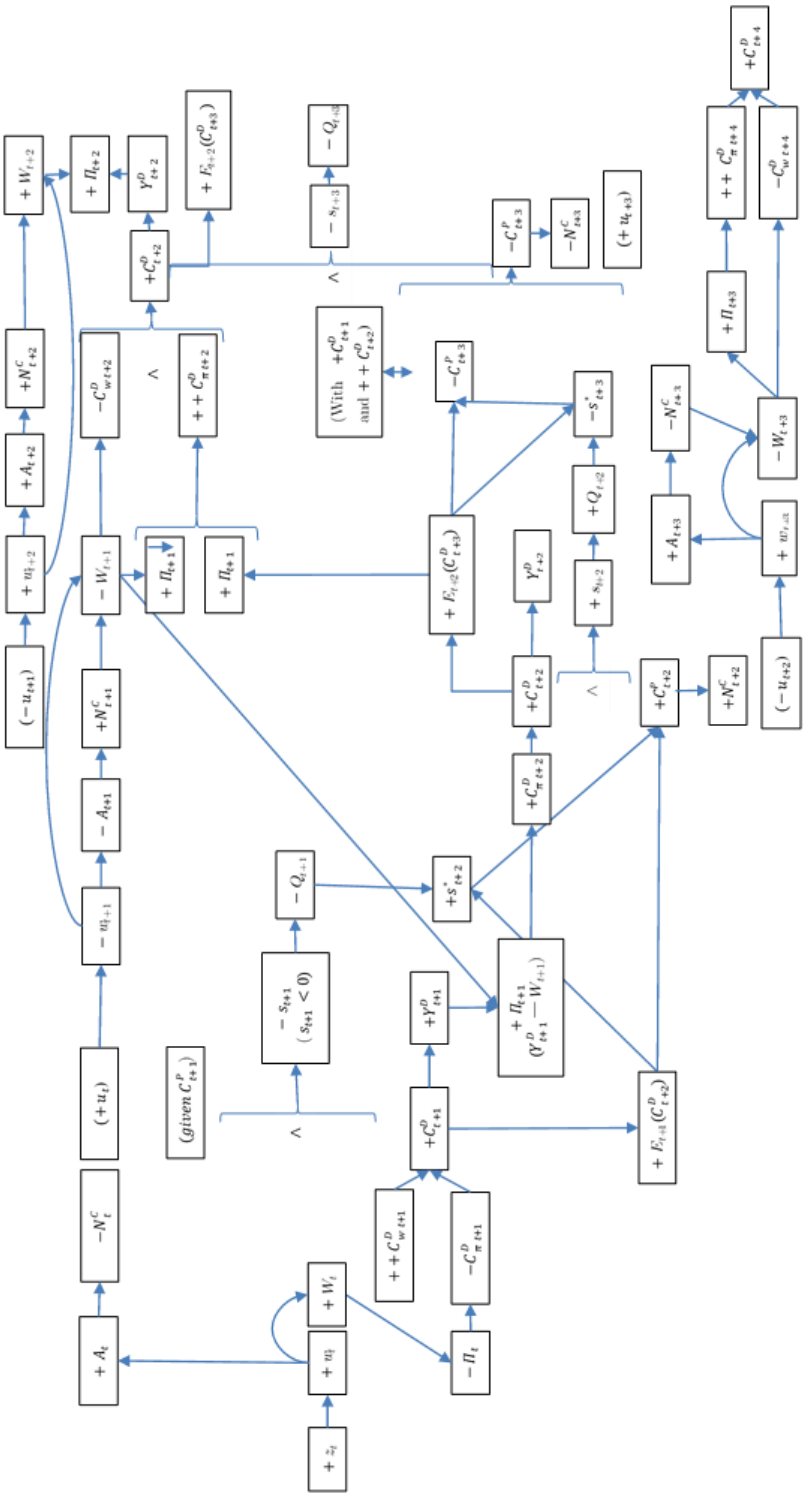


Figure 4.2.0 Analysis of the causal relations after an increase of EPL and workers' claims

2.5.A Scenario with Fixed Expectations: η_t

Parameterizations Analysis considering impact of increasing real wage on employment level

eta (Expectations)

gammaw (W.E.)	-5	-4,5	-4	-3,5	-3	-2,5	-2	-1,5	-1	-0,5	0	0,5	1	1,5	2	2,5	3	3,5	4	4,5	5	
0	E	E	E	E	E	E	E*	E+	E+	E+	E+	E+	E+	E+	E*	E	E	E	E	E	E	0
0,1	E	E	E	E	E	E	E*	E+	E+	E+	E+	E+	E+	E+	E*	E	E	E	E	E	E	0,1
0,2	E	E	E	E	E	E	E*	E+	E+	E+	E+	E+	E+	E+	E*	E	E	E	E	E	E	0,2
0,3	E	E	E	E	E	E	E*	E+	E+	E+	E+	E+	E+	E+	E*	E	E	E	E	E	E	0,3
0,4	E	E	E	E	E	E	E*	E-	E-	E-	E-	E-	E-	E-	E*	E	E	E	E	E	E	0,4
0,5	E	E	E	E	E	E	E*	E-	E-	E-	E-	E-	E-	E-	E*	E	E	E	E	E	E	0,5
0,6	E	E	E	E	E	E	E*	E-	E-	E-	E-	E-	E-	E-	E*	E	E	E	E	E	E	0,6
0,7	E	E	E	E	E	E	E*	E-	E-	E-	E-	E-	E-	E-	E*	E	E	E	E	E	E	0,7
0,8	E	E	E	E	E	E	E-	E-	E-	E-	E-	E-	E-	E-	E-	E	E	E	E	E	E	0,8
0,9	E	E	E	E	E	E	E-	E-	E-	E-	E-	E-	E-	E-	E-	E	E	E	E	E	E	0,9
1	E	E	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E	E	1
1,1	E	E	E	E	E	E	E-	E-	E-	E-	E-	E-	E-	E-	E-	E	E	E	E	E	E	1,1
1,2	E	E	E	E	E	E	E-	E-	E-	E-	E-	E-	E-	E-	E-	E	E	E	E	E	E	1,2
1,3	E	E	E	E	E	E	E-	E-	E-	E-	E-	E-	E-	E-	E-	E	E	E	E	E	E	1,3
1,4	E	E	E	E	E	E	E-	E-	E-	E-	E-	E-	E-	E-	E-	E	E	E	E	E	E	1,4
1,5	E	E	E	E	E	E	E-	E-	E-	E-	E-	E-	E-	E-	E-	E	E	E	E	E	E	1,5
	-5	-4,5	-4	-3,5	-3	-2,5	-2	-1,5	-1	-0,5	0	0,5	1	1,5	2	2,5	3	3,5	4	4,5	5	

Effect of +w on N

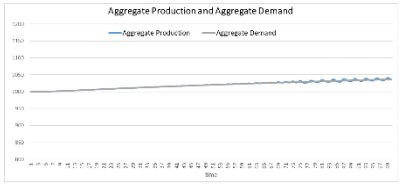
Explosive	E	it is considered explosive if, before period 200, there is an explosive behaviour (+-10% oscillation wrt initial level) in the N level
Postive trend (+) with final explosive behaviours	E+	it is considered positive/positive explosive trend if its trend is clearly positive at least until period 200 and if a strong explosive behaviour (+-10% oscillation wrt initial level) in the N level is present only after period 200
Negative trend (-) with final explosive behaviours	E-	it is considered negative/negative explosive trend if its trend is clearly negative at least until period 200 and if a strong explosive behaviour (+-10% oscillation wrt initial level) in the N level is present only after period 200
"Explosive at the end"	E*	Even if not explosive before 200 periods according to the previous definitions, it starts to have a strong explosive behaviour before period 200

Table 4.2 *Parameterization analysis of the relation between the continuous increase in real wage on the employment level. (It is supposed an exogenous continuous increase by 0.001).*

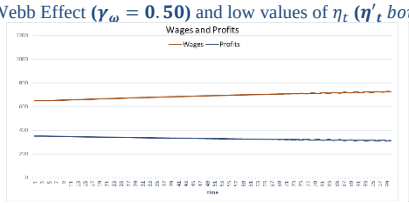
2.6.A Scenario with Variable Expectations: η'_t

EFFECTS OF EPL INCREASE DURING TIME - SOME EXAMPLES:

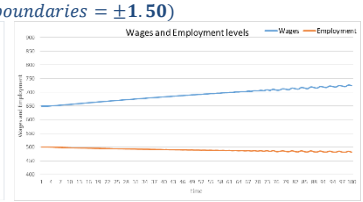
CONTINOUS INCREASE OF EPL OVER TIME: Webb Effect $(\gamma_\omega = 0.50)$ and low values of η_t $(\eta'_t \; boundaries = \pm 1.50)$



4.2.d. Aggregate Production and Aggregate Demand



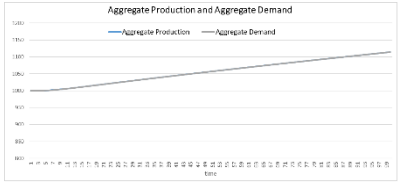
4.2.e. Wages and Profits



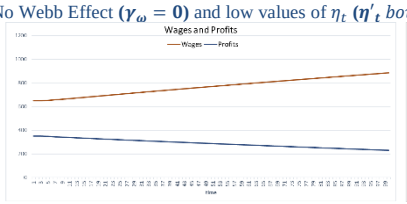
4.2.f. Wages and Employment level

Figures 4.2.d-4.2.f The effects of a continuous increase of EPL and workers' claims (*by 1 point each period from t=1 to t=100*)

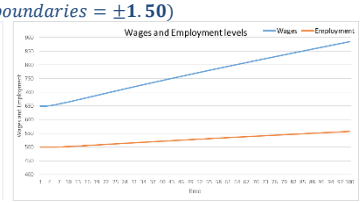
CONTINOUS INCREASE OF EPL OVER TIME: No Webb Effect $(\gamma_\omega = 0)$ and low values of η_t $(\eta'_t \; boundaries = \pm 1.50)$



4.2.g. Aggregate Production and Aggregate Demand



4.2.h. Wages and Profits

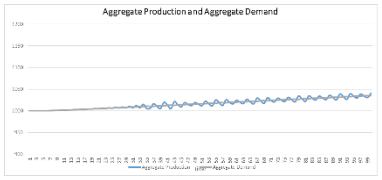


4.2.i. Wages and Employment level

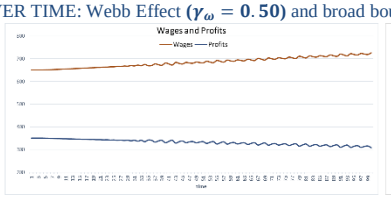
Figures 4.2.g-4.2.i The effects of a continuous increase of EPL and workers' claims (by 1 point each period from t=1 to t=100)

EFFECTS OF REAL WAGE INCREASE DURING TIME - SOME EXAMPLES:

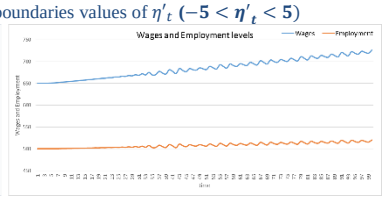
CONTINOUS INCREASE OF REAL WAGE OVER TIME: Webb Effect $(\gamma_\omega = 0.50)$ and broad boundaries values of η'_t $(-5 < \eta'_t < 5)$



4.2.r. Aggregate Production and Aggregate Demand



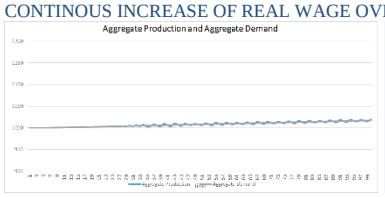
4.2.s. Wages and Profits



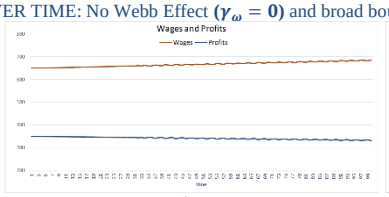
4.2.t. Wages and Employment level

Figures 4.2.r-4.2.t The effects of a continuous increase of real wage (by 0.001 each period from t=1 to t=100)

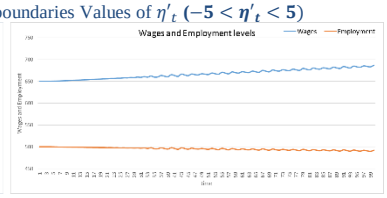
CONTINOUS INCREASE OF REAL WAGE OVER TIME: No Webb Effect $(\gamma_\omega = 0)$ and broad boundaries Values of η'_t $(-5 < \eta'_t < 5)$



4.2.v. Aggregate Production and Aggregate Demand



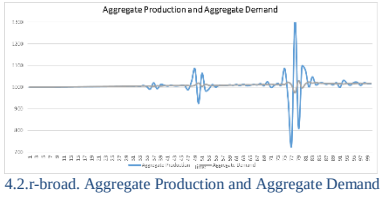
4.2.w. Wages and Profits



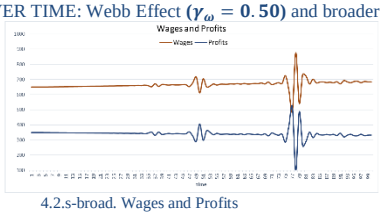
4.2.x. Wages and Employment level

Figures 4.2.v-4.2.x The effects of a continuous increase of real wage (by 0.001 each period from t=1 to t=100)

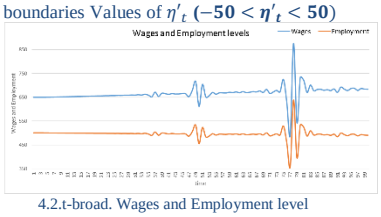
CONTINOUS INCREASE OF REAL WAGE OVER TIME: Webb Effect $(\gamma_\omega = 0.50)$ and broader boundaries Values of η'_t $(-50 < \eta'_t < 50)$



4.2.r-broad. Aggregate Production and Aggregate Demand



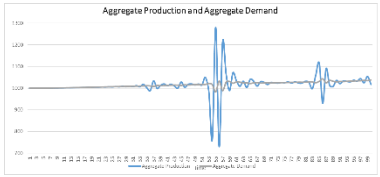
4.2.s-broad. Wages and Profits



4.2.t-broad. Wages and Employment level

Figures 4.2.r-broad-4.2.t-broad The effects of a continuous increase of real wage (by 0.001 each period from t=1 to t=100)

CONTINOUS INCREASE OF REAL WAGE OVER TIME: No Webb Effect $(\gamma_\omega = 0)$ and broader boundaries Values of η'_t $(-50 < \eta'_t < 50)$



4.2.v-broad. Aggregate Production and Aggregate Demand

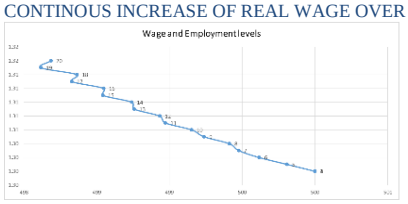
4.2.w-broad. Wages and Profits

4.2.x-broad. Wages and Employment level

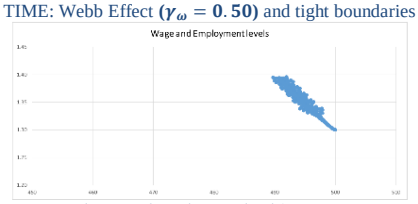
Figures 4.2.v-broad-4.2.x-broad The effects of a continuous increase of real wage (by 0.001 each period from t=1 to t=100)

Scenario with Variable Expectations: η'_t
EFFECTS OF REAL WAGE INCREASE DURING TIME - SOME EXAMPLES:

CONTINOUS INCREASE OF REAL WAGE OVER TIME: Webb Effect $(\gamma_\omega = 0.50)$ and tight boundaries values of η'_t $(-5 < \eta'_t < 5)$



4.2.u. Real wage and Employment level (t:1-20)

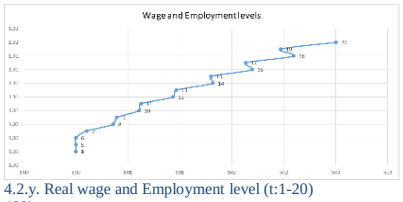


4.2.u'. Real wage and Employment level (t:1-100)

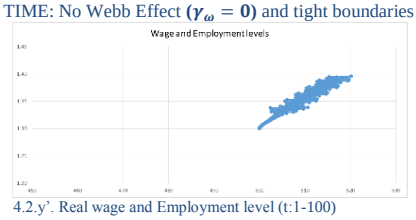
4.2.u''. Real wage and Employment level (t:1-400)

Figures 5.2.f'-5.2.f''' The effects of a continuous increase of real wage (by 0.001 each period from t=1 to t=20; from t=1 to t=100; from t=1 to t=400)

CONTINOUS INCREASE OF REAL WAGE OVER TIME: No Webb Effect $(\gamma_\omega = 0)$ and tight boundaries Values of η'_t $(-5 < \eta'_t < 5)$



4.2.y. Real wage and Employment level (t:1-20)



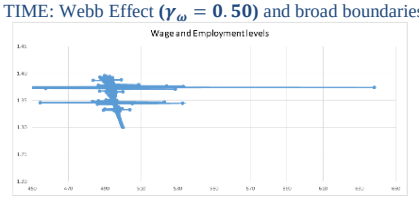
4.2.y'. Real wage and Employment level (t:1-100)

4.2.y''. Real wage and Employment level (t:1-400)

Figures 5.2.i'-5.2.i''' The effects of a continuous increase of real wage (by 0.001 each period from t=1 to t=20; from t=1 to t=100; from t=1 to t=400)

CONTINOUS INCREASE OF REAL WAGE OVER TIME: Webb Effect $(\gamma_\omega = 0.50)$ and broad boundaries Values of η'_t $(-50 < \eta'_t < 50)$

4.2.u-broad. Real wage and Employment level (t:1-20)



4.2. u-broad'. Real wage and Employment level (t:1-100)

4.2. u-broad''. Real wage and Employment level (t:1-400)

Figures 4.2.n'-4.2.n''' The effects of a continuous increase of real wage (by 0.001 each period from t=1 to t=20; from t=1 to t=100; from t=1 to t=400)

CONTINOUS INCREASE OF REAL WAGE OVER TIME: No Webb Effect $(\gamma_\omega = 0)$ and broad boundaries Values of η'_t $(-50 < \eta'_t < 50)$

4.2. y-broad. Real wage and Employment level (t:1-20)

4.2. y-broad'. Real wage and Employment level (t:1-100)

4.2. y-broad''. Real wage and Employment level (t:1-400)

Figures 5.2.q'-5.2.q''' The effects of a continuous increase of real wage (by 0.001 each period from t=1 to t=20; from t=1 to t=100; from t=1 to t=400)

2.7.A Analysis of Parameters

Parameter:	**Abbreviation**	**Value**	**Source:**
mpcw (workers): always valid	cw1	0.8	I bilanci delle famiglie italiane nell'anno 2014, Supplementi al Bollettino Statistico, Banca d'Italia
mpck (capitalists): always valid	ck1	0.6	I bilanci delle famiglie italiane nell'anno 2014, Supplementi al Bollettino Statistico, Banca d'Italia
proportion of inventories/Expected Sales	alfa	0.1	Selected from a reasonable range of values
coefficient of W reaction to change in z	gamma z	0.2	Selected from a reasonable range of values
coefficient of **+W** reaction to change in u	gamma u+	0.5	(Font, Izquierdo, & Puente, 2015)
coefficient of **-W** reaction to change in u	gamma u-	0.5	(Font, Izquierdo, & Puente, 2015)
coefficient of A reaction to change in W	gamma w	0.5	(Vergeer & Kleinknecht, 2014)
Labour Force	L	700	Selected from a reasonable range of values
Lower limit of the expectation boundaries	η'_L	- 1.5	Selected from a reasonable range of values
Upper limit of the expectation boundaries	η'_U	1.5	Selected from a reasonable range of values

* The value of, η' is set free to change between η'_L and η'_U, where not specified differently.

The file with which the simulation exercises have been developed might be requested to the author at samuele.bibi@gmail.com

- Chapter III -
The stabilising role of the Government in a Dynamic Distribution Growth Model

Samuele Bibi*
August 21, 2018

This work builds upon "Keynes, Kalecki and Metzler in a Dynamic Distribution Model". In that paper, the dynamics of an economy from the ultra-short to the short period inside a Post-Keynesian perspective were studied, questioning the general shared assumption of equilibrium between aggregate demand and aggregate supply in the short and long run Kaleckian models. This paper responds to some unresolved issues of the model proposed there considering a proper analysis of the Kaleckian investment function and a more realistic scenario with the presence of the government sector. Moreover, even if that model tried to deal with firms' expectations in producing goods, some values boundaries were exogenously established. Here, those boundaries are questioned again in relation with an active role of the government the aim of which should be to support and secure a high level of economic activity and to smooth and steer the cycles phases toward a sustainable development path. Particularly, we focus on the role of different fiscal policies aimed at obtaining such goals.

Key words: Kalecki, Post-Keynesian Economics, Disequilibrium, Adjustment dynamics, Fiscal Policies
JEL classifications: E11, E12, E32

> *"And today we see how utterly mistaken was the Milton Friedman notion that a market system can regulate itself. We see how silly the Ronald Reagan slogan was that government is the problem, not the solution. This prevailing ideology of the last few decades has now been reversed. Everyone understands now, on the contrary, that there can be no solution without government. The Keynesian idea is once again accepted that fiscal policy and deficit spending has a major role to play in guiding a market economy."*
>
> *(Samuelson Paul, 2009)*

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* This paper has been submitted to the ***Journal of Post Keynesian Economics*** in the date indicated.
I am grateful to my PhD Supervisors, Malcolm Sawyer and Stefano Zambelli, for their suggestions and comments to the present work. I am also grateful to Mark Setterfield, Peter Skott and Marco Veronese Passarella for the inspiring discussions we had about the development of this paper that allowed me to deeply shape and improve it. Any remaining errors or omissions are strictly my own.

3.1 Introduction

Many post-Keynesian scholars have underlined how recent decades have been characterised by a strong downgrading of the fiscal policy role as a stabilisation instrument of macroeconomic policy (Arestis and Sawyer, 2003). As more recently has been noticed "Despite the use of fiscal policy following the crisis that emerged in August 2007, which saved the world from the second 'Great Depression' and ended instead with the 'Great Recession', full faith in fiscal policy is still not there" (Arestis, 2012).

This paper moves in the same line, investigating the role of the fiscal policies into a "functional finance" framework where the Government "can and should be called upon as a key part of the remedy" (Fazzari, 1994) to ensure a high level of economic activity whenever the private sector is unable to do so by itself. We here investigate the possibilities that the Government has to boost and support the economic activity with its two main tools, public investments spending and a taxation system in two scenarios. The first scenario simulates an exogenous fall of private investments while the second one relates to an exogenous increase in labour productivity and real wages. In particular, here we test the canonical Kaleckian model conclusion according to which even when the economy faces a pari passu increase of real wages and productivity level it would be necessary an increase in real autonomous expenditures - such as the one implemented by the government - in order to keep employment from falling.

At the same time, the aim of this work is also to explore the role of the Government in stabilising the economy exactly thanks to the previous tools. In fact, Bibi (2019 a) underlined the possibility of an arising unstable path from a mismatching dynamic between aggregate demand and aggregate production. In particular, it was argued that such an unstable path might develop because "wrong" oversensitive expectations of firms regarding the production of consumption goods. Since there is nothing that could - a priori - prevent such firms' expectations to become hypersensitive and hyper reactive, above all in a context of big uncertainty, the possibility of an emerging strong instability and crisis might be even higher.

This paper proceeds as follows. Section 2 retraces the "Keynes, Kalecki and Metzler model" underlying its conclusions and limits. Section 3 sketches the structure of the model in a dynamics process merging some of the hints by Metzler, Keynes and Kalecki. Section 4 focuses on the private investment function in a more proper Kaleckian and Post-Kaleckian direction. Section 5 explores the role of the government in its expenditure on public investments and in managing its taxation system. Section 6 investigates the performances of an economy to achieve stability under three scenarios, the one without any Government intervention, the one with a passive Government action and the one with a proactive Government role. Such an analysis will be accompanied by

simulations in two different scenarios, one with drop of investments and one with a pari passu increase of productivity and real wages. Section 7 highlights the benefits of the different fiscal policies and, finally, last Section drafts the basic conclusions.

3.2 "Keynes, Kalecki and Metzler model": summary, conclusions and some limits

The canonical Kaleckian short run models are constructed upon the consideration of the effective labour demand curve defined as "the locus of combinations between real wages and levels of employment which ensure that all produced goods are sold at the price set by firms" (Lavoie, 2014). As argued by Lavoie (2014), this construction assures that an increase of real wage leads to an increase in the employment level. That has been and still is definitely one of the cornerstones for the Post-Keynesian authors.

However, focusing on the dynamics analysis from the ultra-short to the short period, Bibi (2019 a) pointed out how the construction of such an effective labour demand curve was based on the critical assumption of adjustment – and finally, equalisation – between the aggregate demand and aggregate production. It was underlined how, even if that equalisation might finally happen, to assume an a priori adjustment mechanism might have been a weakness for any model as it does not guarantee the related conclusions of those models. That is particularly true in a world characterised by uncertainty and adaptive expectations rather than by the forward looking rational ones. To respond to that weakness, the construction of a step by step algorithmic model was there proposed.

Even if the main conclusions of the canonical Kaleckian model were in general confirmed, one conclusion was mainly potentially undermined. In fact, it was argued that the increase in the real wage alone might not guarantee a straight increase of the employment level when the interaction of desired and produced inventories, demand expectations and different marginal propensities of consumption are taken into consideration, as that might give rise to an unstable disequilibrium path. In such a situation, and exactly because of such a possible unstable scenario, the need of an autonomous institution was invoked to let the real wage increase have a positive effect on the employment level. The government was suggested as the emblematic figure for that role since its actions are moved not from expectations but from the achievement of a more stable and sustainable growth path.

However, that suggestion was not tested in that work giving space for speculation about Government's role. Even if the base of that model is still present here, the current work has been improved going more deeply into some important aspects. In fact, in that situation, specific

boundaries on expectations were exogenously established to avoid the explosion of the economic cycles and that was recognised as a weakness of that model. It was underlined therefore the need to tackle the instability issue within a more structured model where an active role of the government was considered in smoothing and steering the cycles phases. All that, as suggested here, might be done trying to influence the expectations of firms through Government main fiscal policies tools to achieve a shared growth sustainable path. To analyse the influence of the Government in such a scenario by supporting the economic activity and stabilising the potential economic fluctuations is one of the goals of this paper.

Another important lack of the previous model was that, even if it did consider the investments produced and demanded by firms, there was no consideration at all of the ways in which those investments were produced. Moreover, there was no role played by the productive capital stock. These issues are tackled here inside a Kaleckian framework that really considers how the production process – above all of the investment goods - takes time. Such an analysis will give rise to non-synchronised dynamics among demand of investments goods, their production and their conclusions or deliveries. Furthermore, in Bibi (2019, a) model, the investments were not going to increase any productive capital stock whereas here we try to include it.

3.3 The basic Structure of the model

We reconsider then the "Keynes, Kalecki and Metzler model" (Bibi, 2019 a) trying to enrich that with more real life features, namely endogenous investments, presence and intervention of the government through fiscal policies. However, before doing that, we briefly recall the basic national identities and the consumption and households' relations that were well specified in that work. Finally, in this work as well as in that one, it is assumed that, in line with a horizontalist approach, commercial banks provide funds on demand to firms for financing their investments. Prices are considered pre-determined and constant. The complete set of equation is displayed in the Appendix while in the current sections only the main relations are highlighted.

3.3.1 National Identities

Equations (1)-(4) describe the national identities of the economy. The only difference to be found here with respect to Bibi (2019 a) is the presence of the Government sector which enters both the amount of aggregate production (1) and the aggregate demand (3). The total production in a given period is mainly composed by production of Consumption goods (C_t^P), by production of private

(I_t^P) and public Investment goods (G_t^P). Firms carry out the production process by hiring and paying workers. Here the superscripts P stand for the produced side of the previous aggregate values. Obviously the Government sector does enter implicitly also the National Income that is actually distributed (2) since here the amount of wages and profits obtained respectively by workers and capitalists are expressed in terms of gross values, including the taxes finally perceived by the Government. The incomes generated by the production sold constitute the national income (4) which is finally completely distributed between workers and capitalists (2). We should underline that, in line with Bibi (2019 a), we are not necessarily supposing that the production obtained in one year is totally absorbed by the aggregate demand, in that way possibly giving rise to the inventories issue.

$$Y_t^P = C_t^P + I_t^P + G_t^P \tag{1}$$

$$Y_t^{NI} = W_t + \Pi_t \tag{2}$$

$$Y_t^D = C_t^D + I_t^D + G_t^D \tag{3}$$

$$Y_t^D = Y_t^{NI} \tag{4}$$

3.3.2 Consumption and households relations

The core of the following equations is also taken from Bibi (2019 a). Aggregate Demand of Consumption goods (5) (C_t^D) is composed by the demand of consumption goods by workers (C_{tw}^D) and the demand of consumption goods by capitalists ($C_{t\pi}^D$). Each of those (6-7) is composed by an exogenous component and an endogenous one linked to receipts obtained by each social class in the previous period. However, in the following equations, we incorporate an important novelty, namely endogeneized marginal propensities of consumption of income for both social classes (8-9). Some authors such as Greenwood-Nimmo (Greenwood-Nimmo, 2014) already endogeneized the marginal propensities of consumption even if as regards different variables compared to us. In fact, here we want to explore the effect of the tax rates on consumption. The main idea is that marginal propensities of both classes tend to grow, even if with different magnitudes, when tax rates decrease. Symmetrically, the former tends to decrease as far as the latter increases. In equations (8-9), the different γ measure the strength of the marginal propensities of consumption on past income and wealth responses to the changes in the different tax rates.

$$C_t^D = C_{t\,w}^D + C_{t\,\pi}^D \quad (5)$$

$$C_{t\,w}^D = C_{w0} + c_{w1t} WD_{t-1} \quad (6)$$

$$C_{t\,\pi}^D = C_{\pi 0} + c_{\pi 1t} \Pi D_{t-1\,cf} \quad (7)$$

3.3.3 Production and firms relations

The following main equations describing the production relations of firms are also recalled by Bibi (2019 a). According to the Lundberg S-O hypothesis, businessmen base their production in period t (10) upon sales in period t-1. This is done through the role of expectations (E_{t-1}) upon the demand for consumption goods to be produced for the following period (11). In line with Metzler (1941) and with many post-Keynesians too, it is also assumed that, more than producing for what they expect to sell in the following period, firms also produce a certain desired level of inventories, $s^*(t)$, described by (16).

Following Bibi (2019 a), we use the slightly changed version of Metzler (1941) expectation parameter (12). There it was highlighted how Metzler (1941) did some strong implicit simplifications as to expectations regarding the constancy of the respective parameter and the boundaries the parameter itself was able to assume. In particular, despite producers' expectations were taken into account, the associated parameter (η) was finally considered as a constant value along the traverse and dynamics of economic activity variations. In light of that, Bibi (2019 a) proposed a slightly different coefficient of expectations (η') the value of which was left free to vary within reasonable boundaries levels. The value of η' still embodies the same ratio of η but now lagged one period back, exactly to allow the expectation parameter to vary. In this way, producers will still have expectations according to the near past having η' the form considered in (12). We would allow η' to vary freely within acceptable boundaries ($\eta'_L \; and \; \eta'_U$) described by equations (13) - (15).

The second change Bibi (2019 a) allowed to the expectations respect to Metzler (1941) regards the boundaries values the related parameter might take. In fact, the analysis of figures (5.0.a-5.0.n in the Appendix) taken by Bibi (2019 a) allows to appreciate that considering only the values proposed by Metzler (-1:1) would implicitly constrain our analysis avoiding those values that exactly describe booms and busts (for values of η higher than 1, figures 5.0.c and 5.0.f) and those ones describing strong reversing behaviours in the economic cycle (for values of η lower than -1, figures 5.0.i and 5.0). In that way, Bibi (2019 a) suggested to include a broader spectrum of values

for the expectations by tackling the previous two aspects. We follow that suggestion considering our η' free to vary between a broader range (-2 and 2), where not differently established.

The production of consumption goods in a certain period (18) is given by the amount of workers employed in such a production process (N_t^C) multiplied by their productivity (A_t). Equation (18) can be expressed as (19) to show the employment level required to obtain such a production.

$$C_t^P = E_{t-1}(C_t^D) + s_t^* \tag{10}$$

$$E_{t-1}(C_t^D) = C_{t-1}^D + \eta'_t(C_{t-1}^D - C_{t-2}^D) \tag{11}$$

$$\eta'_t = \frac{C_{t-1}^D - C_{t-2}^D}{C_{t-2}^D - C_{t-3}^D} \tag{12}$$

$$s_t^* = \alpha\, E_{t-1}(C_t^D) - Q_{t-1} \tag{16}$$

$$Q_t = s_t + Q_{t-1} = C_t^P - C_t^D + Q_{t-1} \tag{17}$$

$$C_t^P = A_t N_t^C \tag{18}$$

$$N_t^C = \frac{C_t^P}{A_t} \tag{19}$$

3.3.4 Employment, Labour Force and Wages-Profits relations

The following equations describe the way in which wages and profits are determined in our model. They still build upon Bibi (2019 a). However, there are some minor and some mayor important differences here. The most obvious modification is that the total amount of workers employed in the economy (24) now takes into account the ones employed in the public sector (N_t^G).

Equation (20) describes the behaviour of the wage variation with regard to the unemployment situation (since in the current model we suppose constant prices, nominal, w_t, and real wage, ω_t, have the same value). It is here suggested that, following a collective wage bargaining approach, there is an inverse relation between wages and unemployment. More specifically, "higher unemployment weakens workers' bargaining power, forcing them to accept lower wages" (Blanchard, 2013) while we would expect lower unemployment to strengthen them increasing their bargaining power.

$$w_t = w_{t-1} + \gamma_z \frac{z_t - z_{t-1}}{z_{t-1}} w_{t-1} - \gamma_u (u_{t-1} - u_{t-2}) w_{t-1} \tag{20}$$

$$W_t = w_t \, N_t^T \tag{23}$$

$$N_t^T = \, N_t^C + N_t^I + N_t^G \tag{24}$$

$$u_t = \frac{U_t}{L_t} = \frac{L - N_t}{L_t} = 1 - \frac{N_t^T}{L_t} \tag{25}$$

The prior three equations build upon Bibi (2019 a) with the difference that equations (25-26) consider a variable Labour Force.

$$L_t = \, L_{t-1} + \gamma_L \frac{Y_{t-1}^D - Y_{t-2}^D}{Y_{t-2}^D} \, L_{t-1} \tag{26}$$

Also the productivity of the workers (30) is enriched. In fact, while in Bibi (2019 a) workers' productivity was related only to the wage variation according to the Webb-Effect impact, now that we are taking into account the capital aspect seriously too, workers' productivity is also function of the capital per worker in the economy. It is reasonable to assume that the more disposable capital is for worker in the economy, the more productive every worker would be. In particular, this second labour productivity explanatory variable takes inspiration by Kaldor who postulated "a positive relation between the rate of technical progress and the rate of accumulation of capital per head" as Lavoie (2014) highlights (equation 6.82, p.429) resuming the theoretical and empirical results of the Kaldor-Veroorn's Law.

$$A_t = A_{t-1} + \gamma_\omega \left(\frac{\omega_t - \, \omega_{t-1}}{\omega_{t-1}} \right) A_{t-1} + \gamma_k \left(\frac{\frac{K_{t-1}^T}{N_{t-1}^T} - \frac{K_{t-2}^T}{N_{t-2}^T}}{\frac{K_{t-1}^T}{N_{t-1}^T}} \right) A_{t-1} \tag{30}$$

$$\Pi_{t\,cf} = Y_t^D - W_t \tag{31}$$

Equation (31) suggests how lower wage bill translates directly into higher level of profits during the same period. However, because the propensity to save out of profits is greater than the propensity to save out of wages, lower real wages decrease effective demand in the future. In fact, during the following period, the increased consumption generated by (previous) higher profits is not able to overwhelm the reduced consumption produced by the (previous) reduced wage bill. In that way, other things being equal, lower consumption demand - decreasing cu - would decrease investment demand too. Even if the drop of real wages might immediately translate into higher

capitalists' profits as (31) suggests, such a drop in aggregate demand would hence eventually translate into a reduction of profits level too. Finally, the last novelty as regards workers and capitalists' conditions is that they have to pay the taxes requested by the government. Once the taxes are paid, both classes can use their disposable income (32-33) for consumption purposes.

$$WD_t = W_t - T_{t\,w} \tag{32}$$

$$\Pi D_{t\,cf} = \Pi_{t\,cf} - T_{t\,\pi} \tag{33}$$

3.4 Kaleckian Investment function and firms' driving force

As to Kaleckian tradition, when we recognize that investments production takes time and effort, we consider the three different investment stages Kalecki himself (Kalecki, 1971) considered: investment order or Demand (I^D), investment Production (I^P) and investment delivery or Completion (I^C).

Inside the heterodox framework, the demand for investment has received several contributions in the last decades. Many authors such as Ciccone (1986), Kurz (1990) and Bhaduri and Marglin (1990) pointed out that the demand for investment should depend on expected profitability. In particular, Bhaduri and Marglin suggested an investment function dependent on the rate of utilization and the share of profit. It can be shown that saying that firms look at the share of profit implicitly means that they look at the difference between the product per unit of labour and the real wage, normalized by labour productivity. As signal and driver for firms to make investments, other authors preferred to use the change of profit level and trend, instead of the profit share. In fact, it could be argued that firms might not care much about the aggregate share of profit instead focusing their attention on the level and change of their profits. We are aware of and we indeed share that concern and we could duplicate our analysis with that investments specification. However, because of space limitation, we decided to focus our attention on the most popular post-Keynesian characterizations of investments. We limit ourselves in duplicating our analysis of the drop in exogenous investments considering them function of the level and change of profit levels instead of the share of profit. Figures 6.1.a'-6.1.f' show that even with such a specification, our main results would not differ greatly.

Here, in line with such post-Kaleckian perspective, we consider the expected profitability and the capacity utilisation as the two main variables that influence investment decision. In the same spirit, Lavoie (2014) underlines that empirical work "has consistently shown that the most

important explanatory variable of investment is the rate of capacity utilizations (or sales) and cash flow (or profits)". This result has now a long trajectory since Fazzari (1994) and others claimed that. Our investment function in a dynamic form would then take the following form:

$$I_t^D = I_{t-1}^D + a_1\, \pi_{cf\ t\ (t+1)}^e I_{t-1}^D + a_2\, cu_{t-1} I_{t-1}^D \tag{34}$$

Equation (34) assumes that firms take their investment decisions based on the previous period but they adjust them exactly considering their expected profitability and the expected level of demand (cu). Here the value of expected capacity utilization is assumed to be based on the previous period one. The parameter a_1 and a_2 are the weights associated with the responsiveness of entrepreneurs to the expected profitability and to the capacity utilization, respectively. Accordingly to what already suggested in Bibi (2019 a), if we suppose entrepreneurs are driven by profits, then the cash flow profits instead of the accountability ones should be taken into consideration. The (expected) share of profit is defined as follows.

$$\pi_{cf\ t\ (t+1)}^e = \frac{\Pi_{cf\ t\ (t+1)}^e}{Y_t^{NI}} = \frac{\Pi_{cf\ t\ (t+1)}^e}{Y_t^D} \tag{35}$$

In particular, we consider such an expected profit function of the previous period one, $\Pi_{cf\ t-1}$, and the difference one of the last two periods. Such a construction reflects the idea that firms do not merely rely on the most recent profit but they try to take into consideration the recent trend of their business.

$$\Pi_{cf\ t\ (t+1)}^e = a_3 \Pi_{cf\ t-1} + a_4(\Pi_{cf\ t-1} - \Pi_{cf\ t-2}) \tag{36}$$

Finally, the capacity utilisation (cu) is described by equation (43),

$$cu_t = \frac{Y_t^D}{Y_t^*} \tag{43}$$

being Y* the capacity output of the economy (44).

$$Y_t^* = Y_{t-1}^* + \psi_L \left(\frac{L_t^T - L_{t-1}^T}{L_{t-1}^T}\right) Y_{t-1}^* + \psi_A \left(\frac{A_t - A_{t-1}}{A_{t-1}}\right) Y_{t-1}^* \tag{44}$$

The form of equations (44) is based on Lavoie (2014, equation 6.69) who defines the natural rate of growth as the sum of the growth rate of active population and the grow rate or labour productivity. If equation (44) is rearranged in terms of variations, it is easy to see how the growth rate of potential output is exactly function of those two terms. The capacity output can therefore

express the amount of total resources available in the economy. Equation (44) also takes theoretical inspiration by the works of Arestis and Sawyer (2005) and Dow (2000). Dow, in particular, emphasises how

> in a major recession underemployment results in the deterioration and premature scrapping of physical equipment, and that disbandment or underemployment of a firm's workforce similarly results in the partial destruction of working practices and working relations. The latter constitute the intangible capital of a firm, the value of which is an important fraction of its market value as a going concern. The capital stock, physical and intangible, takes time to build up, and its destruction cannot be made good rapidly; in effect, therefore, the destruction is quasi-permanent. In this way demand shocks impact on supply. A major recession causes a downward displacement of the growth path of productivity (or potential or capacity output); (p.369)

It is important to underline how, through equation (44), the demand has its impact in shaping the supply side with the potential output. In fact, the impact of the capital accumulation is already contained in the labour productivity component via (30) while the impact of human capital is brought into the analysis by the labour force variation. We previously showed (26) how also the last one should be considered endogenous in response to the demand and economic activity variation. This is also in line with what Leon-Ledesma and Thirlwall (2002) found and that is also underlined by Lavoie (2014):

> They have shown that the natural rate of growth is endogenous to the rate of growth of output demand, demonstrating that the natural rate of growth rises in booms, and falls in recessions. As they say, 'growth creates its own resources in the form of increased labour force availability and higher productivity of the labour force' (2002, p.452).

The negative hysteresis effect of a prolonged unemployment is now recognized also by many mainstream economists such as Blanchard who recognizes such problem admitting that "workers who have been unemployed for a long time may lose their skills, or their morale, and become, in effect, unemployable." (Blanchard, 2017).

Merging (34, 35, 36, 43, 44) we finally obtain the complete version of the Investment Demand equation (45):

$$I_t^D = I_{t-1}^D + a_1 \frac{a_3 \Pi_{cf\,t-1} + a_4(\Pi_{cf\,t-1} - \Pi_{cf\,t-2})}{Y_t^D} I_{t-1}^D + a_2 \frac{Y_{t-1}^D}{Y_{t-1}^*} I_{t-1}^D \tag{45}$$

Once the investment decisions have been done, we can obtain the amount of total productive capacity that is being produced during a certain period, (I_t^P). Following the Kaleckian perspective and trying to consider the time needed to obtain the completed investment, we will assume a period, θ, taking place between the investment decision and its delivery. Here θ represents the period of construction for plants that is considered the same for any investment project. Since

Kalecki himself considers a constant function for the process of production of Investment, the following equation (46) can express the amount of Investment produced in a certain period.

$$I_t^P = \frac{1}{\theta}\sum_{j=1}^{\theta} I_{(t-1-\theta+j)}^D \tag{46}$$

Hence, equation (46) represents the quantity of Investment taking place in a single period, regardless of their stage of completion. To conclude, I_t^C, represents the investment finally completed after θ periods that actively forms the stock of private productive capital, K_t^I.

$$I_t^C = I_{(t-\theta)}^D \tag{47}$$

Private capital stock can be finally expressed by equation (48). According to that, the capital in a certain period is equal to the amount of the capital previously accumulated, K_{t-1}^I, discounted by the depreciation or erosion of capital due to its use (supposed at constant rate of erosion), δ, augmented by the creation of the new capital, that is to say the Completed Investment, I^C.

$$K_t^I = K_{t-1}^I - \delta_{KI} K_{t-1}^I + I_t^C \tag{48}$$

It is important to underline that equation (46) represents the quantum of Investment, that is to say it determines the amount of investments that are being produced in a certain period but it does not express the modum of the investments that is how investment goods are produced. Equation (49) represents just that modum. It is important to underline again that the production of investments in a certain period, I_t^P, is referred only to the amount of investments that are being produced in a certain period, regardless of their degree of completion.

$$I_t^P = A_t N_t^I \tag{49}$$

From equation (49) we can easily obtain the number of workers that are employed in the production of the private Investment goods (50).

$$N_t^I = \frac{I_t^P}{A_t} \tag{50}$$

In regard to the Investments issue, equation (34) suggests a positive and linear relation between the demand of Investment and the capacity utilisation and profitability. Though it can be generally considered true that investments increase with the increase of the capacity utilisation (and therefore with respect to the Aggregate Demand to Output Capacity ratio) and profitability, it is not so in the opposite case. In fact, in a phase while one or both of them are decreasing, the level

of Investment demand would definitely be reduced and most probably firms could even stop investing further but Investment demand would never take a negative value. This means we should consider the floor the investment demand intrinsically has in the real world.

A further aspect of the asymmetrical behaviour of investments might refers to their finance. In fact, while firms could potentially have no problem in finding funds to finance their investments in a time of decreasing demand (for example by auto financing them with retained earnings), they might have an external limit to finance investments in phases of increasing demand and capacity utilisation (in the case their retained earnings are not sufficient). Since the particular issue of financing investments is strictly related to the monetary side of the economy, this aspect needs further investigations. For the moment, we will simply implicitly consider that banks are always fully financing the needs of firms for investments, with no change in the financing conditions during the time (interest rates, etc.). The same would be considered for the Central Bank financing the Government in the production of the public investments.

3.5 The Government into the Scene: goals and fiscal policies

The Government public investments play a similar role of private investments in contributing to the level of an economy aggregate demand in the sense that a drop in the private investments could potentially be substituted by the public ones. Their similarity might be also true for the distinction among demand, production and completion of those investments. In fact, it might be argued that private as well as public investments might both follow exactly the same production timing and they might be both subject to the same rules of accumulation and erosion of capital. With that idea and assumption, the following equations would be similar to the ones describing private investments previously:

$$G_t^P = \frac{1}{\theta}\sum_{j=1}^{\theta} G_{(t-1-\theta+j)}^D \tag{51}$$

$$G_t^C = G_{(t-\theta)}^D \tag{52}$$

$$K_t^G = K_{t-1}^G - \delta_{KG} K_{t-1}^G + G_t^C \tag{53}$$

$$K_t^T = K_t^I + K_t^G \tag{54}$$

$$G_t^P = A_t N_t^I \tag{55}$$

$$N_t^G = \frac{G_t^P}{A_t} \tag{56}$$

If the previous equations regarding public investments are similar to those about the public ones, that similarity is not true for the reason and the way in which public investments are demanded and stimulated. In fact, while private investments are driven by capacity utilizations (or sales) and cash flow (or profits) as equation (34) represented, public investments should be motivated by different purposes. As both Keynes and Kalecki argued, government expenditure in public investments is requested to support and correct a deficiency of aggregate demand (Sawyer, 2011). "The Government spending policy…permits the overcoming of one contradiction in the capitalist system: that of insufficient effective demand (Kalecki, 1945)." That is certainly in line with the 'functional finance' objective (Kalecki, 1944; Lerner, 1943) and purposeful fiscal policy to create the conditions for full employment (Arestis and Sawyer, 2010). Post-Kaleckians suggest that the Government supporting and guiding role is requested even in the situation of an exogenous increase of labour productivity. In fact, their conclusion is that even when the economy faces a pari passu increase of productivity and real wages level, it would be necessary an increase in real autonomous expenditures, such as in public investments, to keep employment from falling (Lavoie, 2014).

Another important function of the expenditure by the government sector has been emphasised by Fazzari et al. (Fazzari et al., 2013) who stressed its role in containing the downward instability. More precisely they show how "autonomous demand has a profound effect on the model dynamics. It induces a floor that turns around negative dynamics toward growth" (Fazzari et al., 2013). In the same line, Arestis (Arestis, 2012) supports the idea of the fiscal policy as a stabilisation instrument of macroeconomic policy.

In consideration of the previous points, we examine different fiscal policies through which government tries to support deficiency of aggregate demand and we assess its presence for stabilising the economy containing possible explosions of the business cycle.

Further on, and together with its guiding influence through government social investments, also the role of taxation will be examined. This will be done, again, thanks to the inspirational work of Keynes and Kalecki. In fact, the former argued that to fight unemployment "the remedy would lie in various measures designed to increase the propensity to consume by the redistribution of incomes or otherwise. …The State will have to exercise a guiding influence on the propensity to consume partly through its scheme of taxation, partly by fixing the rate of interest, and partly, perhaps, in other ways". The theoretical background for a coordinated fiscal policy together with the one aimed at reducing income inequality has been given and developed by several Post-Keynesians such as Sawyer (2011) and Arestis (2012). According to them, an accurate

combination of these fiscal and redistributive policies (boosting aggregate consumption) would solve much of the budget deficit problem (Sawyer, 2011).

The simulation exercises of this paper will then explore the previous hints on the government role as supporter of the economic activity and as stabilizing institution of the economy.

GOVERNMENT SPENDING FUNCTION with 0BD policy (A):

$$G_t^D = T_{t-1}^T \tag{57}$$

The previous equation represents the fiscal policy in a situation where the government tries to equalize expenditures with the total amount of taxes collected in the previous period. This policy might be due to the strict and unique willingness of the government to constantly achieve a zero budget deficit more than other social objectives. Ultimately, such an objective might be pursued not to let the public debt increase supporting the "burden on future generations" claim. However, this policy might be persistently frustrated if we remember that, in the end, the budget deficit is actually an endogenous variable as it has been already observed by Sawyer (2011):

> In effect the budget deficit can be viewed as endogenous and indeed something of a residual in two senses. First, whilst a government can set tax rates and its intentions for public expenditure, the resulting budget deficit arises as a result of decisions made by the private sector and the resulting level of economic activity. … Second, the target budget deficit should be set, along the lines of 'functional finance' as suggested above where the intention is to use the budget position to secure a high level of economic activity.

We also want to assess the impact of the Government intervention policy with respect to a situation where the Government intervenes "moderately" trying to keep its investment spending constant despite any changes of the level of the economic activity.

GOVERNMENT SPENDING FUNCTION - moderate Government policy (B):

$$G_t^D = G_{t-1}^D \tag{58}$$

Finally, and exactly following the functional finance argument, we try here to set a different Government spending function. Such a Government spending function is based, on the contrary, on the idea that the Government would make public social investments to secure a high level of economic activity, supporting the aggregated demand growth. In particular, there would be an increase of the public social investments by the Government every time the growth of the aggregate demand is lower than a determined minimum threshold while there would be a reduction of them every time the growth of the aggregate demand exceeds a particular maximum established threshold.

GOVERNMENT SPENDING FUNCTION – Proactive Government policy (C):

$$G_t^D = G_{t-1}^D + \gamma_g \left(\left| \frac{Y_{t-1}^D - Y_{t-2}^D}{Y_{t-2}^D} \right| \right) G_{t-1}^D, \qquad G_t^D \geq 0 \tag{59}$$

Here, finally, we present the equations defining the taxation system of the economy. Equations (64) and (65) define the taxation resources obtained by the government (63) from workers and capitalists, respectively. Here, equations (66) and (67) express the endogeneity of the tax rates applied to workers and capitalists, respectively. The tax rates applied to wages and profits are made function of the wage and profit growth, meaning that those tax rates increase whenever the income growth rate of the different social classes is higher than a determined maximum threshold and they decrease whenever their income growth rate is lower than a determined minimum threshold. Here the variables that the government can directly manoeuvre are the rates of taxation adjustment, $\gamma_{\tau w}$ and $\gamma_{\tau \pi}$, and the lower and higher thresholds outside which the tax rates start to vary (68-71). Finally equations (72) and (73) define the budget surplus (or deficit) and public credit (or debit) of the Government.

$$T_t^T = T_{tw} + T_{t\pi} \tag{63}$$

$$T_{t\,w} = \tau_{t\,w}\, W_{t-1} \tag{64}$$

$$T_{t\,\pi} = \tau_{t\,\pi}\, \Pi_{t-1\,cf} \tag{65}$$

$$\tau_{t\,w} = \tau_{t-1\,w} + \gamma_{\tau w} \left(\left| \frac{w_{t-1} - w_{t-2}}{w_{t-2}} \right| \right) \tau_{t-1\,w} \tag{66}$$

$$\tau_{t\,\pi} = \tau_{t-1\,\pi} + \gamma_{\tau \pi} \left(\left| \frac{\Pi_{cf\,t-1} - \Pi_{cf\,t-2}}{\Pi_{cf\,t-2}} \right| \right) \tau_{t-1\,\pi} \tag{67}$$

$$BS_t = T_t - G_t \tag{72}$$

$$PC_t = PC_{t-1} + BS_t \tag{73}$$

3.6 Simulation results

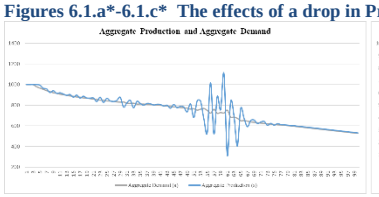
We here simulate two possible shocks. The first one is a drop in private investments, for instance due to a confidence crisis from the firms' side. The second shock is referred to an exogenous increase in labour productivity and real wages. Specifically, we simulate a pari passu increase of both variables during 10 periods.

Analysing those two different shocks, we try to confront different effects of fiscal policies, one with a Government aimed at achieving a zero fiscal budget during all the periods, one where the Government is present but in a moderate way with a fixed exogenous amount of expenditure in public investments irresponsive of the economic situation and, finally, a more proactive government the goal of which is to secure a high level of economic activity supporting the aggregated demand in line with the public finance argument.

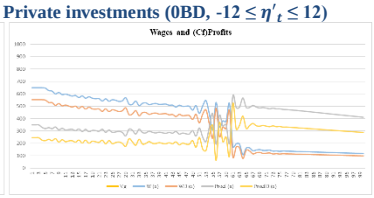
3.6.1 Exogenous drop in Private Investments with a Government committed to 0 Budget Deficit policy

Before presenting the different fiscal policies, we want to highlight the impact of considering different expectations boundaries. For this reason, we start presenting the case of a drop in private investments in a scenario with a Government committed to a 0BD (zero Budget Deficit) policy with broad expectations boundaries ($-12 \leq \eta'_t \leq 12$).

Figures 6.1.a*-6.1.c* The effects of a drop in Private investments (0BD, $-12 \leq \eta'_t \leq 12$)



6.1.a*. Aggregate Production and Aggregate Demand



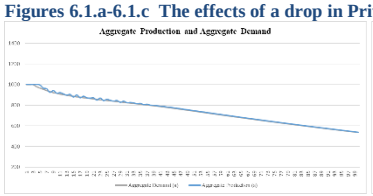
6.1. b*. Wages and Profits

6.1.c*. Wages and Employment level

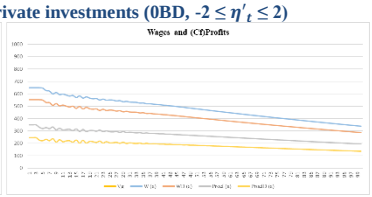
In the previous figures it is possible to notice how, beyond the strong crisis driven by a negative shock in private investments, a high degree of instability into the system is added causing a further severe drop in all the values of the economic activity.

At this point we want to replicate the same numerical exercise in a scenario with tighter expectations boundaries ($-2 \leq \eta'_t \leq 2$). The values taken by the expectation parameter boundaries are still larger than the boundaries originally proposed by Metzler (1941) allowing for situations previously claimed as possibly happening (strong increase, strong decrease, strong upward switch, strong downward switch of expectations). However, to keep expectations' boundaries tight will allow us to reduce the impact of the expectations on the produced consumption goods and on other economic variables. In fact, broader expectations means that once firms realize they overproduced, they will tend to contract production using their inventories stocks, that way, drastically reducing the employees needed, wage bill (6.1.c*) together with aggregate demand. These limits on expectations can be considered, for instance, as conventional limits among firms about their forecasted variation of the consumption goods to be produced.

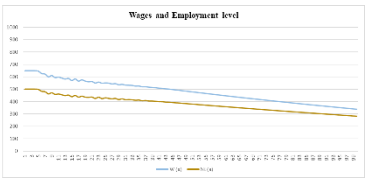
Figures 6.1.a-6.1.c The effects of a drop in Private investments (0BD, -2 ≤ η'_t ≤ 2)



6.1.a. Aggregate Production and Aggregate Demand

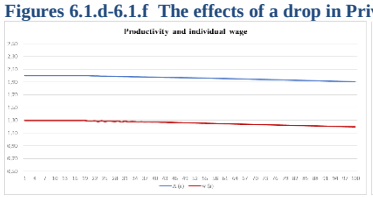


6.1. b. Wages and Profits

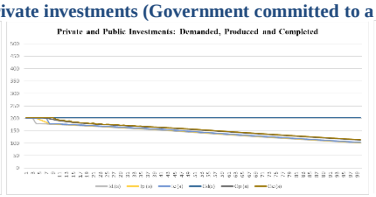


6.1.c. Wages and Employment level

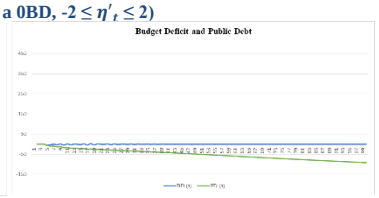
Figures 6.1.d-6.1.f The effects of a drop in Private investments (Government committed to a 0BD, -2 ≤ η'_t ≤ 2)



6.1.d. Productivity and Individual wage (A, w)



6.1. e. Private and Public Investments



6.1.f. Budget Deficit and Public Debt

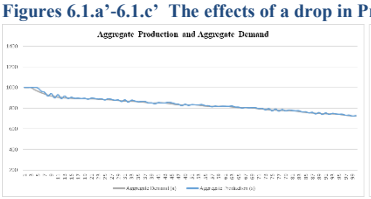
At the same time, it is also possible to observe how, despite the Government commitment of achieving a OBD, such a goal is actually almost always frustrated. In fact, the initial drop in aggregate demand causes the reduction of production and of the income distributed between social classes. Henceforth, the taxes that workers and capitalists are able to pay decrease and, as a consequence, if the government tries to base public investments exclusively on the resources collected in the previous period, the amount of public investments put into order are inevitably going to be reduced.

The policy of a 0BD in time of crisis, in this way, shows to be sterile not only because of its own ineffectiveness in achieving such an objective and in avoiding an increasing public debt (see figure 6.1.f) but also, and most dangerously, in another dimension. Since in that scenario the public investments are de facto inevitably reduced by its own goal, such a reduction plays a further negative effect on dropping the aggregate demand hence causing the economy to gravitate toward a dangerous downward trend of all its variables. It is possible to compare the just described negative triggering effect in a recession with a situation where the government keeps a fixed amount of public investments (figures 6.3.a-6.3f).

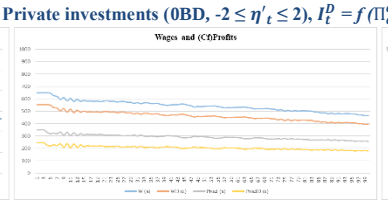
Furthermore, as previously suggested, we can confront the situation where investment demand is influenced by the profit share with the one where investment demand is influenced by the profits levels (figures 6.1.a'-6.1.f', below)[3]. It is possible to notice how, the overall trends and results of the shocks are indeed very similar than the previous figures produced considering cu and the share of profits as the main drivers of investments demanded.

[3] In the simulated scenario with demand for investments function of wage levels and cu, we rescaled the a_1 and a_2 parameters, now assuming respectively the values of 0,00005 and 0,0005.

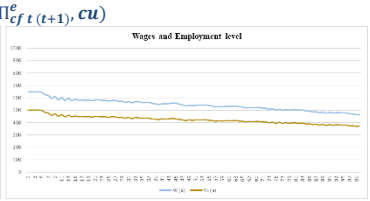
Figures 6.1.a'-6.1.c' The effects of a drop in Private investments (0BD, -2 ≤ η'_t ≤ 2), $I_t^D = f(\Pi^e_{cf\,t\,(t+1)}, cu)$



6.1.a'. Aggregate Production and Aggregate Demand

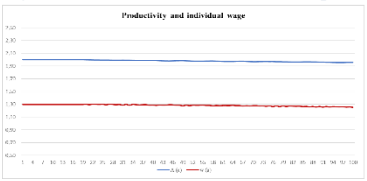


6.1. b'. Wages and Profits

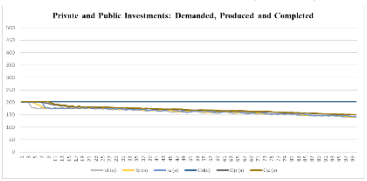


6.1.c'. Wages and Employment level

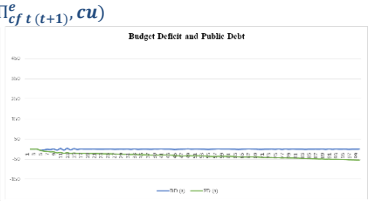
Figures 6.1.d'-6.1.f' The effects of a drop in Private investments (0BD, -2 ≤ η'_t ≤ 2), $I_t^D = f(\Pi^e_{cf\,t\,(t+1)}, cu)$



6.1.d'. Productivity and Individual wage (A, w)



6.1.e'. Private and Public Investments



6.1.f'. Budget Deficit and Public Debt

3.6.2 Who controls the (broad or tight) expectations boundaries?

Through the previous exercise, we also showed how much firms' expectations and their boundaries might profoundly matter in determining the level of instability into the system. At this point, one may wonder which should be the right boundaries of the expectation parameter (η'_t) to be used in studying a (possibly unstable) economy. It is important then to reflect on the significance and the role of the expectation parameter and finally, even more, on its boundaries. For exposition clarity, we here propose the expectation relation on consumption demanded goods again.

$$E_{t-1}(C_t^D) = C_{t-1}^D + \eta'_t(C_{t-1}^D - C_{t-2}^D) \tag{11}$$

$$\eta'_t = \frac{C_{t-1}^D - C_{t-2}^D}{C_{t-2}^D - C_{t-3}^D} \tag{12}$$

We used the coefficient of expectations η'_t slightly differently with respect to its original use by Metzler (1941) - lagging it one period behind – since, as suggested by Bibi (2019 a), we recognized that considering it fixed during all the business cycle it was not necessarily correct. We also kept broader boundaries respect than the ones considered in Metzler (1941) (-1 ≤ η_t ≤ 1). In this way, using the modified version of η'_t (12) we were able to let the expectations value free to endogenously fluctuate accordingly with the business cycle. However, η'_t as described in (12) would not be a proper expectation parameter since it simply reflects the expectations about the past periods of the demand for consumption goods. Hence, for letting η'_t enter a proper expectations relation such as (11) an implicit assumption was made, namely that firms used η'_t

as a proxy for the coming period expectation, assuming somehow $\eta_t = \eta'_t$. In the same way, and simultaneously, considering the boundaries on the - free to fluctuate – expectation parameter η'_t implied considering also those boundaries projected for the coming period.

At this point, then, one simple question might arise: who or what can really influence and keep restrained the limits on the expectations about the coming period in order to have a more stable economy? The answer is that it doesn't really matter that those limits to the expectations actually do exist. What does matter is that, to achieve a more stable scenario, firms must believe that those boundaries somehow exist - namely that the variation in the consumption of demanded goods will not exceed those boundaries.

Ultimately, then, the actual important question is "who firms believe" can really influence and set limits on the expectations about the coming period - namely "who firms believe" can keep restrained and set limits on the variation in the demanded consumption goods. At this point the simulations exercise might become even more important.

In a scenario of a very limited government intervention, firms might possibly rely on the pure faith of the self-adjusting mechanism of the market that would restore any situation to its pre-shock status. Nevertheless, it is improbable that after a drop in the private investments of a significant amount as the one simulated – and, for example, as the one of the recent 2007 recession – firms might really have faith in a self-adjusting mechanism of the market. Even if they kept their faith strong, with the first periods after the shocks, that would not be sufficient to avoid a further drop in the aggregate demand and, finally, in their own investments and business profits.

On the other hand, in a scenario with a more interventionist state aimed at effectively support the aggregate demand, it is high likely that firms might absorb and consider those limits on expectations as stable and proper of such an economy (figures 6.3.a-6.3f). For the following simulation exercises we could assume that the commitment of the Government intervention is strong and that has the effect of restraining the expectation boundaries to those initially assumed ($-2 \leq \eta'_t \leq 2$).

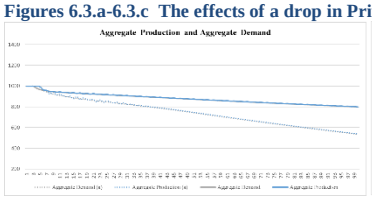
3.6.3 Exogenous drop in Private Investments with a moderate Government intervention

We here simulate the same drop in the private investments previously simulated in a scenario where the level of expenditure in public investments has been kept fixed, unresponsive of any shocks consequences. By replacing the 0BD policy with the one where the government simply maintains the level of its support to the economic activity, it is possible to appreciate the different deepness of the recession according to the relative scenarios. In such a situation, the drop in

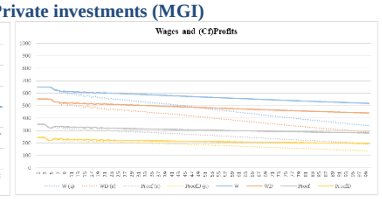
aggregate demand and production is much less intense if compared to the 0BD scenario and the same conclusion might be drawn for the level of workers' wages, capitalists' profits and employment level (figures 6.3.a-6.3.c).

In this case, the cost of a greater support of the aggregate demand from the Government side is a greater budget deficit and public debt, at least in the short and medium run (figure 6.3.f). The monetization of the budget deficit through combined proper monetary policies might easily solve the concern of an increasing public debt. However, this model does not tackle deeply the monetary side of the economy and such question should be the objective of further investigations. However, it is possible to observe that, despite the alleviation of the crises, this moderate intervention does not avoid the economic activity, the private investments as well as wages, the employment and all the variables of the economic activity under analysis to decrease. In figures 6.3.a-6.3.f and all the following ones, the dotted lines represent the economic values under the 0BD policy.

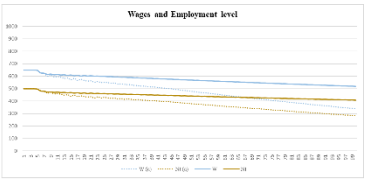
Figures 6.3.a-6.3.c The effects of a drop in Private investments (MGI)



6.3.a. Aggregate Production and Aggregate Demand

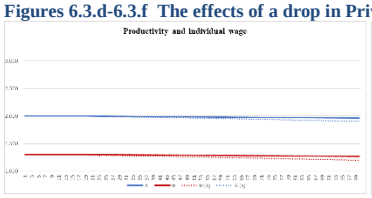


6.3. b. Wages and Profits

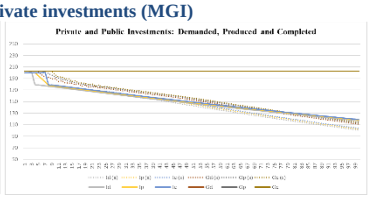


6.3.c. Wages and Employment level

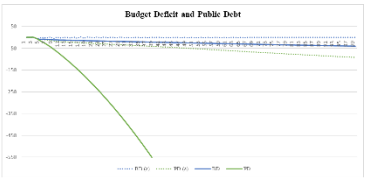
Figures 6.3.d-6.3.f The effects of a drop in Private investments (MGI)



6.3.d. Productivity and Individual wage (A, w)



6.3. e. Private and Public Investments

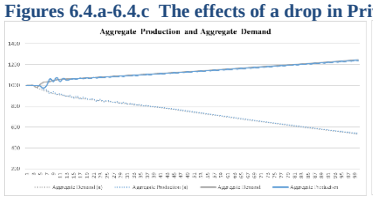


6.3.f. Budget Deficit and Public Debt

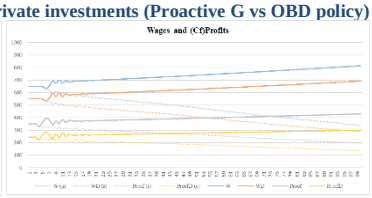
3.6.4 Exogenous drop in Private Investments with a Proactive Government

Finally, we present the same exercise with two scenarios that coincide with two more pro-active government fiscal policies. In the first one the government has a pro-active role trying to adjust its expenditure in public investments in accordance with a functional finance objective - namely to support and secure a high level of economic activity - and trying to stabilise the economic instability. In such a case, the Government is intervening only managing its public expenditure in relation to the variation of the aggregated demand, boosting the economy in the periods where it slows down and trying to cool it down whenever there might be the risk of an overheating situation.

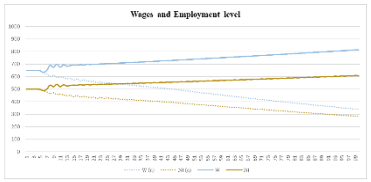
Figures 6.4.a-6.4.c The effects of a drop in Private investments (Proactive G vs OBD policy)



6.4.a'. Aggregate Production and Aggregate Demand

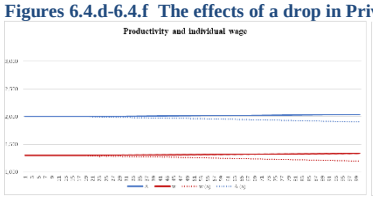


6.4. b'. Wages and Profits

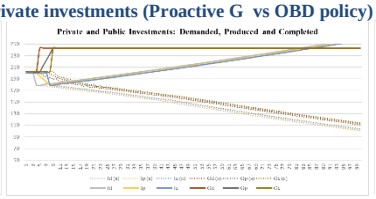


6.4.c'. Wages and Employment level

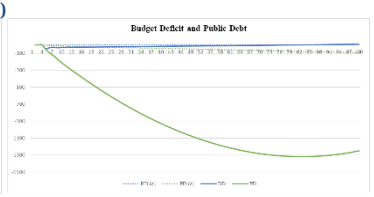
Figures 6.4.d-6.4.f The effects of a drop in Private investments (Proactive G vs OBD policy)



6.4.d. Productivity and Individual wage (A, w)



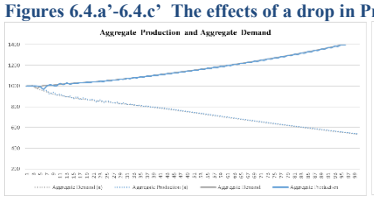
6.4. e. Private and Public Investments



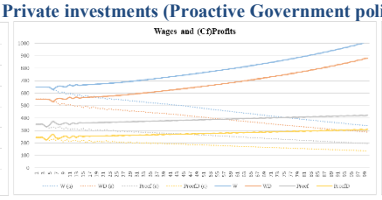
6.4.f. Budget Deficit and Public Debt

In the second situation, beyond the variation of public investments, the Government is proactively intervening through its taxation system. The fiscal policy about tax rates is designed to have a twofold purpose. The (endogenous) tax rates work as stabilisers on the variation of workers and capitalists' consumption and also stimulate and guide that. In fact here, the tax rates increase whenever the income perceived by the different classes increases beyond a certain maximum threshold - to collect resources in times of prosperity - and they decrease whenever their income falls below a minimum threshold fixed by the Government - in order to increase disposable income, boost consumption and in this way aggregate demand. Furthermore, since the tax rates applied to workers and capitalists react differently for the different social classes, the taxation system also works to reduce the economic gap between them.

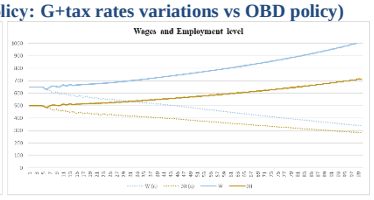
Figures 6.4.a'-6.4.c' The effects of a drop in Private investments (Proactive Government policy: G+tax rates variations vs OBD policy)



6.4.a'. Aggregate Production and Aggregate Demand

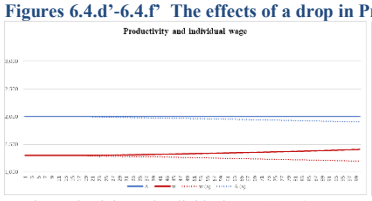


6.4. b'. Wages and Profits

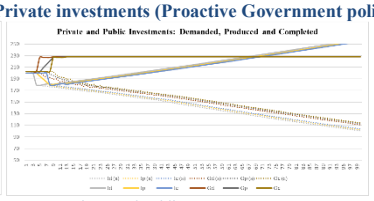


6.4.c'. Wages and Employment level

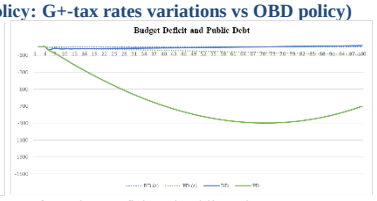
Figures 6.4.d'-6.4.f' The effects of a drop in Private investments (Proactive Government policy: G+-tax rates variations vs OBD policy)



6.4.d'. Productivity and Individual wage (A, w)



6.4. e'. Private and Public Investments



6.4.f'. Budget Deficit and Public Debt

In both cases it is possible to appreciate how the situation of crisis is rapidly solved by boosting aggregate demand, even if in two different ways. This is exactly in line with what Kalecki

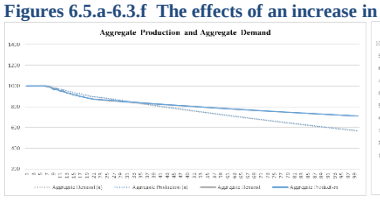
suggested in 'Three Ways to Full Employment' Kalecki (1944). In such a work, as Arestis and Sawyer (2011) suggest, Kalecki highlighted the ways in which a high level of economic activity (and employment) could have been secured, namely (i) the use of budget deficits, (ii) stimulation of investment, (iii) income redistribution. We furthermore advocate for a strong presence and intervention of the government, essential to the effective stimulation of private investments. This is so mainly because of the variability range of firms' expectations as underlined below. All previous Pro-active Government fiscal policies show their essential role for a fast economic recovery in terms of employment and social classes' income.

3.6.5 Exogenous increase in productivity and real wages under different fiscal policies

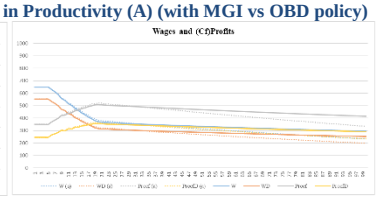
Here we simulate the situation of an exogenous increase in productivity and of a "pari passu" increase in productivity and real wage with a 0BD and a MGI.

First of all, we compare a reduction of the sole increase of productivity in the 0BD and in the MGI scenarios. In line with the post-Kaleckian conclusion an increase in productivity produces a reduction of employment and wage bill (6.5.c). Such a reduction of the previous variables drastically shrinks the $C^D_{t\,w}$ and in that way, as its weight overwhelms $C^D_{t\,\pi}$, also the overall C^D_t, aggregate demand and production. While the drop of Y^D_t drives private investments down, the reduction of income resources shrinks taxes income while public debt increases over time. Despite the previous effects happen both with a 0BD and with a MGI fiscal policy, the former has stronger negative effects on all the economic variables. That is so exactly because of the Government need to reduce the expenditures in public investments to balance out the (decreasing) revenues and its expenditures. Such a further reduction in aggregate demand depresses the economic activity even further.

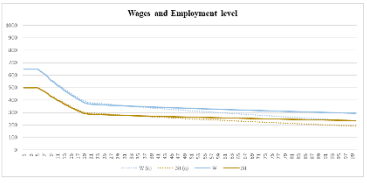
Figures 6.5.a-6.3.f The effects of an increase in Productivity (A) (with MGI vs OBD policy)



6.5.a. Aggregate Production and Aggregate Demand

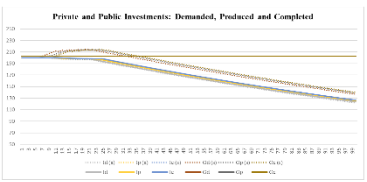


6.5. b. Wages and Profits

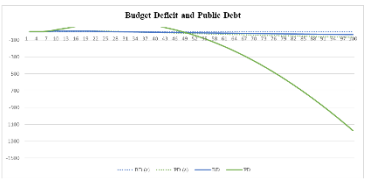


6.5.c Wages and Employment level

6.5.d. Productivity and Individual wage (A, w)



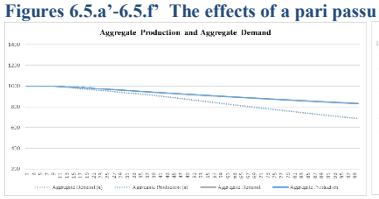
6.5.e. Private and Public Investments



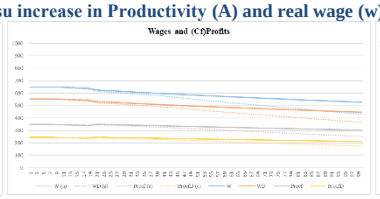
6.5.f. Budget Deficit and Public Debt

We finally simulate a pari passu exogenous increase of productivity and real wages (both constantly increase 3% during 10 periods) confronting the effects with a 0BD and with the MGI fiscal policy (6.5.a'-6.5.f'). Two features can be observed. The first one is that with both fiscal policies, the increase of real wages that accompanies the one in productivity better supports the employment and the economic activity levels respect to the situation of the sole increase in productivity. The second aspect that should be stressed is that even with that pari passu increase, even if a MGI policy still performs better respect to the 0BD, none of them is able to restore the employment and economic pre-crises values.

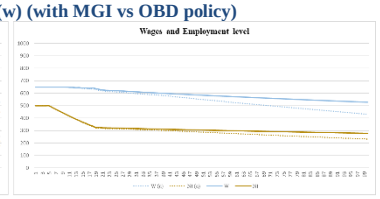
Figures 6.5.a'-6.5.f' The effects of a pari passu increase in Productivity (A) and real wage (w) (with MGI vs OBD policy)



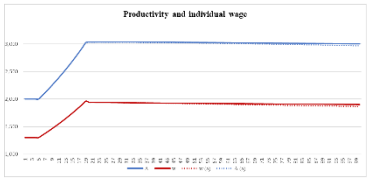
6.5.a'. Aggregate Production and Aggregate Demand



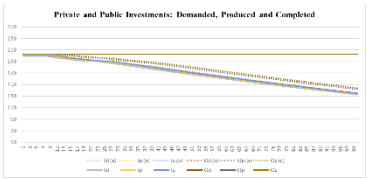
6.5.b'. Wages and Profits



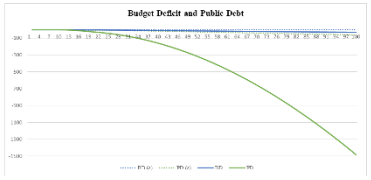
6.5.c'. Wages and Employment level



6.5.d'. Productivity and Individual wage (A, w)



6.5.e'. Private and Public Investments

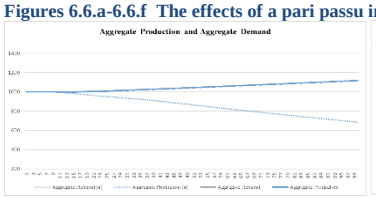


6.5.f'. Budget Deficit and Public Debt

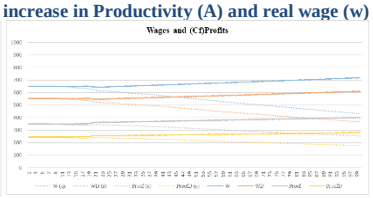
3.6.6 Exogenous increase in productivity and real wages with proactive fiscal policies

In our last step, we analyse the same scenario of a pari passu increase of productivity and real wage under two pro-active fiscal policies. The first one models a simple pro-active expenditure policy in public investments while the second one models a combined public expenditure and tax rate variation policy, as in section 6.4. According to the former (6.6.a-f), the government still adjusts its expenditure in public investments to support and secure a high level of economic activity and tries to restore a growth path in an economic and social sustainability way. Here it is possible to notice how, despite the government is successful in reversing the negative trend toward a growth path also pulling the private investments up, the employment level is not quickly restored.

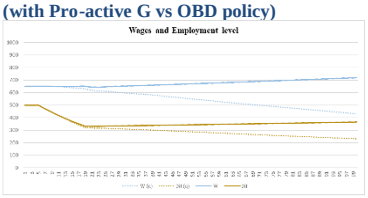
Figures 6.6.a-6.6.f The effects of a pari passu increase in Productivity (A) and real wage (w) (with Pro-active G vs OBD policy)



6.6.a. Aggregate Production and Aggregate Demand

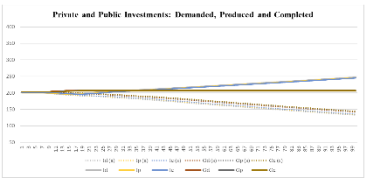


6.6.b. Wages and Profits

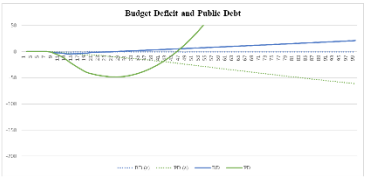


6.6.c. Wages and Employment level

6.6.d. Productivity and Individual wage (A, w)



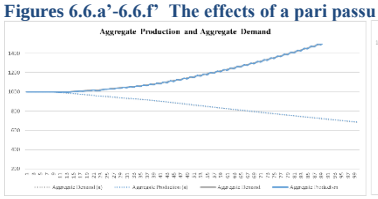
6.6.e. Private and Public Investments



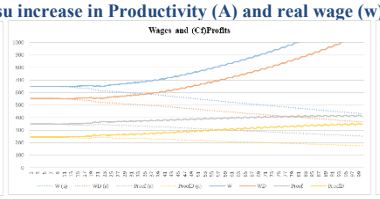
6.6.f. Budget Deficit and Public Debt

In the second scenario, with a proactive combined fiscal policy of public expenditure and tax rates management, the government achieves two results. In fact, as soon as the effects of increased productivity decrease the wage bill (because less employment is now required), the government quickly reacts by lowering the taxes on workers to boost their consumption and revitalizing their demand that might otherwise lower the aggregate demand level. By revitalizing C_{tw}^{D} and therefore C_{t}^{D}, the government quickly boosts the production of consumption and investment goods restoring the pre-crises employment level. The management of both expenditure and tax revenue sides gives the government the possibility to face an increasing BD and PD to boost the economic activity and later to collect more resources from income when the economic growth is restored. Secondly, such a combined fiscal policy also tackles the distributional issue. In fact, while such a policy is able to increase both workers' wages and capitalists' profits levels, it rises the wage share more effectively than all the previous fiscal policies (6.6.b').

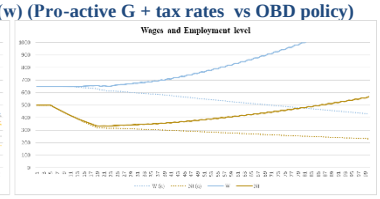
Figures 6.6.a'-6.6.f' The effects of a pari passu increase in Productivity (A) and real wage (w) (Pro-active G + tax rates vs OBD policy)



6.6.a'. Aggregate Production and Aggregate Demand

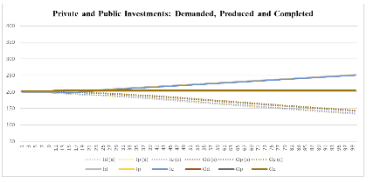


6.6.b'. Wages and Profits

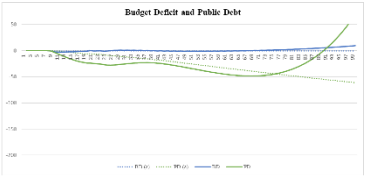


6.6.c'. Wages and Employment level

6.6.d'. Productivity and Individual wage (A, w)



6.6.e'. Private and Public Investments



6.6.f'. Budget Deficit and Public Debt

3.7 Policy implications

With respect to the situation of an exogenous drop in private investments, the most interventionist previous scenarios (the proactive government expenditure fiscal policy and the policy with the addition of a proactive tax rates) show strong similarities. First of all, both of them succeed in boosting all the components of aggregate demand, stimulating consumption and also private investments. This result is exactly in contrast with the mainstream point of view of a negative role of public government expenditure that would crowd out private investments. We argue that the presence of a strong and proactive government intervention committed to maintain a high level of economic activity, reducing future uncertainty and expectation variability, make firms more willing to invest in a safer and prosperous environment.

With respect to the scenario of an exogenous increase of productivity and real wages, our model supports the Kaleckian conclusion suggesting that in the presence of the former the pari passu increase of the latter does not ensure the employment level to be maintained. On the contrary, an increase in real autonomous expenditures - such as the one implemented by the government - is needed to support the aggregate demand, production and in this way the employment level.

However, our model suggests something further respect to that canonical Kaleckian model conclusion. In fact, in both the simulated scenarios (the exogenous drop of private investments and the exogenous increase in productivity and real wages) while both the proactive fiscal policies contribute to a more even distribution between social classes , the combined policy of public expenditure and tax rates is more effective in obtaining that result. Secondly, in both scenarios, a combined proactive expenditure and tax policy is also quicker and more effective in restoring the pre-shocks level of employment.

Finally, both fiscal policies are effective in supporting the economy only through an initial increasing budget deficit that, indeed, is much greater in the first period with respect to a 0BD policy but such a BD is eventually able to shrink over time. In fact, while the 0BD policy is incapable of restoring the economic activity and of avoiding an over increasing public debt, both the proactively fiscal policies under consideration are able to do so. The initial deeper budget deficit is exactly used to support the economic activity in a period of crises and to invert and revitalize the negative trend of the economy in the following recovery phase. Once the public sector restored the prosperity route, the private economic sectors have the strength to play a bigger role and, at the same time, to contribute more strongly to the public resources eventually allowing a reduction of the public debt (figures 6.4.f' - 6.4.f'' and 6.6.f-6.6.f').

Conclusions

This paper focused on the opened question of Bibi (2019 a), namely investigating the role of the Government in supporting the economy whenever there was a lack of demand together with its role in smoothing and steering the cycles phases. Those features have been tested in two different scenarios, one where there was an exogenous drop in private investments and the other where there was an increase of productivity and real wages. The aspect of aggregate demand support is related to the well-known "functional finance" through which the government aim is to ensure a high level of economic activity when the private sector is not able to do so by itself. The aspect of smoothing and steering the cycles phases is related to the instability issue underlined in Bibi (2019 a). In such a work, it was argued that whenever firms have "wrong" oversensitive expectations regarding the production of consumption goods for the following period, this might lead to an unstable mismatching between aggregate demand and aggregate production. Obviously, such a phenomena has its own spill over effects on different variables among which, most important, the employment level needed to produce those consumption goods. The presence and clear commitment of the government can effectively reduce the uncertainty about the future and, in that way, shrink the corridor of expectations.

Under both the simulated scenarios, even if the presence of the Government spending in public investments could prevent the economy to drop below a certain threshold, its "moderate intervention" might not be sufficient to obtain an economic recovery. The attempt of the Government to achieve a constant zero budget deficit policy tackling the "burden on future generation" argument would depress the economy even more, through a constant reduction of the public resources allocated to the public investments. In such a situation, only a proactive government intervention with an attitude of "functional finance" might ensure to achieve a pre-crisis aggregate demand and employment levels, or the targeted ones. Together with such an approach, also a proactive taxation system has demonstrated to have the twin role of stabilising the economy while reducing the gap between the social classes.

In the end, it is important to remember that in the current model we were still supposing the commercial banks were providing funds on demand to firms for financing their investments according to the endogenous money theory but we are aware that a deeper analysis of such an aspect is extremely important to catch the interactions among the variables under study.

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The file with which the simulation exercises have been developed might be requested to the author at samuele.bibi@gmail.com

- Chapter III - Appendix -
The stabilising role of the Government in a Dynamic Distribution Growth Model

Samuele Bibi
August 21, 2018

3.1.A System of Equations

a. National Identities:

$$Y_t^P = C_t^P + I_t^P + G_t^P \tag{1}$$

$$Y_t^{NI} = W_t + \Pi_t \tag{2}$$

$$Y_t^D = C_t^D + I_t^D + G_t^D \tag{3}$$

$$Y_t^D = Y_t^{NI} \tag{4}$$

b. Consumption and households relations:

$$C_t^D = C_{t\,w}^D + C_{t\,\pi}^D \tag{5}$$

$$C_{t\,\pi}^D = C_{\pi 0} + c_{\pi 1 t} \Pi D_{t-1\,cf} \tag{6}$$

$$C_{t\,w}^D = C_{w0} + c_{w1t} W D_{t-1} \tag{7}$$

$$c_{w1t} = c_{w1t-1} - \gamma_{cw1} \frac{\tau_{wt-1} - \tau_{wt-2}}{\tau_{wt-2}} c_{w1t-1} \tag{8}$$

$$c_{\pi 1t} = c_{\pi 1t-1} - \gamma_{c\pi 1} \frac{\tau_{\pi t-1} - \tau_{\pi t-2}}{\tau_{\pi t-2}} c_{\pi 1t-1} \tag{9}$$

c. Production and firms relations:

$$C_t^P = E_{t-1}(C_t^D) + s_t^* \tag{10}$$

$$E_{t-1}(C_t^D) = C_{t-1}^D + \eta'_t (C_{t-1}^D - C_{t-2}^D) \tag{11}$$

$$\eta'_t = \frac{C^D_{t-1} - C^D_{t-2}}{C^D_{t-2} - C^D_{t-3}} \tag{12}$$

$$\eta'_t = \eta'_L \quad if \quad \eta'_t > \eta'_L \tag{13}$$

$$\eta'_t = \eta'_U \quad if \quad \eta'_t < \eta'_U \tag{14}$$

$$\eta'_t = 0 \quad if \quad C^D_{t-2} = C^D_{t-3} \tag{15}$$

$$s^*_t = \alpha E_{t-1}(C^D_t) - Q_{t-1} \tag{16}$$

$$Q_t = s_t + Q_{t-1} = C^P_t - C^D_t + Q_{t-1} \tag{17}$$

$$C^P_t = A_t N^C_t \tag{18}$$

$$N^C_t = \frac{C^P_t}{A_t} \tag{19}$$

d. Employment, Labour Force and Wages-Profits relations

$$\omega_t = \omega_{t-1} + \gamma_z \frac{z_t - z_{t-1}}{z_{t-1}} \omega_{t-1} - \gamma_u (u_{t-1} - u_{t-2}) \omega_{t-1} \tag{20}$$

$$\gamma_u = \gamma_{u-} \quad if \quad u_{t-1} - u_{t-2} > 0 \tag{21}$$

$$\gamma_u = \gamma_{u+} \quad if \quad u_{t-1} - u_{t-2} < 0 \tag{22}$$

$$W_t = \omega_t N^T_t \tag{23}$$

$$N^T_t = N^C_t + N^I_t + N^G_t \tag{24}$$

$$u_t = \frac{U_t}{L_t} = \frac{L - N_t}{L_t} = 1 - \frac{N^T_t}{L_t} \tag{25}$$

$$L_t = L_{t-1} + \gamma_L \frac{Y^D_{t-1} - Y^D_{t-2}}{Y^D_{t-1}} L_{t-1} \tag{26}$$

$$\gamma_L = \gamma_{L-} \quad if \quad \frac{Y^D_{t-1} - Y^D_{t-2}}{Y^D_{t-1}} < 0 \tag{27}$$

$$\gamma_L = 0 \quad if \quad \frac{Y^D_{t-1} - Y^D_{t-2}}{Y^D_{t-1}} = 0 \tag{28}$$

$$\gamma_L = \gamma_{L+} \quad if \quad \frac{Y^D_{t-1} - Y^D_{t-2}}{Y^D_{t-1}} > 0 \tag{29}$$

$$A_t = A_{t-1} + \gamma_\omega \left(\frac{\omega_t - \omega_{t-1}}{\omega_{t-1}}\right) A_{t-1} + \gamma_k \left(\frac{\frac{K^T_{t-1}}{N^T_{t-1}} - \frac{K^T_{t-2}}{N^T_{t-2}}}{\frac{K^T_{t-2}}{N^T_{t-2}}} \right) A_{t-1} \tag{30}$$

$$\Pi_{t\,cf} = Y^D_t - W_t \tag{31}$$

$$WD_t = W_t - T_{t\,w} \tag{32}$$

$$\Pi D_{t\,cf} = \Pi_{t\,cf} - T_{t\,\pi} \tag{33}$$

3.2.A Kaleckian Investment function and firms' driving force

$$I^D_t = I^D_{t-1} + a_1\, \pi^e_{cf\,t\,(t+1)} I^D_{t-1} + a_2\, cu_{t-1} I^D_{t-1} \tag{34}$$

$$\pi^e_{cf\,t\,(t+1)} = \frac{\Pi^e_{cf\,t\,(t+1)}}{Y^{NI}_t} = \frac{\Pi^e_{cf\,t\,(t+1)}}{Y^D_t} \tag{35}$$

$$\Pi^e_{cf\,t\,(t+1)} = a_3 \Pi_{cf\,t-1} + a_4 (\Pi_{cf\,t-1} - \Pi_{cf\,t-2}) \tag{36}$$

$$a_1 = +|a_1| \qquad if \qquad (\Pi_{cf\,t-1} - \Pi_{cf\,t-2}) > 0 \tag{37}$$

$$a_1 = -|a_1| \qquad if \qquad (\Pi_{cf\,t-1} - \Pi_{cf\,t-2}) < 0 \tag{38}$$

$$a_1 = 0 \qquad if \qquad (\Pi_{cf\,t-1} - \Pi_{cf\,t-2}) = 0 \tag{39}$$

$$a_2 = +|a_2| \qquad if \qquad (Y^D_{t-1} - Y^D_{t-2}) > 0 \tag{40}$$

$$a_2 = -|a_2| \qquad if \qquad (Y^D_{t-1} - Y^D_{t-2}) < 0 \tag{41}$$

$$a_2 = 0 \qquad if \qquad (Y^D_{t-1} - Y^D_{t-2}) = 0 \tag{42}$$

$$cu_t = \frac{Y^D_t}{Y^*_t} \tag{43}$$

$$Y^*_t = Y^*_{t-1} + \psi_L \left(\frac{L^T_t - L^T_{t-1}}{L^T_{t-1}}\right) Y^*_{t-1} + \psi_A \left(\frac{A_t - A_{t-1}}{A_{t-1}}\right) Y^*_{t-1} \tag{44}$$

$$I^D_t = I^D_{t-1} + a_1\, \frac{a_3 \Pi_{cf\,t-1} + a_4 (\Pi_{cf\,t-1} - \Pi_{cf\,t-2})}{Y^D_t}\, I^D_{t-1} + a_2\, \frac{Y^D_{t-1}}{Y^*_{t-1}} I^D_{t-1} \tag{45}$$

$$I^P_t = \frac{1}{\theta} \sum\nolimits_{j=1}^{\theta} I^D_{(t-1-\theta+j)} \tag{46}$$

$$I_t^C = I_{(t-\theta)}^D \tag{47}$$

$$K_t^I = K_{t-1}^I - \delta_{KI} K_{t-1}^I + I_t^C \tag{48}$$

$$I_t^P = A_t N_t^I \tag{49}$$

$$N_t^I = \frac{I_t^P}{A_t} \tag{50}$$

3.3.A The Government into the Scene: goals and fiscal policies

GOVERNMENT SPENDING – *Option A*:

$$G_t^P = \frac{1}{\theta} \sum_{j=1}^{\theta} G_{(t-1-\theta+j)}^D \tag{51}$$

$$G_t^C = G_{(t-\theta)}^D \tag{52}$$

$$K_t^G = K_{t-1}^G - \delta_{KG} K_{t-1}^G + G_t^C \tag{53}$$

$$K_t^T = K_t^I + K_t^G \tag{54}$$

$$G_t^P = A_t N_t^I \tag{55}$$

$$N_t^G = \frac{G_t^P}{A_t} \tag{56}$$

GOVERNMENT SPENDING FUNCTION with 0BD policy (A):

$$G_t^D = T_{t-1}^T \tag{57}$$

GOVERNMENT SPENDING FUNCTION - moderate Government policy (B):

$$G_t^D = G_{t-1}^D \tag{58}$$

GOVERNMENT SPENDING FUNCTION – Proactive Government policy (C):

$$G_t^D = G_{t-1}^D + \gamma_g \left(\left| \frac{Y_{t-1}^D - Y_{t-2}^D}{Y_{t-2}^D} \right| \right) G_{t-1}^D, \qquad G_t^D \geq 0 \tag{59}$$

$$\gamma_g = +|\gamma_g| \qquad \textit{if} \qquad \frac{Y_{t-1}^D - Y_{t-2}^D}{Y_{t-2}^D} \leq \varphi_{Gl} \tag{60}$$

$$\gamma_g = -|\gamma_g| \qquad \textit{if} \qquad \frac{Y_{t-1}^D - Y_{t-2}^D}{Y_{t-2}^D} > \varphi_{Gh} \tag{61}$$

$$\gamma_g = 0 \qquad \textit{else if} \tag{62}$$

$$T_t^T = T_{tw} + T_{t\pi} \tag{63}$$

$$T_{t\,w} = \tau_{t\,w}\, W_{t-1} \tag{64}$$

$$T_{t\,\pi} = \tau_{t\,\pi}\, \Pi_{t-1\,cf} \tag{65}$$

$$\tau_{t\,w} = \tau_{t-1\,w} + \gamma_{\tau w}\left(\left|\frac{w_{t-1} - w_{t-2}}{w_{t-1}}\right|\right) \tau_{t-1\,w} \tag{66}$$

$$\tau_{t\,\pi} = \tau_{t-1\,\pi} + \gamma_{\tau\pi}\left(\left|\frac{\Pi_{cf\ t-1} - \Pi_{cf\ t-2}}{\Pi_{cf\ t-1}}\right|\right)\tau_{t-1\,\pi} \tag{67}$$

$$\gamma_{\tau w} = +|\gamma_{\tau w}| \quad if \quad \frac{w_{t-1}-w_{t-2}}{w_{t-1}} > \varphi_{\tau wh} \tag{68}$$

$$\gamma_{\tau\pi} = +|\gamma_{\tau\pi}| \quad if \quad \frac{\Pi_{cf\ t-1}-\Pi_{cf\ t-2}}{\Pi_{cf\ t-1}} > \varphi_{\tau\pi h} \tag{69}$$

$$\gamma_{\tau w} = -|\gamma_{\tau w}| \quad if \quad \frac{w_{t-1}-w_{t-2}}{w_{t-1}} \leq \varphi_{\tau wl} \tag{70}$$

$$\gamma_{\tau\pi} = -|\gamma_{\tau\pi}| \quad if \quad \frac{\Pi_{cf\ t-1}-\Pi_{cf\ t-2}}{\Pi_{cf\ t-1}} \leq \varphi_{\tau\pi l} \tag{71}$$

$$BS_t = T_t - G_t \tag{72}$$

$$PC_t = PC_{t-1} + BS_t \tag{73}$$

3.4.A BOX 1. Production and utilization function

As regards to production it is important to remember that, as well as in Bibi (2019 a), equation (18) represents our "pseudo-production function" from which the employment level is obtained through (19). Really, in the Kaleckian version of the Post-Keynesian model a proper production function does not exist as Lavoie (Lavoie, 2014) perfectly explains:

> "With a given stock of capital, more labour can be employed because a larger portion of the machinery is utilized. While there is no production function in the neoclassical sense, there is in post-Keynesian theory a 'utilization function' relating output to employment as suggested by Robinson (1964, p. 25), whereby a higher rate of utilization of capacity is associated with higher employment (Nell, 1978, p.7)."

In this way (and according to equation 5.14 in Lavoie, 2014, p.292) the Kaleckian aggregate supply function – or utilization function - takes the form of (18) where the production is obtained by the product of workers employed and their labour productivity. A deeper discussion of the production function is included in the Appendix (See box 1).

In equations (18, 49, 55) of our model we used the canonical post-Kaleckian functions as used in Lavoie (2014) who perfectly explains the motivation of using an utilisation function. It might be argued that, while those utilization functions should be used in the short or ultra-short run where the capital is constant, we should incorporate the (varying) capital in the production functions in a more medium run model as the one presented here. However, in our scenario of crises, the use of such functions do still not let our model to be invalid.

Let us suppose a very simple economy that use workers and capital with fixed coefficients, in a proportional way. This production function equation would then assume a Leontief form as the following:

$$C_t^P = \min\ (A\ \ N\ \ ,\ \ B\ \ K)$$

In line with the Post – Keynesian school of thought, our model assume that the production - of goods consumption for example (C_t^P) - is determined by the demand C_t^D. Let us suppose that the demand of consumption goods calls for the production of 1,000 tons of wheat. Knowing that each ton of wheat requires 2 workers (N) with a labour productivity (A) of 0.5 together with 5 tools of capital (K) with a productivity (B) of 0.2, 1,000 tons of wheat will require 2,000 workers (N) together with 5,000 tools of capital (K).

Let us also suppose a situation of a non-full employment and an underutilized full capacity of capital. In particular we assume that the labour force (L) is composed by 2,400 potential workers and the total existent capital is composed of 6,000 tools. In this situation, therefore, both workers and capital are below their full capacity utilisation and the potential resources available in the economy are higher than the ones actually requested to produce the demanded goods. It might be argued that, for example, this was exactly also the situation of the pre-2007 crises and it is the situation that Post–Keynesians assume to be the general case of the economy.

In such a situation and in every similar situation of underutilised human and capital resources, and where A N is lower than B K, the amount of employment actually asked for the production is determined uniquely by the amount of the demand. More specifically, 2,000 workers will be actually employed for the required production:

$$C_t^P = \min\ (A\ \ \ \ N\ \ \ ,\ \ \ B\ \ \ \ K\ \ )$$

$$C_t^P = \min\ (0.5\ \ 2{,}400\ \ ,\ \ 0.2\ \ 6{,}000)$$

Potential

$$C_t^P = \min\ (0.5\ \ 2{,}000\ \ ,\ \ 0.2\ \ 5{,}000)$$

Needed

$$C_t^P = \min\ (0.5\ \ 2{,}000\ \ ,\ \ 0.2\ \ 5{,}000)$$

Actual

$$N^* = \frac{C_t^P}{A} = \frac{1{,}000}{0.5} = 2{,}000$$

Actual Employment

$$K^* = \frac{A\ N^*}{B} = \frac{0.5\ \ 2{,}000}{0.2} = 5{,}000$$

Capital tools actually used

[Situation of underutilised full resources and where $A\ N \leq B\ K$]

As shown, in the situation described - and even more in a situation of a crises where neither existent capital nor workers constitute a limit to what can be actually produced - the level of employment is determined uniquely by the level of demand and equation (18) - $C_t^P = A_t N_t^C$ - can be used as a pseudo production function.

3.5.A Eta (η) Analysis: Figures 5.0.a - 5.0.n

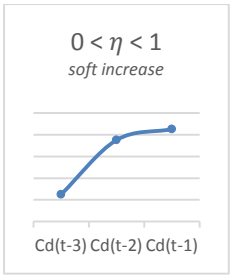

Figure 5.0.a: Soft increase

$C^D_{t-2} - C^D_{t-3} > 0$
$C^D_{t-1} - C^D_{t-2} > 0$
$C^D_{t-1} - C^D_{t-2} < C^D_{t-2} - C^D_{t-3}$

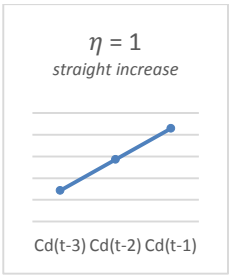

Figure 5.0.b: Straight increase

$C^D_{t-2} - C^D_{t-3} > 0$
$C^D_{t-1} - C^D_{t-2} > 0$
$C^D_{t-1} - C^D_{t-2} = C^D_{t-2} - C^D_{t-3}$

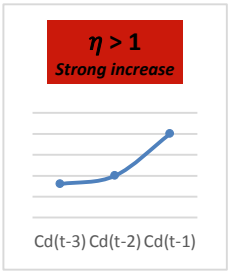

Figure 5.0.c: Strong increase

$C^D_{t-2} - C^D_{t-3} > 0$
$C^D_{t-1} - C^D_{t-2} > 0$
$C^D_{t-1} - C^D_{t-2} > C^D_{t-2} - C^D_{t-3}$

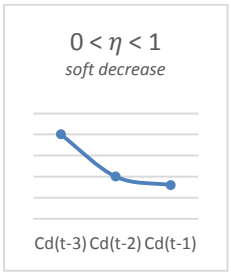

Figure 5.0.d: Soft decrease

$C^D_{t-2} - C^D_{t-3} < 0$
$C^D_{t-1} - C^D_{t-2} < 0$
$C^D_{t-1} - C^D_{t-2} > C^D_{t-2} - C^D_{t-3}$

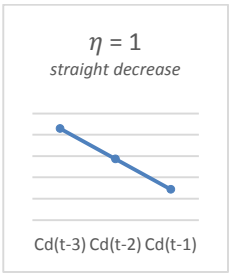

Figure 5.0.e: Straight decrease

$C^D_{t-2} - C^D_{t-3} < 0$
$C^D_{t-1} - C^D_{t-2} < 0$
$C^D_{t-1} - C^D_{t-2} = C^D_{t-2} - C^D_{t-3}$

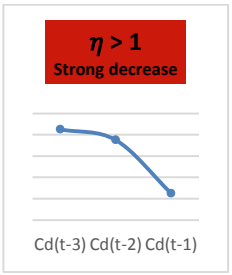

Figure 5.0.f: Strong decrease

$C^D_{t-2} - C^D_{t-3} < 0$
$C^D_{t-1} - C^D_{t-2} < 0$
$C^D_{t-1} - C^D_{t-2} < C^D_{t-2} - C^D_{t-3}$

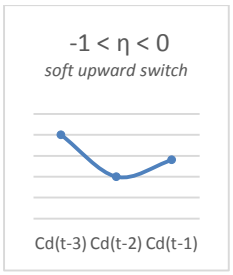

Figure 5.0.g: Soft upward switch

$C^D_{t-2} - C^D_{t-3} < 0$
$C^D_{t-1} - C^D_{t-2} > 0$
$C^D_{t-1} - C^D_{t-2} < |C^D_{t-2} - C^D_{t-3}|$

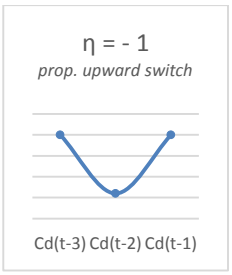

Figure 5.0.h: Prop. upward switch

$C^D_{t-2} - C^D_{t-3} < 0$
$C^D_{t-1} - C^D_{t-2} > 0$
$C^D_{t-1} - C^D_{t-2} = |C^D_{t-2} - C^D_{t-3}|$

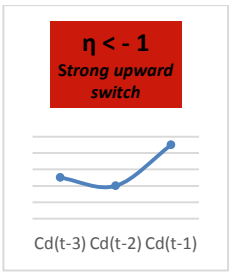

Figure 5.0.i: Strong upward switch

$C^D_{t-2} - C^D_{t-3} < 0$
$C^D_{t-1} - C^D_{t-2} > 0$
$C^D_{t-1} - C^D_{t-2} > |C^D_{t-2} - C^D_{t-3}|$

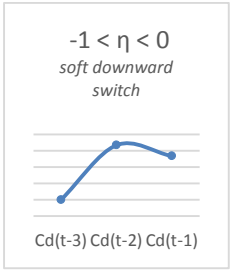

Figure 5.0.l: Soft downward switch

$C^D_{t-2} - C^D_{t-3} > 0$
$C^D_{t-1} - C^D_{t-2} < 0$
$|C^D_{t-1} - C^D_{t-2}| < C^D_{t-2} - C^D_{t-3}$

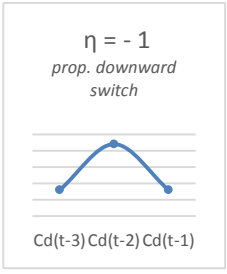

Figure 5.0.m: Prop downward switch

$C^D_{t-2} - C^D_{t-3} 0$
$C^D_{t-1} - C^D_{t-2} < 0$
$|C^D_{t-1} - C^D_{t-2}| = C^D_{t-2} - C^D_{t-3}$

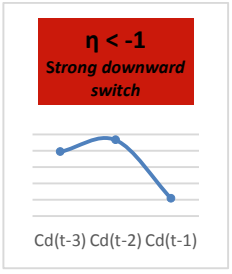

Figure 5.0.n: Strong downward switch

$C^D_{t-2} - C^D_{t-3} > 0$
$C^D_{t-1} - C^D_{t-2} < 0$
$|C^D_{t-1} - C^D_{t-2}| > C^D_{t-2} - C^D_{t-3}$

Source: Bibi Samuele (2019 a)

3.6.A Analysis of Initial Equilibrium State and Parameters

$$Y_t^P = C_t^P + I_t^P + G_t^P \quad (1)$$
$$1{,}000 = 597.5 + 200 + 202.5$$

$$Y_t^{NI} = W_t + \Pi_t \quad (2)$$
$$1{,}000 = 650 + 350$$

$$Y_t^D = C_t^D + I_t^D + G_t^D \quad (3)$$
$$1{,}000 = 597.5 + 200 + 202.5$$

$$Y_t^D = Y_t^{NI} \quad (4)$$
$$1000 = 1000$$

$$C_t^D = C_{t\,w}^D + C_{t\,\pi}^D \quad (5)$$
$$597.5 = 447.5 + 150$$

$$C_{t\,\pi}^D = C_{\pi 0} + c_{\pi 1 t}\, \Pi D_{t-1\,cf} \quad (6)$$
$$150 = 3 + 0.6\,(245)$$
$$150 = 3 + 0.6\,(350 - 105)$$

$$C_{t\,w}^D = C_{w0} + c_{w1 t}\, WD_{t-1} \quad (7)$$
$$447.5 = 5.5 + 0.8\,(552.5)$$
$$447.5 = 5.5 + 0.8\,(650 - 97.5)$$

$$WD_{tw} = W - T_{tw} \quad (32)$$
$$552.5 = 650 - 97.5$$

$$\Pi D_{t\,cf} = \Pi_{t\,cf} - T_{t\pi} \quad (33)$$
$$245 = 350 - 105$$

$$T_{t\,w} = \tau_{t\,w}\, W_{t-1} \quad (64)$$
$$97.5 = 0.15(650)$$

$$T_{t\,\pi} = \tau_{t\,\pi}\, \Pi_{t-1\,cf} \quad (65)$$
$$105 = 0.30(350)$$

3.7.A Analysis of Key Parameters:

Parameter:	Abbreviation	Value	Source:
mpcw (workers) based on their past Wages	c_{w1}	0.8	I bilanci delle famiglie italiane nell'anno 2014, Supplementi al Bollettino Statistico, Banca d'Italia
mpck (capitalists) based on their past Profits	$c_{\pi 1}$	0.6	I bilanci delle famiglie italiane nell'anno 2014, Supplementi al Bollettino Statistico, Banca d'Italia
adjustment Workers' mpc parameter	γ_{cw1}	0.4	Selected from a reasonable range of values
adjustment Capitalists' mpc parameter	$\gamma_{c\pi 1}$	0.3	Selected from a reasonable range of values
Workers' tax rate	τw	0.15	Selected from a reasonable range of values
Capitalists' tax rate	$\tau\pi$	0.30	Selected from a reasonable range of values
proportion of inventories/Expected Sales	α	0.1	Selected from a reasonable range of values
coefficient of W reaction to change in z	γ_z	0.2	Selected from a reasonable range of values
coefficient of **+W** reaction to change in u	γ_{u+}	0.50	(Font, Izquierdo, & Puente, 2015)
coefficient of **-W** reaction to change in u	γ_{u-}	0.50	(Font, Izquierdo, & Puente, 2015)
coefficient of **+L** reaction to change in (+) Y^D	γ_{L+}	0.50	Proxied from (Elmeskov and Pichelmann, 1993)
coefficient of **- L** reaction to change in (-) Y^D	γ_{L-}	0.50	Proxied from (Elmeskov and Pichelmann, 1993)
coefficient of A reaction to change in W	γ_w	0.5	(Vergeer & Kleinknecht, 2014)
coefficient of A reaction to change in (K/N)	γ_K	0.25	Selected from a reasonable range of values
coefficient of LF reaction to change in (+) Yd	γ_{L+}	0.5	Selected from a reasonable range of values
coefficient of LF reaction to change in (-) Yd	γ_{L-}	0.50	Selected from a reasonable range of values
Lower limit of the expectation boundaries	η'_L*	- 2	Selected from a reasonable range of values
Upper limit of the expectation boundaries	η'_U*	2	Selected from a reasonable range of values
Average period of construction of Investments	θ	4	Selected from a reasonable range of values
coefficient of Expected Investment	a_1	0.05	Selected from a reasonable range of values
coefficient of reaction to capacity utilization	a_2	0.05	Selected from a reasonable range of values
coefficient of weight to previous level of profits	a_3	1.0	Selected from a reasonable range of values
coefficient of weight to previous change in profits	a_4	1.0	Selected from a reasonable range of values
coefficient of Y* (capacity output) growth wrt LF	ψ_L	3.0	Selected from a reasonable range of values
coefficient of Y* (capacity output) growth wrt A	ψ_A	1.0	Selected from a reasonable range of values
coefficient of erosion of private capital stock	δ_{KI}	0.2000	Selected from a reasonable range of values
coefficient of erosion of public capital stock	δ_{KG}	0.2025	Selected from a reasonable range of values

* The limit boundaries of η are set equal to -20 and +20 to explore the effect of higher corridor of volatility in the expectations.

Parameter		Baseline Scenario	Proactive G fiscal policy	Proactive G + tax rates fiscal policy
Threshold of (+)w to let w tax increase	$\varphi_{\tau wh\,(high)}$	0,0%	0,0%	5,0%
Threshold of (+)π to let π tax increase	$\varphi_{\tau\pi h\,(high)}$	0,0%	0,0%	3,0%
Threshold of (-)w to let w tax decrease	$\varphi_{\tau whl\,(low)}$	0,0%	0,0%	2,0%
Threshold of (-)π to let π tax decrease	$\varphi_{\tau\pi l\,(low)}$	0,0%	0,0%	2,0%
Variation of (-)Government Intervention	$\gamma_{g(-)}$	0	0	0
Variation of (+)Government Intervention	$\gamma_{g(+)}$	0	10	6
Threshold of (-)Yd to let Government +G	$\varphi_{Gl\,(low)}$	0,0%	0,0%	0,0%
Threshold of (+)Yd to let Government -G	$\varphi_{Gh\,(high)}$	0,0%	0,0%	0,0%

Notes:
The underlined values are the key parameters that the government is able to directly manipulate to steer and guide the economy.

3.8.A Analysis of Shock in the different scenarios:

6.1. Exogenous drop in Private Investments with a Government committed to 0 Budget Deficit policy

Period t = 3 (and previous periods): I_3^D = 200.
In t = 4:exogenous drop by 20: I_4^D = 180.
6.1.a*-6.1.f* : 0BD policy with -12 ≤ η'_t ≤ 12
6.1.a-6.1.f : 0BD policy with -2 ≤ η'_t ≤ 2
6.1.a'-6.1.f' : 0BD policy with -2 ≤ η'_t ≤ 2. $I_t^D = f(\Pi^e_{cf\,t\,(t+1)}, cu)$. a_1 =0,00005. a_2 =0,0005.

6.3. Exogenous drop in Private Investments with a Government committed to 0 Budget Deficit policy

Period t = 3 (and previous periods): I_3^D = 200.
In t = 4:exogenous drop by 20: I_4^D = 180.
6.3.a-6.3.f : MGI (Moderate Government Intervention) vs 0BD policy with 0BD.
6.3.a-6.3.f : Proactive G vs 0BD policy.

6.4. Exogenous drop in Private Investments with a Government committed to 0 Budget Deficit policy

Period t = 3 (and previous periods): I_3^D = 200.
In t = 4:exogenous drop by 20: I_4^D = 180.
6.4.a-6.4.f: Pro-active G vs OBD policy
6.4.a'-6.4.f': Pro-active G + tax rates vs OBD policy

6.5. Exogenous drop in Private Investments with a Government committed to 0 Budget Deficit policy

Period t = 3 (and previous periods): A(productivity)=2,00
Since t = 6: exogenous increase by 3% A during 10 periods.
6.5.a-6.5.f: MGI vs OBD policy

Period t = 3 (and previous periods): w =1,30, A=2,00
Since t = 6: exogenous increase by 3% of both variables during 10 periods.
6.5.a'-6.5.f': MGI vs OBD policy

6.6. Exogenous drop in Private Investments with a Government committed to 0 Budget Deficit policy

Period t = 3 (and previous periods): w =1,30, A=2,00
Since t = 6: exogenous increase by 3% of both variables during 10 periods.
6.6.a-6.6.f: Pro-active G vs OBD policy
6.6.a'-6.6.f': Pro-active G + tax rates vs OBD policy

The file with which the simulation exercises have been developed might be requested to the author at samuele.bibi@gmail.com

- Chapter IV-
The distributive monetary analysis of a sustainable ecological economy

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June 18, 2018

This paper builds upon "Keynes, Kalecki and Metzler in a Dynamic Distribution Model" and "The stabilizing role of the Government in a Dynamic Distribution Growth Model". In the former the dynamics of an economy from the ultra-short to the short period inside a Post-Keynesian perspective were studied, questioning the general shared assumption of equilibrium between aggregate demand and aggregate supply in the short and long run Kaleckian models. In the latter the endogeneity of the investments in a Kaleckian perspective and the intervention of the government were introduced. There it was argued that the intervention of a pro-active government was twofold. On the one hand, the Government intervention would have rapidly supported the economy in a situation of lack of aggregate demand. On the other hand, it would have stabilized the economy restraining the expectations of the production sector in a situation of uncertainty. These hints were supported by numerical dynamic simulations after a negative shock of the private investments. For simplification it was assumed that, in line with a horizontalist approach, commercial banks were providing funds on demand to firms for financing their investments.
In the current work we deeply focus on the monetary analysis of such an economy characterized by different real stylized facts, namely the temporal lag between production and sales of products by firms, the one between income received by the social classes and their expenditure, the gestation period of the investments and, finally, the intervention of the government. The theoretical analysis framework of the endogenous money is accompanied by dynamic numerical simulation.
The model questions the expenditure margins of the Government – in particular after a crisis - and uses the suggestions of the monetary circuit theory to analyse the space for fiscal policies aimed to reduce unemployment boosting the economic activity, to obtain a more equitable distribution between social classes while obtaining those goals in a sustainable ecological way.
Beyond the relevance at a theoretical level, the analysis of endogenous money supported by Graziani founds its relevance also in the recent and current economic scenario. In fact its relevance has also been recently recognized by the Bank of England (McLeay, Radia, & Ryland, 2014) and by the Deutsche Bundesbank in their Monthly Report April 2017, which carried the article – Die Rolle von Banken, Nichtbanken und ZentralbankimGeldschöpfungsprozess (The Role of Banks, Non-banks and the central bank in the money-creation process). The analysis of the Endogenous Money is a cornerstone in understanding the economic system, its stability and social-ecological sustainability.

Key words: *Kalecki, Post-Keynesian Economics, Economic instability, Distribution, Endogenous Money, Ecological sustainability*
JEL classifications: E12, E32, E51

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* This paper has been submitted to the ***Ecological Economics Journal*** in the date indicated.
I am grateful to my PhD Supervisors, Malcolm Sawyer and Stefano Zambelli, for their suggestions and comments to the present work. I am also grateful to Yannis Dafermos, Marco Veronese Passarella and Gennaro Zezza for the inspiring discussions that deeply shaped and motivated me in carrying out this research project.

4.1 Introduction

In the years after the 2007 crises, the recovery and the distribution issues revamped interest both in the economic theories and in the political discussions. Together with those, a particular attention was given to the ecological problems with the ambitious nonetheless necessary objective of achieving the first two goals in an ecologically sustainable way.

Despite many contributions focused on some of the previous topics, few of them tried to tackle them all in a comprehensive way considering one of the most important breakthroughs in the last decades, namely the rediscovery of the endogenous money phenomena. Here we argue that exactly the endogenous money feature is the essential fil rouge to better understand and connect those three importantly related aspects. It is so in analysing the sectors connections and the policies ones devoted to recovery, in analysing how the different incomes and wealth are captured and distributed by the different social classes and finally in pointing out the ways of financing long term ecological path to preserve a sustainable environment.

Our work is strongly based on Sawyer (2002), Arestis & Sawyer (2005) and takes inspiration also from Fontana & Sawyer, (2016), Jackson & Victor (2016), Sawyer & Passarella Veronese (2017), Dafermos, et al., (2017), and Bibi (2019 a, b). The base of the Endogenous Money and of the structure of the economy in what has been known as Post Keynesian Stock-Flow Consistent approach mainly relies on the works by Graziani (2003), by Godley & Lavoie (2007a) and by Fontana & Setterfield (2009). The previous works constitute the cornerstones of the topics we want to tackle here. The space to study the (un)sustainability is extremely relevant especially when the endogenous money approach is taken into account in a Post-Keynesian Stock-Flow Consistent (PK-SFC) approach.

The structure benchmark of our model is Godley and Lavoie (2006), chapter 11. In particular, it is so since, in line with that, we are also considering that:

- production takes time. Since workers need to be paid with the activation of the production while firms can obtain the remuneration of their activity only when the products are finally sold, such process creates the need to be financed outside the production sector itself – from the banking sector.
- banks create credit money. In fact, exactly because commercial banks make loans to firms in need of paying the production activation - and therefore inventories - without receiving the related receipts, the commercial banks create credit money. With that firms can then pay workers who use it to buy consumption goods from the same firms.

- the lack of market clearing condition. In fact, the mismatching between aggregate demand and aggregate production in consumption goods creates inventories.
- firms undertake fixed investments and therefore are able to accumulate capital.

However different features distinguish the main characteristics of our model.

- First of all, households are made up of two social groups, workers and capitalists. These households differ in terms of their initial endowment, their consumption behaviour, the different loans repayment conditions required to them by the banks and in terms of the ways in which they can use their financeable wealth.
- Secondly, we consider the a-synchronized Kaleckian investment production process. In line with that, the three different investment stages that Kalecki himself (Kalecki M. , 1971) analysed are considered: investment order or Demand, investment Production and investment delivery or Completion. Our intuition is that the a-synchronization of those steps might lead to a sustainability issue in supporting the aggregate demand because of the way in which the investments are financed.
- Thirdly, we consider the investments and capital hold both by non-financial firms and the one hold by the Government; this distinction is relevant because we want to explore how different drivers of investments can affect the formation of capital and the economic and ecological sustainability of our economy.
- Finally, we consider the ecological impacts of the workers and capitalists' consumption process. In particular, their dissimilar consumption level - based on different incomes and wealth - is assumed to have different impacts on the ecological balances and resources needed to obtain the consumptions goods required. This seems in line with the conclusions of most studies about the environmental pressure related to levels of incomes (Mackenzie, Messinger, & Smith, 2008).

This paper proceeds as follows. Section 2 describes the overall model through its balance sheet and transaction flow matrices. Section 3 gives a sketch of the model and underlines the main behavioural rules of the actors while section 4 presents the main simulations based on our key question about the government space of manoeuvre to achieve an economic, social and ecological sustainable recovery. Section 5 concludes offering some policies recommendations and concluding remarks.

	Households		Production Firms	Government	Central Bank	Banks	Σ
	Workers	Capitalists					
Inventories			$+IN$				$+IN$
Fixed Capital			$+K^I$	$+K^G$			$+K^T$
HPM *(Cash)*	$+H_w$	$+H_\pi$			$-H$	$+H_b$	0
Money *(Deposit)*	$+M_w$	$+M_\pi$				$-M$	0
Bills		$+B_\pi$		$-B$	$+B_{cb}$	$+B_b$	0
Bonds		$+BL_\pi \cdot p_{bL}$		$-BL_\pi \cdot p_{bL}$			0
Loans	$-L_w$	$-L_\pi$	$-L_f$			$+L$	0
Bank capital		$+OF_b$				$-OF_b$	0
Balance *(Net Worth)*	$-V_w$	$-V_\pi$	$-V_f$	$-V_g$	0	0	$-(IN+K)$
Σ	0	0	0	0	0	0	0

Table 1. Balance Sheet Matrix

4.2 Balance Sheet and transactions-flow matrix

Following Kaleckian features, we describe an economy characterized by two different types of socio-economic classes, namely the workers and the capitalists' households. They are different because of the wealth they are endowed with, because of their consumption capacity linked to the different purchasing power and because of the different loans repayment conditions required to them by the commercial banks. Finally, even if production firms are described as a separate sector in the economy, these are legally owned by the capitalists' households while workers' households don't have any claim towards the firms beyond the wage related to the labour-power they sell to them.

Workers' and capitalists' households are allowed to take loans by commercial banks (CBs hereafter) and they maintain their wealth in the form of cash and deposits. Additionally, the capitalists have also access and can maintain their wealth in form of bills and bonds and, being the owners of both financial and nonfinancial firms, they hold banks OF (own funds) too.

In our economy, production firms own both inventories and fixed capital and they are allowed to take loans to finance their productive activity.

The government is supposed to own capital, reflected for example in the value of transport and educational infrastructures, while emitting bills and bonds. Central Bank (CB) holds part of the bills emitted by the government and emits cash (or High Power Money). CBs make loans to firms and households while having Treasury bills $B_b$and cash balances H_b.The net worth of the CBs calculated as difference between assets and liabilities constitutes their own funds (OF_b) and is also reflected in the balance sheet of their owners, the capitalists.

The transaction-flow matrix (TFM hereafter) describes how the flows of the different sectors of the economy are connected within a certain unit of time using a positive sign for the source of funds and a negative sign for the use of funds.

Workers households receive their wages and deposit interests while using their income in consumption for final goods, in paying taxes and interests on loans and, finally, saving the residual in form of cash, deposits or paying back the loans that they previously took. While capitalists' households do not receive any wages, they do receive part of the nonfinancial and financial firms' profits, being for the rest subject to the same transaction structure of workers' households. In addition, they receive positive interests on financial assets and they are supposed to keep their saving in bills and bonds too.

Non-financial firms sell consumption goods to households and public investments to the government. Furthermore, they produce private investments and inventories. The resources generated by the productive activities are used to pay the workers employed for their supply of labour, the interests on loans that allowed to activate the production process and finally, after retaining part of the profits, to distribute the remaining ones to the capitalists.

The government is supposed to invest in public expenditure to create physical and social capital paying back interests on the bills and bonds it emitted while collecting taxes from households and obtaining back the profits obtained by the Central Bank. The CB obtains interests from the bills but since we suppose a CB with nil profit goals, it redistributes every profit to the government.

Finally, the CBs obtain the interests on the loans provided to non-financial firms and on bills emitted by the government and pay the ones on deposits to households. CBs are supposed to entirely distribute their profits to the owners of the banks, the capitalists.

	Households		Firms		Government		Central Bank		Banks		Σ
	Workers (1)	Capitalists (2)	Current (3)	Capital (4)	Current (5)	Capital (6)	Current (7)	Capital (8)	Current (9)	Capital (10)	
Consumption	$-C_w^D$	$-C_\pi^D$	$+\boldsymbol{C^D}$								0
Government Expenditure					$-G^D$	$+G^D$					0
Government Expenditure			$+\boldsymbol{G^D}$			$-G^D$					0
Fixed Investment			$+\boldsymbol{I^D}$	$-I^D$							0
Inventory accumulation											0
Taxes	$-T_w$	$-T_\pi$			$+T$						0
Wages	$+WB$		$-WB$								0
Inventory financing cost			$-r_{l-1} \cdot IN_{-1}$						$+r_{l-1} \cdot IN_{-1}$		0
Entrepreneurial Profits		$+FD_f$	$-F_f$	$+FU_f$					$+r_{l-1} \cdot (L_{f-1} - IN_{-1})$		0
Bank Profits		$+F_b$							$-F_b$		0
Central Bank Profits					$+F_{cb}$		$-F_{cb}$				0
Loan interests	$-r_{l-1} \cdot L_{w-1}$	$-r_{l-1} \cdot L_{\pi-1}$							$+r_{l-1} \cdot L_{h-1}$		0
Deposit interests	$+r_{m-1} \cdot M_{w-1}$	$+r_{m-1} \cdot M_{\pi-1}$							$-r_{m-1} \cdot M_{-1}$		0
Bill interests		$+r_{b-1} \cdot B_{\pi-1}$			$-r_{b-1} \cdot B_{-1}$		$+r_{b-1} \cdot B_{cb-1}$		$+r_{b-1} \cdot B_{h-1}$		0
Bond interests		$+BL_{-1}$			$-BL_{-1}$						0
Flows of funds (changes in stocks)											
Change in Loans	$+\Delta L_w$	$+\Delta L_\pi$		$+\Delta L_f$						$-\Delta L$	0
Change in HPM *(Cash)*	$-\Delta H_w$	$-\Delta H_\pi$						$+\Delta H$		$-\Delta H_b$	0
Change in Money *(Deposits)*	$-\Delta M_w$	$-\Delta M_\pi$								$+\Delta M$	0
Change in bills		$-\Delta B_\pi$				$+\Delta B$		$-\Delta B_{cb}$		$-\Delta M_b$	0
Change in bonds		$-\Delta BL \cdot p_{bL}$				$+\Delta BL \cdot p_{bL}$					0
Σ	0	0	0	0	0	0	0	0	0	0	0

Table 2. Transaction-Flow Matrix

4.3 A sketch of the economy

Our economy is characterized by a social, monetary and environmental framework. In fact, beyond considering the distributional effects linked to the sectors interactions, we study the impacts that the economic consumption has in terms of ecological erosion of natural resources. In such a social and ecological environment, the monetary links in the endogenous money framework allow us to track all the economic interactions among the sectors involved. To fully grasp them we make use of a Post-Keynesian Stock Flow Consistent model that guarantees that "there are no black holes - every flow comes from somewhere and goes somewhere" (Godley W. , 1996).

It makes sense to sketch out the model verbally before jumping into the mathematics that more strictly describes all the accounting and behavioural relations of our economy.

4.3.1 *The endogenous money framework*

In this work, the underlying mechanism related to Graziani's endogeneity of money is in place. Such as Kalecki, the circuitists introduce a preliminary distinction between producers and wage earners. The first step of the monetary circuit is characterized by firms' decision to activate production and, in order to do so, they take up loans by commercial banks. In this sense, commercial banks are able to create deposits ex nihilo, granting them loans and, at the same time, creating deposits. In this way, the starting logical cause of the expansion of money is exactly the firms' willingness of contracting a liability to activate production.

In the second step, firms use those loans to pay workers and in this way to obtain the amount of consumption goods desired through the production process. When such funds are transferred by firms to households they instantaneously become income paid for the work provided to firms by workers. In line with the circuitists, before households spend such income, it constitutes households' savings and it is equal, by logic, to the loans initially given to firms by commercial banks.

Finally, the last step of the Monetary Circuit is characterized by the households' spending decision to use the money balances previously obtained as income. In this step, while households use their funds to buy consumption goods, firms obtain back those money balances they initially paid to households for their work. Hence, as Godley & Lavoie (2007a) wrote, "the outstanding loans of firms diminish pari passu, as long as firms use the proceeds to pay back loans instead of using the proceeds to beef up their money balances or their other liquid financial assets." This

monetary circuit is perfectly explained with the relative matrices in Godley & Lavoie (2007a) where the authors deeply analyse the three steps just exposed.

The previous Monetary Circuit analysis is not in contrast with the one made by Kalecki upon the way workers obtain their wages and use all of that to buy consumption goods while capitalists are able to spend just a proportion of their income. In this work we further explore the possibility that workers' households do not spend entirely all their income but are indeed able to save part of such income, during time.

4.3.2 *The ecological framework of the society*

In the spirit of Taylor et al. (2016) and Fontana and Sawyer (2016), we here analyse a demand driven economy where the consumption and its distribution between the two different social classes influences the surrounding ecological scenario.

In particular, the ecological sustainability of the operating economy is generally measured by two related values, namely the ecological footprint and the greenhouse gases (respectively EF and GHG hereafter), indicators particularly related to the consumption activity. In fact, the EF is a "measure of how much area of biologically productive land and water an individual, population or activity requires to produce all the resources it consumes and to absorb the waste it generates, using prevailing technology and resource management practices" (Global Footprint Network, 2015). In this way, the EF can properly represent a proxy for the ecological sustainability[4] of an economy. The key features of our model are the following ones:

First of all, capitalists' and workers' households have different income and wealth as the former having a higher purchasing power and more possibilities to consume if compare to the letter. This is a standard assumption in post Keynesian models and a well-known stylized fact too.

Furthermore, we assume difference also regarding the typology and impact of their consumption with the capitalists having larger ecological footprints than workers. This supposition is based on Mackenzie, Messinger, & Smith (2008), one of the few rigorous research that relates EF to social distribution within a country. They highlight how the richest 10% of Canadian households create an ecological footprint nearly two-and-a-half times that of the poorest 10%. It is also shown how:

[4]"Ecological overshoot occurs when a population's demand on an ecosystem exceeds the capacity of that ecosystem to regenerate the resources it consumes and absorb its wastes; a practice that leads to a depletion of the planet's life supporting biological capital and/or to an accumulation of waste products."

- while in general the size of an individual's ecological footprint increases as household income increases, the real jump is at that top 10% level.
- In housing and transportation in particular, the ecological footprint of the richest 10 percent of Canadian households is several times the size of the footprint of lower - and lower-middle-income Canadians and significantly greater than that of the next highest-income 10% of households. According to the data collected, the richest decile consumes more than 9 times the footprint size of the poorest decile. This is particularly relevant if we also consider that in 2015, the transport sector contributed to more than 25% of total EU-28 GHG (EEA, 2017) and in US (EPA, 2017). These stylized facts are represented through figures 1 and 2.

Along the same line, an OECD review in 2008 noted how 'most studies conclude that consumption behaviour-related environmental pressure increases with household income. This can be observed in relation to waste, recycling, transportation choices and domestic use of energy and water' (Berthe & Elie, 2015). Considering those conclusions on income and ecological sustainability[5] as a fair description of the reality, we absorb them in our model assuming therefore a higher capitalists EF respect to the workers one.

TABLE 1 **Canadian household consumption and ecological footprint** (GHA/CAP)

	Poorest 10%	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6
Food	2.06	2.15	2.14	2.14	2.14	2.16
Housing	1.51	1.82	1.79	1.73	1.88	1.98
Mobility	0.36	0.62	0.88	1.04	1.20	1.43
Goods	0.56	0.74	0.82	0.85	0.93	1.00
Services	0.55	0.68	0.71	0.74	0.79	0.82
Size of ecological footprint	**5.03**	**5.66**	**6.34**	**6.48**	**6.93**	**7.36**

	Decile 7	Decile 8	Decile 9	Richest 10%	Total consumption
Food	2.15	2.16	2.13	2.24	2.13
Housing	2.06	2.19	2.31	3.40	2.16
Mobility	1.55	1.74	2.17	3.23	1.43
Goods	1.09	1.16	1.33	2.11	0.97
Services	0.83	0.89	0.95	1.48	0.74
Size of ecological footprint	**7.67**	**8.12**	**8.87**	**12.42**	**7.49**

Figure 1. Canadian household consumption and ecological footprint
Source: Mackenzie, Messinger, & Smith, 2008, p. 7

[5] An OECD review in 2008 noted 'most studies conclude that consumption behaviour-related environmental pressure increases with household income. This can be observed in relation to waste, recycling, transportation choices and domestic use of energy and water' (Berthe & Elie, 2015).

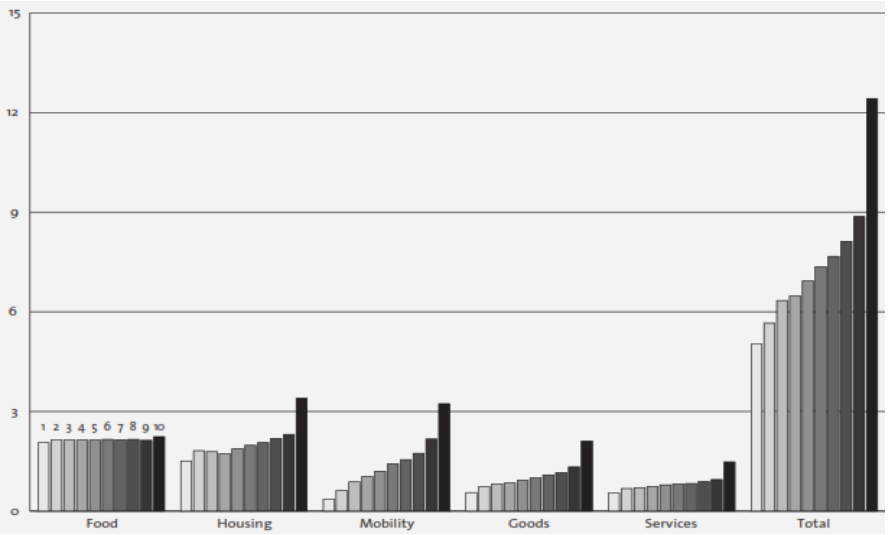


Figure 2. Ecological Footprint by Income Deciles and Consumption Categories (GHA/CAP)
Source: Mackenzie, Messinger, & Smith, 2008, p. 15

4.3.3 *Firms' production and investment relations*

In line with the Kaleckian tradition, we recognize that investments production takes time and effort. Even if most Post Keynesians highlight this principle, few studies reflect this insight through the three different Investment stages that Kalecki himself (Kalecki, 1971) considered: investment order or Demand (I^D), investment Production (I^P) and investment delivery or Completion (I^C). A good formalization of that intuition is contained in Bibi (2019, b). We here share that approach since we want to highlight how the different drivers of the private and public investments demand can affect their pattern development. That is particularly relevant if we are interested in the way the a-synchronization of those investment stages can affect the demand sustainability of an economy. Finally, we consider the financial links that make those investments possible.

We here proceed in describing the main relations in a more structured and formalized way. Equations (1) -(27) take inspiration from Bibi (2019, b) and they describe firms' behaviour in the production of consumption goods and the investment decision process. They highlight how firms produce based on their expectation on the consumption goods taking into account a variation of the inventories. In particular, equations (3)-(10) show how firms decide to produce based on their expectation on future sales adding a certain margin of desired inventories (s^*) for safety reason.

Firms are considered to make investments based on investments' most important explanatory variables: the rate of capacity utilizations (or sales) and cash flow (or cash flow profits), as

suggested by Lavoie (2014). This idea is contained in equations (12)-(22). Equation (23) describes the amount of investments produced by firms each period of time while (24) measures the investments actually concluded. In this way, the concluded investments will enter the private capital stock through (25).

The only real difference in this section from Bibi (2019, b) is that, as suggested by Godley and Lavoie (2007a, equation 8.6) the difference between the nominal and real value of the inventories should be considered more deeply. Following that hint, equation (11) represents the value of inventories at their production cost.

$$Y^D = C^D + I^D + G^D \tag{1}$$

$$Y^P = C^P + I^P + G^P \tag{2}$$

$$C^P = E_{-1}(C^D) + s^* \tag{3}$$

$$E_{-1}(C^D) = C^D_{-1} + \eta'(C^D_{-1} - C^D_{-2}) \tag{4}$$

$$\eta' = \frac{C^D_{-1} - C^D_{-2}}{C^D_{-2} - C^D_{-3}} \tag{5}$$

$$\eta' = 0 \qquad if \qquad C^D_{-2} = C^D_{-3} \tag{6}$$

$$\eta' = \eta'_L \qquad if \qquad \frac{C^D_{-1} - C^D_{-2}}{C^D_{-2} - C^D_{-3}} < \eta'_L \tag{7}$$

$$\eta' = \eta'_U \qquad if \qquad \frac{C^D_{-1} - C^D_{-2}}{C^D_{-2} - C^D_{-3}} \geq \eta'_U \tag{8}$$

$$s^* = \alpha E_{-1}(C^D) - Q_{-1} \tag{9}$$

$$Q = s + Q_{-1} = C^P - C^D + Q_{-1} \tag{10}$$

$$IN = Q \cdot UC \tag{11}$$

$$I^D = I^D_{-1} + a_1 \cdot \pi^e_{(t+1)} \cdot I^D_{-1} + a_2 \cdot cu_{-1} \cdot I^D_{-1} \tag{12}$$

$$\pi^e_{(t+1)} = \frac{\Pi^e_{(t+1)}}{Y^D} \tag{13}$$

$$\Pi^e_{(t+1)} = a_3 \cdot F_{f_{-1}} + a_4 \cdot (F_{f_{-1}} - F_{f_{-2}}) \tag{14}$$

$$a_1 = +|a_1| \qquad if \qquad \left(F_{f_{-1}} - F_{f_{-2}}\right) > 0 \tag{15}$$

$$a_1 = -|a_1| \qquad if \qquad \left(F_{f_{-1}} - F_{f_{-2}}\right) < 0 \tag{16}$$

$$a_1 = 0 \qquad if \qquad \left(F_{f_{-1}} - F_{f_{-2}}\right) = 0 \tag{17}$$

$$a_2 = +|a_2| \qquad if \qquad (Y^D_{-1} - Y^D_{-2}) > 0 \tag{18}$$

$$a_2 = -|a_2| \qquad if \qquad (Y^D_{-1} - Y^D_{-2}) < 0 \tag{19}$$

$$a_2 = 0 \qquad if \qquad (Y^D_{-1} - Y^D_{-2}) = 0 \tag{20}$$

$$cu = \frac{Y^D}{Y^*} \tag{21}$$

$$Y^* = Y^*_{-1} + \psi_L \cdot \left(\frac{L^T - L^T_{-1}}{L^T_{-1}}\right) \cdot Y^*_{-1} + \psi_A \cdot \left(\frac{A - A_{-1}}{A_{-1}}\right) \cdot Y^*_{-1} \tag{22}$$

$$I^P = \frac{1}{\theta}\sum_{j=1}^{\theta} I^D_{(-1-\theta+j)} \tag{23}$$

$$I^C = I^D_{-\theta} \tag{24}$$

$$K^I = K^I_{-1} - \delta_{KI} \cdot K^I_{-1} + I^C \tag{25}$$

$$C^P = AN^C \tag{26}$$

$$I^P = AN^I \tag{27}$$

4.3.4 *Employment, Costs and Wage-Profit determination*

In the spirit of Lavoie (2007a) and following the collective wage bargaining approach used in Bibi (2019, b), we consider that workers claim higher wages based on their labour productivity and on the pressure of the demand for labour (28)-(31). Following Sawyer and Passarella Veronese (2017) and Sawyer (1995), we also assume that firms are able to set long term strategic prices6. In this way, and assuming that they are equal to unit, nominal and real values are the same.

Total employment (37) is the sum of employees in the production of consumption goods, the ones in the production of private and public investments. The latter allow to determine the unemployment rate (38), considering the Labour Force available in the economy.

Equations (45)-(49) about entrepreneurial, distributed and undistributed firms profits follow the approach and the hint suggested by Godley & Lavoie (2007a)[7]. Part of the entrepreneurial

[6] This assumption is in line with the idea that firms are not willing to change their prices often unless their unit cost changes significantly.

[7] In particular, and along the lines of Godley & Lavoie (2007a), equation (45) describes the realized entrepreneurial profits obtained by firms assuming that commercial banks finance instantaneously every change in inventories. Considering that, firms will be able to distribute the entrepreneurial profits considered in (46)-(47) only if they are able to continuously borrow from banks the equivalent of the change in the value of inventories. In particular, normally, firms would distribute a proportion of the entire entrepreneurial profits (46) while keeping the rest as the undistributed (48). However, whenever a big proportion of the inventories value turns out to be greater than the loans they asked the banks for, firms are supposed to maintain an undistributed profit able to cover the only investments (47) while distributing all the rest (49).

profit is considered to be undistributed while the distributed portion will be shared through the capitalists as soon as it is obtained by the firms.

Finally, equation (50) highlights the amount of loans requested by firms. In a particular period, they are the sum of the loans requested in the previous one with the addition to the Investments and the variation in inventories' value with the deduction of the undistributed profits being partly offsetting the firms need of loans.

$$w = w_{-1} + \gamma_z \cdot \frac{\mathrm{z} - z_{-1}}{z_{t-1}} \cdot w_{-1} - \gamma_u \cdot (u_{-1} - u_{-2}) \cdot w_{-1} \quad (28)$$

$$\gamma_u = \gamma_{u-} \qquad if \qquad (u_{-1} - u_{-2}) > 0 \quad (29)$$

$$\gamma_u = \gamma_{u+} \qquad if \qquad (u_{-1} - u_{-2}) < 0 \quad (30)$$

$$\gamma_u = 0 \qquad if \qquad u_{-1} = u_{-2} \quad (31)$$

$$WB = w \cdot N^T \quad (32)$$

$$p_y = (1 + \rho)\left(\frac{w}{A_{-1}}\right) \quad (33\ A)$$

$$\rho = \left(\frac{Y^D}{WB}\right) - 1 \quad (33)$$

$$N^C = \frac{C^P}{A} \quad (34)$$

$$N^I = \frac{I^P}{A} \quad (35)$$

$$N^G = \frac{G^P}{A} \quad (36)$$

$$N^T = N^C + N^I + N^G \quad (37)$$

$$u = \frac{U}{LF} = \frac{LF - N^T}{LF} = 1 - \frac{N^T}{LF} \quad (38)$$

$$LF = LF_{-1} + \gamma_L \cdot \frac{Y^D_{-1} - Y^D_{-2}}{Y^D_{-2}} \cdot LF_{-1} \quad (39)$$

$$\gamma_L = \gamma_{L-} \qquad if \qquad \frac{Y^D_{-1} - Y^D_{-2}}{Y^D_{-2}} < 0 \quad (40)$$

$$\gamma_L = \gamma_{L+} \qquad if \qquad \frac{Y^D_{-1} - Y^D_{-2}}{Y^D_{-2}} > 0 \tag{41}$$

$$\gamma_L = 0 \qquad if \qquad \frac{Y^D_{-1} - Y^D_{-2}}{Y^D_{-2}} = 0 \tag{42}$$

$$A = A_{-1} + \gamma_\omega \cdot \left(\frac{w - w_{-1}}{w_{-1}}\right) \cdot A_{-1} + \gamma_k \cdot \left(\frac{\frac{K^T_{-1}}{N^T_{-1}} - \frac{K^T_{-2}}{N^T_{-2}}}{\frac{K^T_{-1}}{N^T_{-1}}} \right) \cdot A_{-1} \tag{43}$$

$$UC = \frac{WB}{A} \tag{44}$$

$$F_f = Y^D - WB + \Delta IN - r_l \cdot IN_{-1} \tag{45}$$

$$FD_f = \psi_D \cdot F_{f-1} \quad if\ L_{fd-1} > \psi_{IN} \cdot IN_{-1} \tag{46}$$

$$FD_f = F_f - FU_f - r_l \cdot (L_{fd-1} - IN_{-1}) \quad if\ L_{fd-1} \leq \psi_{IN} \cdot IN_{-1} \tag{47}$$

$$FU_f = F_f - FD_f - r_l \cdot (L_{fd-1} - IN_{-1}) \quad if\ L_{fd-1} > \psi_{IN} \cdot IN_{-1} \tag{48}$$

$$FU_f = I^D \quad if\ L_{fd-1} \leq \psi_{IN} \cdot IN_{-1} \tag{49}$$

$$L_{fd} = L_{fd-1} + I^D + \Delta IN - FU_f \tag{50}$$

4.3.5 *Consumption and households' relations*

We here describe the relations of both workers and capitalists' households of our model. While the personal income of the workers is just made up of their wages and the interests they obtain for their deposits (51), the capitalists' one (52) is made up of the firms and banks profits and the interests on deposits, bills and bonds. Equations (53) and (54) describe the disposable income of those households that is obtained by deducing taxes and interest payment on the loans they required from the banks.

In line with Godley & Lavoie (2007a), we assume that in our growth model taxes are paid on personal income of households (55)-(56) and that their consumption (59)-(60) is based partly on

their disposable income increased by the new loans and partly on their accumulated wealth. As well as Bibi (2019, b), (61)-(62) assume that marginal propensities of both classes tend to grow, even if with different magnitudes, when tax rates decrease. Symmetrically, the former tends to decrease as far as the latter increases. This idea of a variable marginal propensity of consumption is not a new one, being already firstly considered by Samuelson (1939).

Finally, equations (64)-(66) estimate the ecological impact of workers, capitalists and overall consumption in terms of EF. The parameters φ_w and φ_π reflect the respective green consumption weight of workers and capitalists .

$$YP_w = WB + r_{m-1} \cdot M_{w-1} \tag{51}$$

$$YP_\pi = FD_f + FD_b + r_{m-1} \cdot M_{\pi-1} + r_{b-1} \cdot B_{\pi_{-1}} + BL_{-1} \tag{52}$$

$$YD_w = YP_w - T_w - r_{l-1} \cdot L_{w-1} \tag{53}$$

$$YD_\pi = YP_\pi - T_\pi - r_{l-1} \cdot L_{\pi-1} \tag{54}$$

$$T_w = \tau_w \cdot YP_{w-1} \tag{55}$$

$$T_\pi = \tau_\pi \cdot YP_{\pi-1} \tag{56}$$

$$V_w = V_{w-1} + YD_w - C_w^D \tag{57}$$

$$V_\pi = V_{\pi-1} + YD_\pi - C_\pi^D \tag{58}$$

$$C_w^D = c_{\pi 1} \cdot (YD_{\pi-1} + NL_{\pi-1}) + c_{\pi 2} \cdot V_{\pi-1} \tag{59}$$

$$C_\pi^D = c_{\pi 1} \cdot (YD_{\pi-1} + NL_{\pi-1}) + c_{\pi 2} \cdot V_{\pi-1} \tag{60}$$

$$c_{w1} = c_{w1-1} - \gamma_{cw1} \frac{\tau_{w-1} - \tau_{w-2}}{\tau_{w-2}} \cdot c_{w1-1} \tag{61}$$

$$c_{\pi 1t} = c_{\pi 1-1} - \gamma_{c\pi 1} \frac{\tau_{\pi-1} - \tau_{\pi-2}}{\tau_{\pi-2}} \cdot c_{\pi 1-1} \tag{62}$$

$$C^D = C_w^D + C_\pi^D \tag{63}$$

$$EF_w = \varphi_w \cdot C_w^D \tag{64}$$

$$EF_\pi = \varphi_\pi \cdot C_\pi^D \tag{65}$$

$$TEF = EF_w + EF_\pi \tag{66}$$

In line with Godley & Lavoie (2007a), equations (67)-(74) model an economy where households are able to take loans. However, differently from them, we suppose the existence of two different social classes where workers' households have higher repayment requirements from commercial banks than those requested to capitalist households. This could be due to the insufficient wealth guarantees owned by the workers that make CBs needy of a quicker repayment of their credits.

$$GL_T = GL_\pi + GL_w \tag{67}$$

$$GL_\pi = \beta \cdot YP_\pi \tag{68}$$

$$GL_w = \beta \cdot YP_w \tag{69}$$

$$\beta = \beta_0 - \beta_r \cdot r_l \tag{70}$$

$$NL_\pi = GL_\pi - REP_\pi \tag{71}$$

$$NL_w = GL_w - REP_w \tag{72}$$

$$REP_\pi = \xi_\pi \cdot L_{h\pi d-1} \tag{73}$$

$$REP_w = \xi_w \cdot L_{hwd-1} \tag{74}$$

$$L_{hd} = L_{h\pi d} + L_{hwd} \tag{75}$$

$$L_{h\pi d} = L_{h\pi d-1} + NL_\pi \tag{76}$$

$$L_{hwd} = L_{hwd-1} + NL_w \tag{77}$$

Equations (78)-(85) now consider the possibility of households allocating their wealth among financial activities, mainly based on their relative remuneration.

We model an economy where using their savings mainly for precautionary reasons, workers' families keep them in the form of deposits or cash for consumption. Capitalist households, instead, are supposed to save enough to maintain part of their wealth for precautionary reason and, at the same time, to invest in financial activities. In this way, beyond keeping their resources in deposits and cash, they keep part of them also in bonds and bills. Equations (AC1 - AC8) define the Tobin's vertical and Godley's horizontal constraints which ensure consistency to the asset demand functions.

Following Godley & Lavoie (2007a), we also assume - both for capitalists and workers - that expected investible wealth is the financial assets wealth of the previous period. With respect to the allocation of the wealth of households, we assume that the demands for financial assets are always realized, with the exception of the demand for money. In fact, we consider bank deposits having a buffering role in the allocation of resources (80)-(81).

$$\begin{bmatrix} \frac{M_{\pi d}}{V_{fma\pi-1}} \\ \frac{B_{\pi d}}{V_{fma\pi-1}} \\ \frac{(p_{bL} \cdot BL_d)}{V_{fma\pi-1}} \end{bmatrix} = \begin{bmatrix} \lambda\pi_{10} \\ \lambda\pi_{20} \\ \lambda\pi_{30} \end{bmatrix} + \begin{bmatrix} \lambda_{\pi 11} & \lambda_{\pi 12} & \lambda_{\pi 13} \\ \lambda_{\pi 21} & \lambda_{\pi 22} & \lambda_{\pi 23} \\ \lambda_{\pi 31} & \lambda_{\pi 32} & \lambda_{\pi 33} \end{bmatrix} \begin{bmatrix} \mathrm{r}_m \\ \mathrm{r}_b \\ \mathrm{r}_{bL} \end{bmatrix} + \begin{bmatrix} \lambda_{\pi 14} \\ \lambda_{\pi 24} \\ \lambda_{\pi 34} \end{bmatrix} YP_\pi \tag{78}$$

$$\lambda\pi_{10} + \lambda\pi_{20} + \lambda\pi_{30} = 1 \tag{AC1}$$

$$\lambda\pi_{11} + \lambda\pi_{21} + \lambda\pi_{31} = 0 \tag{AC2}$$

$$\lambda\pi_{12} + \lambda\pi_{22} + \lambda\pi_{32} = 0 \tag{AC3}$$

$$\lambda\pi_{13} + \lambda\pi_{23} + \lambda\pi_{33} = 0 \tag{AC4}$$

$$\lambda\pi_{14} + \lambda\pi_{24} + \lambda\pi_{34} = 0 \tag{AC5}$$

$$\lambda\pi_{11} = -(\lambda\pi_{12} + \lambda\pi_{13}) = 0 \tag{AC6}$$

$$\lambda\pi_{22} = -(\lambda\pi_{21} + \lambda\pi_{23}) = 0 \tag{AC7}$$

$$\lambda\pi_{33} = -(\lambda\pi_{31} + \lambda\pi_{32}) = 0 \tag{AC8}$$

$$\frac{M_{wd}}{V_{fmaw-1}} = \lambda_{w10} + \lambda_{w11} \cdot \mathrm{r}_m + \lambda_{w14} \cdot \frac{YP_w}{V_{fmaw-1}} \tag{79}$$

$$M_{\pi h} = V_{fma\pi} - B_{\pi d} - p_{bL} \cdot BL_{\pi d} \tag{80}$$

$$M_{wh} = V_{fmaw} \quad (81)$$

$$V_{fma\pi} = M_{\pi d} + B_{\pi d} + p_{bL} \cdot BL_{\pi d} \quad (82)A$$

$$V_{fmaw} = M_{wd} \quad (83)A$$

$$V_{fma\pi} = V_{\pi} + L_{\pi d} - H_{\pi d} - OF \quad (82)$$

$$V_{fmaw} = V_{w} + L_{wd} - H_{wd} \quad (83)$$

$$H_{\pi d} = \lambda_{c\pi} \cdot C_{\pi}^{D} \quad (84)$$

$$H_{wd} = \lambda_{cw} \cdot C_{w}^{D} \quad (85)$$

4.3.6 *Public Sector relations*

We here consider an active public sector formed by Government and Central Bank (CB). The former collects resources through taxation and makes long term investment for the economy (86)-(104) while the latter is in charge of the monetary policy.

As for private investments, we adopt the same distinction between demanded, produced and concluded public investments that eventually form public capital (93)-(96). Such relations and the ones regarding the fiscal policy are taken from Bibi (2019, b).

The reaction of Government intervention to the economic situation is dependent on the scenario we will study later, in the following section. In fact, while in the first scenario we will study a situation where the government maintains its public expenditure and tax rates as constant through time, in the second scenario it will try to achieve a zero budget deficit through (93) with the final purpose of not letting the public debt increase. In those two first scenarios the tax rates are constant and therefore equations (87)-(92) are not active as well as equations (93) and (99)-(101).

Those equations exactly describe the pro-active Government behaviour in the third scenario under consideration where it tries to manage all the fiscal tools available to steer a sustainable recovery path. More specifically, the government (99)-(101) will increase its demand of public investments whenever the growth of the aggregate demand is lower than a determined minimum threshold and it will decrease its level whenever the growth of the aggregate demand exceeds a particular maximum established threshold. At the same time, the government implements a fiscal policy (87)-(92) so that capitalists and workers' tax rates decrease whenever their personal incomes fall behind a certain negative growth threshold and increase whenever they exceed a certain positive

growth threshold. The aim of such a fiscal policy is to stimulate (calm) their consumption – and therefore the overall economic activity - whenever the economic activity is facing an excessive negative slowdown or a booming period when the government can collect more resources.

Finally, equation (102) describes the government deficit while (104) represents the government debt and (103) the amount of new bills issued by the government.

$$T_T = T_w + T_\pi \tag{86}$$

$$T_w = \tau_w \cdot YP_{w-1} \tag{55}$$

$$T_\pi = \tau_\pi \cdot YP_{\pi-1} \tag{56}$$

$$\tau_w = \tau_{w-1} + \gamma_{\tau w} \cdot \left(\left| \frac{YP_{w-1} - YP_{w-2}}{YP_{w-1}} \right| \right) \cdot \tau_{w-1} \tag{87}$$

$$\tau_\pi = \tau_{\pi-1} + \gamma_{\tau\pi} \cdot \left(\left| \frac{YP_{\pi-1} - YP_{\pi-2}}{YP_{\pi-1}} \right| \right) \cdot \tau_{\pi-1} \tag{88}$$

$$\gamma_{\tau w} = +|\gamma_{\tau w}| \quad if \quad \frac{YP_{w-1} - YP_{w-2}}{YP_{w-1}} > \varphi_{\tau wh} \tag{89}$$

$$\gamma_{\tau\pi} = +|\gamma_{\tau\pi}| \quad if \quad \frac{YP_{\pi-1} - YP_{\pi-2}}{YP_{\pi-1}} > \varphi_{\tau\pi h} \tag{90}$$

$$\gamma_{\tau w} = -|\gamma_{\tau w}| \quad if \quad \frac{YP_{w-1} - YP_{w-2}}{YP_{w-1}} \leq \varphi_{\tau wl} \tag{91}$$

$$\gamma_{\tau\pi} = -|\gamma_{\tau\pi}| \quad if \quad \frac{YP_{\pi-1} - YP_{\pi-2}}{YP_{\pi-1}} \leq \varphi_{\tau\pi l} \tag{92}$$

$$G^D = G^D_{-1} + \gamma_g \cdot \left(\left| \frac{Y^D_{-1} - Y^D_{-2}}{Y^D_{-2}} \right| \right) \cdot G^D_{-1}, \qquad G^D \geq 0 \tag{93}$$

$$G^D = G^D_{-1} - PSBR_{-1}\,, \qquad G^D \geq 0 \tag{93}$$

$$G^P = \frac{1}{\theta} \sum_{j=1}^{\theta} G^D_{(-1-\theta+j)} \tag{94}$$

$$G^C = G^D_{(-\theta)} \tag{95}$$

$$K^G = K^G_{-1} - \delta_{KG} \cdot K^G_{-1} + G^C \tag{96}$$

$$K^T = K^I + K^G \tag{97}$$

$$G^P = AN^G \tag{98}$$

$$\gamma_g = +|\gamma_g| \qquad if \qquad \frac{Y^D_{t-1} - Y^D_{t-2}}{Y^D_{t-2}} \leq \varphi_{Gl} \tag{99}$$

$$\gamma_g = -|\gamma_g| \qquad if \qquad \frac{Y^D_{t-1} - Y^D_{t-2}}{Y^D_{t-2}} > \varphi_{Gh} \tag{100}$$

$$\gamma_g = 0 \qquad else\ if \tag{101}$$

$$PSBR = G^D + r_{b-1} \cdot (B_{\pi s-1} + B_{bs-1}) + BL_{s-1} - T_T \tag{102}$$

$$B_s = B_{s-1} + PSBR - \Delta BL_{\pi s} \,.\, p_{bL} \tag{103}$$

$$GD = B_{\pi s} + BL_{\pi s} + H_s \tag{104}$$

Following our benchmark model, we here consider a simplified CB that holds Treasury bills as assets and have bank reserves and banknotes as liabilities. Government securities and CB liabilities are supposed to be supplied on demand (106)-(112) allowing interest rates on Treasury bills and government bonds (113)-(114) to be treated as exogenous variables in line with the horizontalist approach of our benchmark model.

$$F_{cb} = r_{b-1} \cdot B_{cbd-1} \tag{105}$$

$$BL_{\pi s} = BL_{\pi d} \tag{106}$$

$$B_{\pi s} = B_{\pi d} \tag{107}$$

$$H_{hs} = H_{\pi d} + H_{wd} \tag{108}$$

$$H_{bs} = H_{bd} \tag{109}$$

$$H_s = H_{bs} + H_{hs} \tag{110}$$

$$B_{cbd} = H_s \tag{111}$$

$$B_{cbs} = B_{cbd} \tag{112}$$

$$r_b = \bar{r}_b \tag{113}$$

$$r_{bL} = r_b + add_{BL} \tag{114}$$

$$p_{bL} = \frac{1}{r_{bL}} \tag{115}$$

4.3.7 *The banking sector relations*

The equations (116)-(126) of this section express the endogenous monetary approach followed by the majority of horizontalists according to whom, money is mainly an endogenous phenomenon being created on demand. More precisely, we follow here the Godley & Lavoie (2007a) approach. Bank deposits, loans to firms and personal loans are all supplied on demand. Banks' holdings of bills (120) are considered as the buffer absorbing the mismatching between banks' assets and liabilities while their demand of bills (121) is determined as a part of their balance-sheet constraint. Finally, equations (122)-(126) describe the mechanism trough which CBs decide the deposit interest rate variation based on their aim of maintaining the BLR (Bank Liquidity Ratio) within certain boundaries.

$$M_s = M_h \tag{116}$$

$$L_{fs} = L_{fd} \tag{117}$$

$$L_{hs} = L_{hd} \tag{118}$$

$$H_{bd} = \rho_b \cdot M_s \tag{119}$$

$$B_{bs} = B_s - B_{hs} - B_{cbs} \tag{120}$$

$$B_{bd} = M_s - L_{fs} - L_{hs} - H_{bd} + OF_b \quad (121)$$

$$B_{bs} = B_{bd} \quad (130)\text{A}$$

$$BLR = \frac{B_{bd}}{M_s} \quad (122)$$

$$r_m = r_{m-1} + \Delta r_m \quad (123)$$

$$\Delta r_m = \zeta_m \cdot (z_1 - z_2) \quad (124)$$

$$z_1 = 1 \quad iff\ BLR < bot \quad (125)$$

$$z_2 = 1 \quad iff\ BLR > top \quad (126)$$

The last equations below (127)-(130) describe banks' mark-up policy in determining the banks loan interest rate. This structure is a simplified version of the one considered in our reference model since the determination of banks' profits is not the main focus of our work.

$$r_l = r_m + add_1 \quad (127)$$

$$F_b = r_{l-1} \cdot \left(L_{fs-1} + L_{hs-1}\right) + r_{b-1} \cdot B_{bd-1} - r_{m-1} \cdot M_{s-1} \quad (128)$$

$$OF = OF_{-1} \quad (129)$$

$$B_{bd} = B_{bs} \quad (130)$$

4.4 The effects of a crises on socio economic and ecological distribution

In the recent decades, many activists and researchers too claimed that a growth reduction would be necessary and sufficient to take care of the ecological balance in our economies since containing or reducing consumer consumptions would directly contain the ecological footprint and the greenhouse gases. According to some of them even a crisis might be helpful since the economic activity reduction will shrink the consumption level and hence will contribute to a more balanced ecological path.

Our analysis focuses exactly on the effects of a crises on the economic, social and ecological distribution. Through a simulations exercise, we analyse the impact of a negative demand for investments shock. The same shock is analysed considering three different scenarios such as the one with a "passive" government, the one where the government follows a 0BD (zero budget deficit) rule and finally a scenario with a "pro-active" government with a fiscal policy focused on restoring the economic activity and employment.

4.4.1 *A passive government scenario*

In this first scenario we consider a "moderate-passive" government that, despite the crises, does not change its government expenditure.

The reduction of investments has a negative impact both on the demand side, further causing a reduction of expected and actual consumption, and on the production side, through a reduction of produced consumption and investments goods (Fig 3a-e). The linked increased unemployment makes wages and wage bill fall down further (Fig 3b-3c) depressing even more the demand.

However, while profits are initially reduced by the negative impact of the economic crises, the wage and costs reduction allow profits to stop falling and to increase again (Fig 3c). Such reversed trend in profits stimulates the economic activity expectations and in that way investments both demanded and produced (Fig 3e).

The partial recovery of investments stimulates the overall demand and production again together with a slightly increase of the wage bill. However, such recovery is not strong enough to restore the pre-crises wage bill and activity level. In that way, while the wage bill level remains much lower, the total and the distributed profits remain higher than the pre-crises level, exactly thanks to the reduced cost of production (Fig 3c).

Despite the first more volatile periods mainly due to wrong expectations, such instability is increasingly reduced and the resultant trend of the previous scenario impacts the overall social distribution between workers and capitalists in a clear way. In fact, the lower wage bill reduces the workers' personal income (Fig 3f) affecting in this way also their overall wealth and the one they can invest in the financial market. In the same way, the increased distributed profits obtained by capitalists contribute to their persistently higher personal income building up, in this way, higher level of overall and financially investible wealth (Fig 3g).

The increase of the latter stimulates the capitalists' demand of bills and bonds that are supplied on demand. Such an increase of bills and bonds is the main reason of the increasing government

debt, according to equation (104). The rising of the latter joint with the reduction of GDP are the main reason for an increased and increasing Government Debt to GDP ratio (Fig 3h).

Despite the crises did generate a much lower level of the economic activity and of the consumption goods demand at aggregate level (Fig 3i), it did reduce only the one of the workers while it increased the capitalists' one, as a reflection of the distributional effect on disposable income and wealth.

In this way, even the EF reduction caused by the lower workers' consumption is compensated by the increase in the capitalists' one. The final effect, in that way, is a substantially unchanged level of Ecological Footprint (Fig 3l), with more polarized social classes. The economy faced a shift in the social classes distribution as well as one in their burden of EF.

A sensitivity test is conducted (Fig 4), considering weaker (stronger) reactions of the economic agents in response to the exogenous drop in investment compared to the baseline scenario (BL). The values used in the simulation analysis are reported in table 3.

4.4.2 *A 0BD government policy scenario*

In our second scenario, we consider a "zero budget deficit" (0BD hereafter) policy framework where the government tries to achieve a constant parity between its outlays (pure expenditure plus interest payments on both kinds of debt) and all revenues (tax receipts and the profits of the central bank, F_{cb}, which are returned to the government). This policy might be due to the government final aim of not letting the Public Debt/GDP ratio increase above the current levels.

However, as Sawyer (2011) clearly pointed out, the budget deficit cannot be exactly controlled by the government potentially making such a policy goal persistently frustrated if we consider that, in the end, the budget deficit is actually an endogenous variable:

> In effect the budget deficit can be viewed as endogenous and indeed something of a residual… whilst a government can set tax rates and its intentions for public expenditure, the resulting budget deficit arises as a result of decisions made by the private sector and the resulting level of economic activity.

Because of the impossibility for the Government to calculate the amount of public expenditure that would satisfy a constant zero budget deficit, the government best approximation would probably be to spend an amount of public resources in public investments that would have allowed a parity of budget if such an amount was spent in the previous period, according to (93).

In this scenario, the starting dynamics are similar to the one in previous scenario. In fact, as soon as the economy faces the external negative shock in investments demanded, it suffers a decrease of aggregate demand and in this way, directly a decrease of production too (Fig 5a). Such a decrease in production leads to a decrease in the employment (Fig 5b) having a further

negative impact on the aggregate demand. In that way, at first, both workers' wage bill and capitalists' profits drop (Fig 5c) decreasing their personal incomes too (Fig 5f).

The decreased personal incomes produce a reduction on the amount of taxes collected by the government. In the attempt of achieving a zero budget deficit, the government decreases the amount of public investments demanded (Fig 5d) and that represents definitely the strongest difference with the previous scenario. In fact, such a decrease of the government demand for public investments affects their production level (Fig 5d) and in so doing it decreases the employment needed, lowering the overall employment level even further respect to the BL (Fig 5c) where the government was not decreasing its public expenditure.

The stronger decrease in employment makes the wage bill decline further respect to the BL (Fig 5c). Exactly the lower level of the main cost of production - wages - allows profits finally to increase in this way stimulating private investments (Fig 5e). Meanwhile, the decreased wage bill and the increased profits affect their personal incomes building up higher capitalists' overall and financially investible wealth and lowering the ones of workers (Fig 5f-g).

Even if the recovery of private investments partially attenuates the fall of aggregate demand, the levels of such a demand remain much lower than the pre-crises ones without any significant prospects of increasing again. Those prospects make private investments stagnate and slightly decrease (Fig 5e) until the disassociation between demanded, produced and concluded investments becomes relevant again. In fact, despite the demand for public investments almost recovered after its first strong decline, also the concluded public investments start to fall because of the previous continuously lowered levels of demanded and produced public investments (Fig 5d). Such a fall in the concluded public investments decreases the public and therefore the overall capital in the economy. In that way it reduces the capital per worker level available in the economy and such a reduction leads to a decrease of labour productivity too via 30 producing two direct effects, namely the reduction of potential output (22) and the increase of the workers needed in the production activities (34)-(36). The former puts pressure on the capacity utilization therefore having a positive stimulus on private investments (Fig 5e) while the latter, attenuating the fall of the employment level, also allows wage and wage bill not to fall further (Fig 5c).

The stopped falling trend of the wage bill together with the increased demand for investments, finally leads to a light recovery trend of the overall economy. However, there are several differences with respect to the BL. While both the BL and the 0BD aggregate demand and aggregate production levels remain lower than the pre-crises ones, in 0BD those levels stay even considerably lower than the BL until the end.

Such prolonged levels of reduced demand and production caused a consistent lower level of employment that remain significantly lower than the BL scenario in every moment after the crises (Fig 5b). The decreased level of employment affects the wage bills level that remains at a lower level respect the BL while it allows the firms to reduce their main production costs obtaining higher profits consequently. That resultant effect is an even further polarization of the social classes with respect to both the BL and the pre-crises situation. In fact, while the higher levels of profits produce higher capitalists' personal incomes therefore building up higher levels of overall and financially investible wealth, lower levels of wage bill negatively affect workers' personal income worsening theirs (Fig 5c, f, g).

The 0BD policy did not contribute to reduce the Public Debt to GDP ratio below the pre-crises level while its value remained constantly even higher than the BL (Fig 5h). At the same time, the final level of aggregate consumption remains inferior to the level achieved in that scenario. However, the composition of that demand for consumption goods is quite different. In fact, we can highlight a shift between the workers and the capitalists' consumption (Fig 5i) correspondent to the more polarized income and wealth they dispose of. In this way, the workers consume less while the capitalists consume more respect to the pre-crises situation and with respect to the BL.

Such workers – capitalists' consumption shift produces a correspondent shift in the ecological footprint (Fig 5l). In fact, while the EF of the former is reduced, the one of the latter is higher respect to the BL. The final overall level of the EF is higher than the pre-crises situation and it is finally even slightly higher than the BL with a projection to increase further.

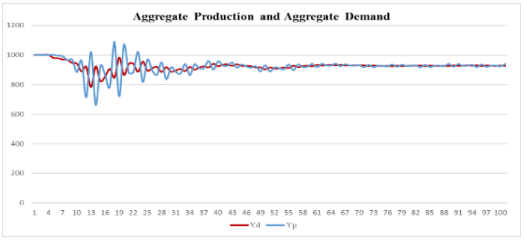
Values of key parameters in the sensitivity and policy analysis

Parameter		Baseline Scenario	Sensitivity Test I	Sensitivity Test II	OBD Government (Scenario I)	Proactive Government (Scenario II)	Notes:
Adjustment Workers mpcW parameter	$\gamma_{c\pi 1}$	0,800	0,600	1,000	0,800	0,80	In Sensitivity test I (Sensitivity test II) weaker (stronger) reaction parameters respect to the Baseline scenario are considered. In the 0 Budget Deficit policy (0BD, scenario I), the Government try to achieve a 0 Budget Deficit demanding an amount of Government expenditure such that the Budget Deficit of the previous period could have been nil. In the Proactive policy (scenario II) the government implements a fiscal policy such that capitalists and workers' tax rates decrease (increase) when their personal incomes fall behind (exceed) a certain degrowth (growth) threshold with the aim of stimulate (calm) their consumption and in this way the economic activity. With the same intention, Government expenditure increase (decrease) when the aggregate demand fall behind (exceed) a certain degrowth (growth) threshold.
Adjustment Capitalists mpcW parameter	γ_{cw2}	1,500	1,200	1,800	1,500	1,50	
Coefficient of w reaction to change in z	γ_z	0,200	0,100	0,300	0,200	0,20	
Coefficient of (+)w reaction to change in (-)u	γ_{u+}	0,500	0,200	0,800	0,500	0,50	
Coefficient of (-)w reaction to change in (+)u	γ_{u-}	0,250	0,100	0,400	0,250	0,25	
Coefficient of A reaction to change in w	γ_w	0,500	0,080	0,700	0,500	0,50	
Coefficient of A reaction to change in (K/N)	γ_K	0,300	0,275	0,325	0,300	0,30	
Labour Force reaction to change in (+)Yd	γ_{L+}	0,250	0,200	0,300	0,250	0,25	
Labour Force reaction to change in (-)Yd	γ_{L-}	0,250	0,200	0,300	0,250	0,25	
Expected Investment parameter	a_1	0,100	0,080	0,120	0,100	0,10	
cu parameter related to Investment	a_2	0,012	0,010	0,014	0,012	0,012	
Weight to previous level of profits	a_3	0,100	0,040	0,160	0,100	0,10	
Weight to previous change in profits	a_4	1,000	0,200	1,800	1,000	1,00	
Capacity Output growth wrt L	ψ_L	2,000	1,000	3,000	2,000	2,00	
Capacity Output growth wrt A	ψ_A	2,000	1,000	3,000	2,000	2,00	
Change in deposit rate reaction parameter	ζ_m	0,00020	0,00020	0,00025	0,00020	0,0002	
Adjustment Workers tax parameter	$\gamma_{\tau w}$	0	0	0	0	0,5	
Adjustment Capitalists tax parameter	$\gamma_{\tau\pi}$	0	0	0	0	0,3	
Threshold of (+)w to let w tax increase	$\varphi_{\tau wh\,(high)}$	0,0%	0,0%	0,0%	0,0%	0,5%	
Threshold of (+)π to let π tax increase	$\varphi_{\tau\pi h\,(high)}$	0,0%	0,0%	0,0%	0,0%	0,5%	
Threshold of (-)w to let w tax decrease	$\varphi_{\tau whl\,(low)}$	0,0%	0,0%	0,0%	0,0%	-6,0%	
Threshold of (-)π to let π tax decrease	$\varphi_{\tau\pi l\,(low)}$	0,0%	0,0%	0,0%	0,0%	-7,0%	
Variation of (-)Government Intervention	$\gamma_{g(-)}$	0	0	0	0	0	
Variation of (+)Government Intervention	$\gamma_{g(+)}$	0	0	0	0	0,75	
Threshold of (-)Yd to let Government +G	$\varphi_{Gl\,(low)}$	0,0%	0,0%	0,0%	0,0%	0,0%	
Threshold of (+)Yd to let Government -G	$\varphi_{Gh\,(high)}$	0,0%	0,0%	0,0%	0,0%	5,0%	

Table 3. Values of the key parameters in the BL scenario, in the Sensitivity test and in Scenario I and Scenario II

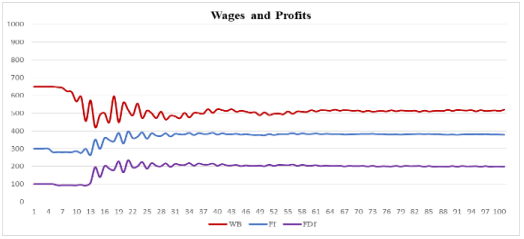
A Passive Government Scenario (Baseline Scenario)

(a) Aggregate Production and Aggregate Demand

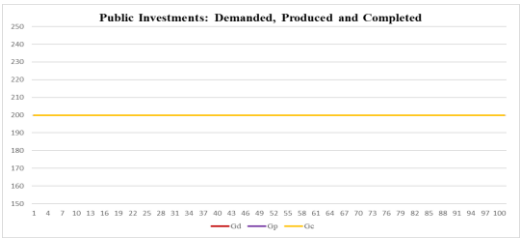


(b) Employment levels

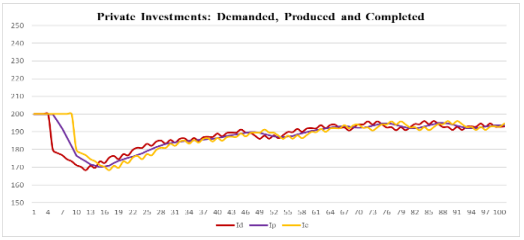
(c) Wages and Profits



(d) Public Investments

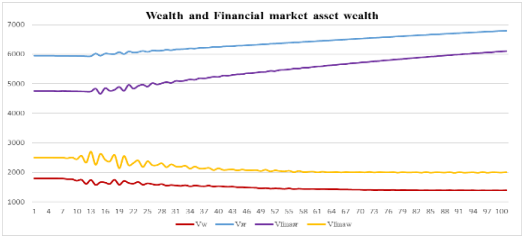


(e) Private Investments

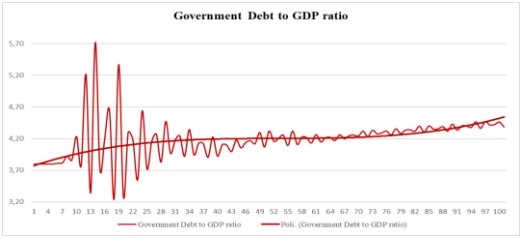


(f) Capitalists and Workers' Personal Incomes

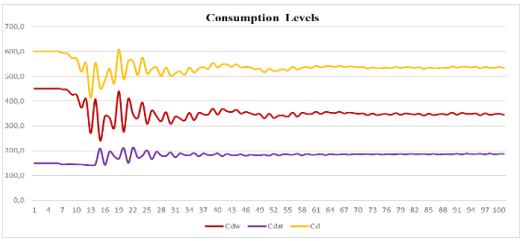
(g) Wealth and Financial market asset wealth



(h) Government Debt to GDP ratio



(i) Consumption Levels



(l) Ecological Footprint

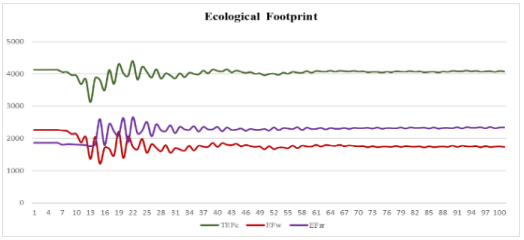
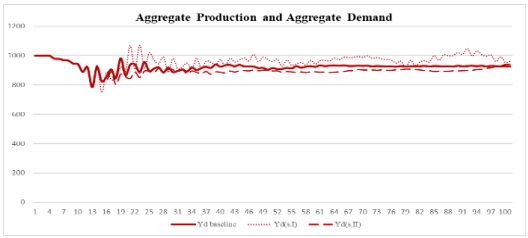


Fig 3. Evolution of macroeconomic, financial and environmental variables of Baseline Scenario. (a) Aggregate Production and Aggregate Demand (b) Employment Levels (c) Wages and Profits, (d) Public Investments, (e) Private Investments, (f) Capitalists and Workers' Personal Incomes, (g) Wealth and Financial market asset wealth, (h) Government Debt to GDP ratio, (i) Consumption Levels, (l) Ecological Footprint.
Note: The values used in the simulation analysis are reported in table 3.

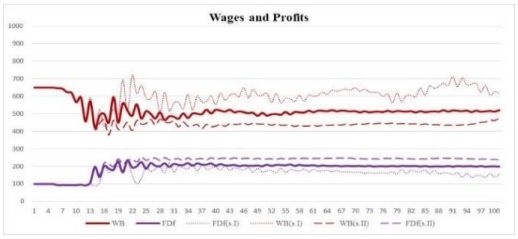
Sensitivity Analysis of the Baseline Scenario

(a) Aggregate Production and Aggregate Demand

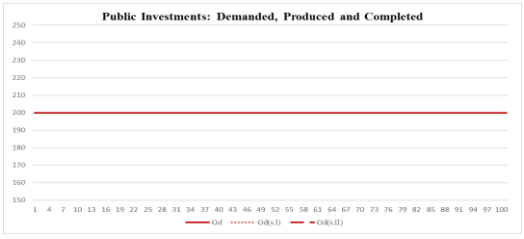


(b) Employment levels

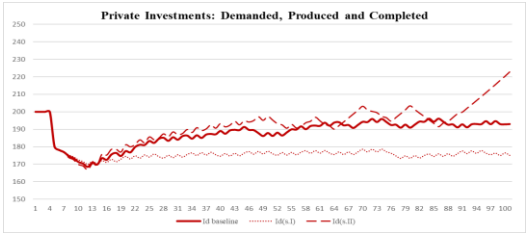
(c) Wages and Profits



(d) Public Investments

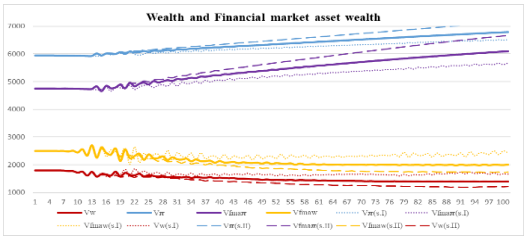


(e) Private Investments

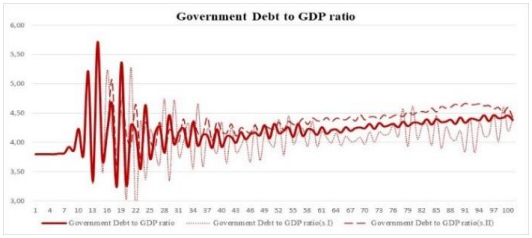


(f) Capitalists and Workers' Personal Incomes

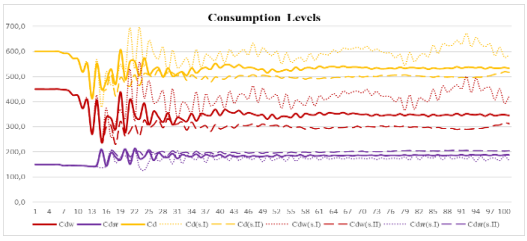
(g) Wealth and Financial market asset wealth



(h) Government Debt to GDP ratio



(i) Consumption Levels



(l) Ecological Footprint

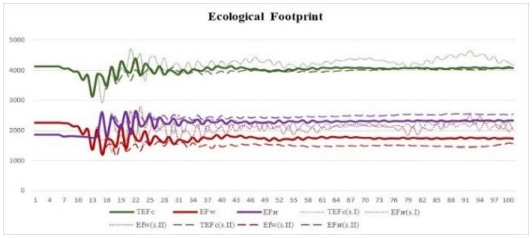
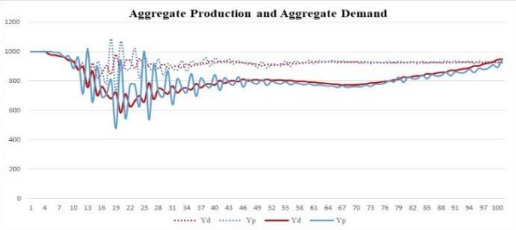


Fig 4. Sensitivity test of the Baseline Scenario related to the evolution of macroeconomic, financial and environmental variables. (a) Aggregate Production and Aggregate Demand (b) Employment Levels (c) Wages and Profits, (d) Public Investments, (e) Private Investments, (f) Capitalists and Workers' Personal Incomes, (g) Wealth and Financial market asset wealth, (h) Government Debt to GDP ratio, (i) Consumption Levels, (l) Ecological Footprint. Note: The values used in the simulation analysis are reported in table 3.

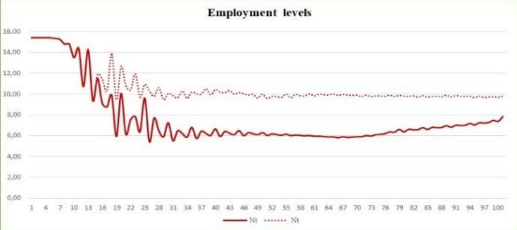
A 0BD Policy Scenario (Scenario I)

(OBD (bold lines) vs Baseline (dotted lines) scenarios)

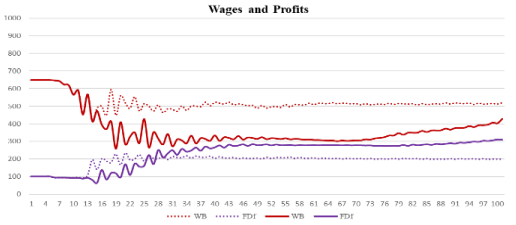
(a) Aggregate Production and Aggregate Demand



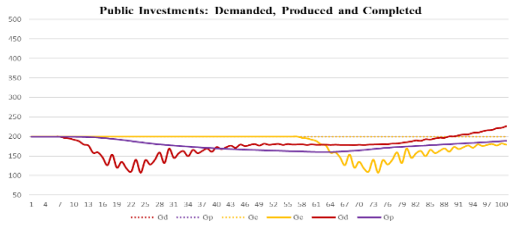
(b) Employment levels



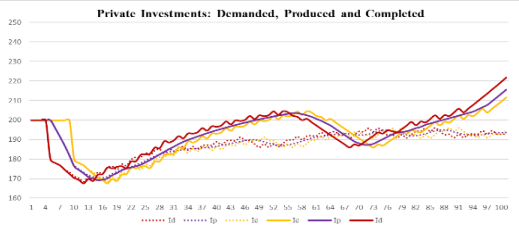
(c) Wages and Profits



(d) Public Investments

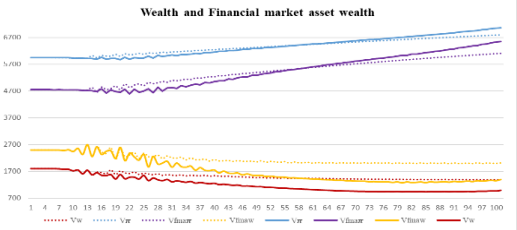


(e) Private Investments

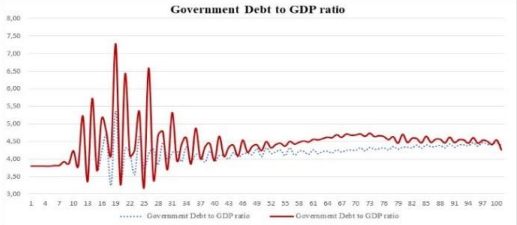


(f) Capitalists and Workers' Personal Incomes

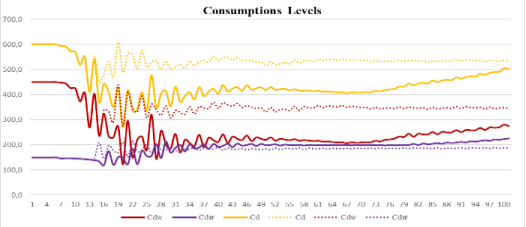
(g) Wealth and Financial market asset wealth



(h) Government Debt to GDP ratio



(i) Consumption Levels



(l) Ecological Footprint

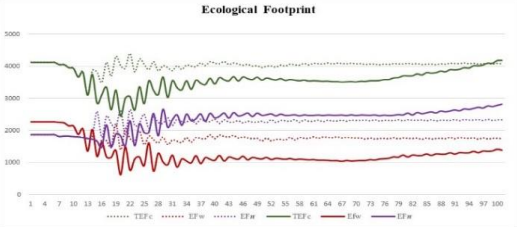


Fig 5. Evolution of macroeconomic, financial and environmental variables. OBD (bold lines) vs Baseline (dotted lines) Scenarios. (a) Aggregate Production and Aggregate Demand (b) Employment Levels (c) Wages and Profits, (d) Public Investments, (e) Private Investments, (f) Capitalists and Workers' Personal Incomes, (g) Wealth and Financial market asset wealth, (h) Government Debt to GDP ratio, (i) Consumption Levels, (l) Ecological Footprint. Note: The values used in the simulation analysis are reported in table 3..

4.4.3 *A proactive government scenario*

In our last scenario we consider a "proactive" government the final aim of which is to secure a high level of economic activity supporting the aggregated demand level through public social investments. According to this, the Government increases its demand of public investments whenever the growth of the aggregate demand is lower than a determined minimum threshold while it decreases its level whenever the growth of the aggregate demand exceeds a particular maximum established threshold. Such a government spending policy will be tackled together with a fiscal policy based on taxation.

Keynes perfectly suggested this way of supporting the aggregate demand and fighting unemployment by stating that "the remedy would lie in various measures designed to increase the propensity to consume by the redistribution of incomes or otherwise. …The State will have to exercise a guiding influence on the propensity to consume partly through its scheme of taxation, partly by fixing the rate of interest, and partly, perhaps, in other ways" (Keynes J. , 1936).

As previously mentioned in section 3.6, in a such policy scenario, the government implements a fiscal policy so that capitalists and workers' tax rates decrease whenever their personal incomes fall behind a certain negative growth threshold and increase whenever they exceed a certain positive growth threshold. The aim of such a fiscal policy is to stimulate (calm) their consumption – and therefore the overall economic activity - whenever the economic activity is facing an excessive negative slowdown or a booming period in which the government can collect more resources. The theoretical background for such a coordinated fiscal policy to steer the economy together with the one aimed at reducing income inequality has been suggested and developed by several Post-Keynesians such as Sawyer (2011) and Arestis (2012). The simulation exercises showed in Fig 6 will explore those hints.

In this scenario, as soon as the crises induced by the exogenous investment demand causes an overall negative impact on the overall aggregate demand, the government rapidly reacts by increasing its public investments demand (Fig 6d) that increases the overall aggregate demand containing the downward instability. Such an idea was previously given by Fazzari et al. (2013) who argued how "autonomous demand has a profound effect on the model dynamics. It induces a floor that turns around negative dynamics toward growth". In effect, that demand support directly stimulates the private investment demand and, consequently, the production of both the public and private investments (Fig 6d,e).

The overall increasing trend on both public and private investment production after the crises leads (see period 15) to a reversed trend in the employment needed (Fig 6b) pushing it above the

pre-crises level. Such an effect causes the wage and therefore the wage bill to increase. At first (see period 20), such a strong increase in wages level brings to profits reduction, reducing capitalists' consumption and therefore a reduction of the aggregate demand too.

The latter calls for a further government intervention (see period 22), which again stimulates the overall aggregate demand, the aggregate production and the level of profits too. The restauration of the economic activity continues also lifting the private demanded and produced investments (Fig 6e).

The economic cyclicality characterized the moment after the exogenous negative shock and the immediate support by the government demand and production is reduced over time but the dynamics of the economy is quite clear. In fact, the strong intervention of the government via the higher public investments demanded and produced generated a positive impact on the overall levels and trajectory of the aggregate demand in this way increasing the private investments demanded and produced too. The increased production stimulated the employment levels that, together with the wage increase, generated an overall positive trend in the wage bill supporting the aggregate consumption and overall aggregate demand.

The increase of both the capitalist' profits and consumers' wages induce their personal income to constantly rise. However, alongside a pro-active spending policy, as long as their personal income varies, the government managed to change the disposable income pattern of workers and capitalists' by affecting their tax rates. By doing so, the government was finally able to steer higher levels of overall and financially investible wealth of both social classes. While the personal incomes of both classes are finally higher than the pre-crises levels with a projection to increase, their wealth difference is very much reduced with respect to both the pre-crises and the BL scenarios.

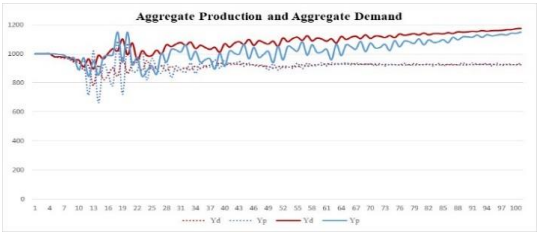
The Government Debt to GDP ratio volatility is much lower respect to the BL during all the period under consideration finally stabilizing with a decreasing trend projection in opposition to the BL.

While the overall consumption is finally slightly decreased with respect to the pre-crises levels - such as in the BL scenario - that does not assure a decreased level in the EF too. In fact, what seems to be relevant for reducing the total EF is mainly the composition of consumption and the EF weight from the different social classes. Since the workers have a lower EF weight with respect to the capitalists, even a relevant reduction in workers' consumption together with an increase in the capitalists' one might not assure that an overall aggregate consumption decrease leads to an overall reduction in total EF. In effect, the great contribution to the reduction of the total EF comes mainly from the slightly reduction of the capitalists' EF.

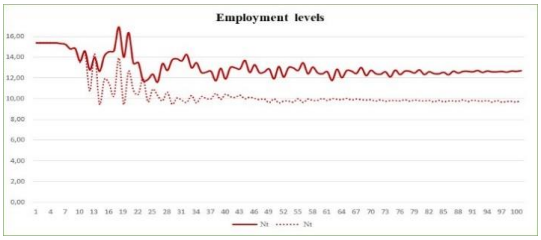
A Pro-active Policy Scenario (Scenario II)

(Proactive (bold lines) vs Baseline (dotted lines) scenarios)

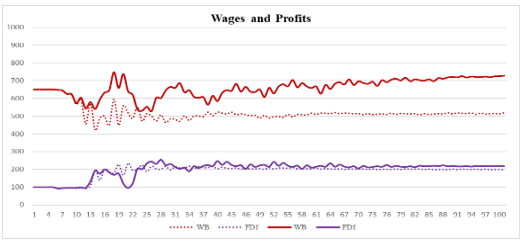
(a) Aggregate Production and Aggregate Demand



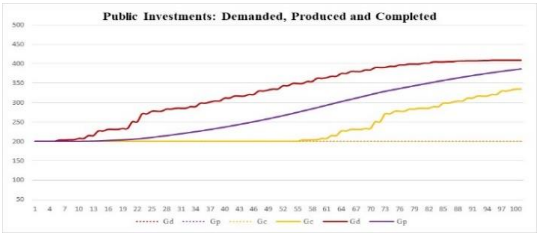
(b) Employment levels



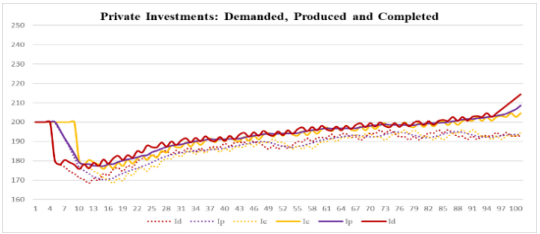
(c) Wages and Profits



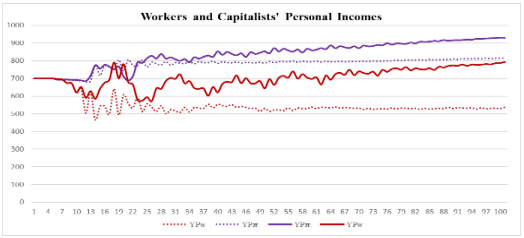
(d) Public Investments



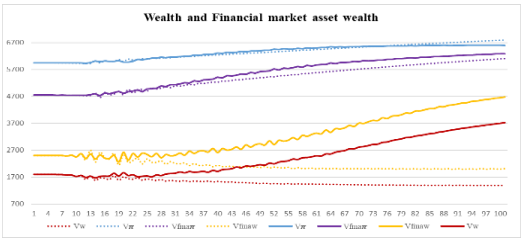
(e) Private Investments



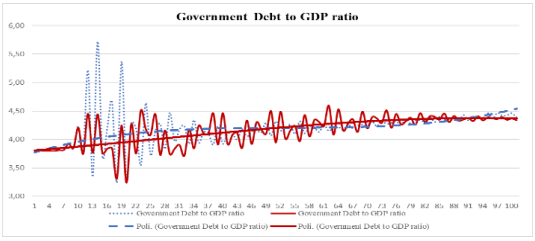
(f) Capitalists and Workers' Personal Incomes



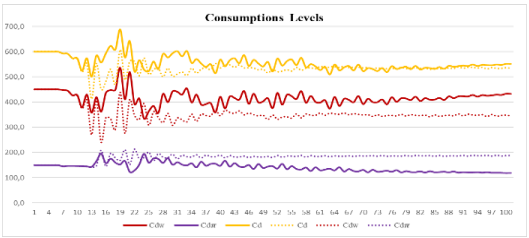
(g) Wealth and Financial market asset wealth



(h) Government Debt to GDP ratio



(i) Consumption Levels



(l) Ecological Footprint

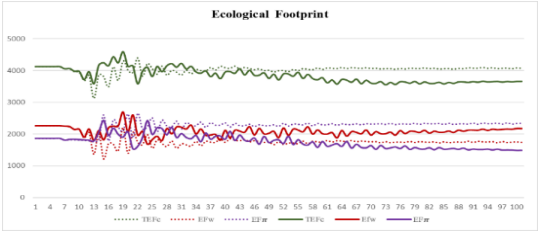


Fig 6. Evolution of macroeconomic, financial and environmental variables. Pro-active (bold lines) vs Baseline (dotted lines) Scenarios. (a) Aggregate Production and Aggregate Demand (b) Employment Levels (c) Wages and Profits, (d) Public Investments, (e) Private Investments, (f) Capitalists and Workers' Personal Incomes, (g) Wealth and Financial market asset wealth, (h) Government Debt to GDP ratio, (i) Consumption Levels, (l) Ecological Footprint. Note: The values used in the simulation analysis are reported in table 3.

4.5 Policy recommendations and conclusions

We analysed three different policy scenarios as a reaction to an exogenous shock in the aggregate demand as a fall in the private investments demanded. As baseline scenario (BL) we considered the one where the government does not change its government spending despite the negative exogenous shock while the second scenario (OBD) was one where the Government tried to obtain a zero budget deficit with the final aim of not letting the Public Debt to GDP ratio increase. Finally, the third one was a pro-active policy scenario where the Government implemented its main fiscal policies - the government spending and tax one - to support the economic activity following a functional finance approach.

In the BL, even though the government did not decrease its demand of public investments, it was unable to avoid and reverse the negative impacts caused by such a negative shock. The following fall in the employment caused the workers to lose its bargaining power and, together with a decrease of wage, that made the wage bill fall. While such a drop in the wage bill translated into a reduction of firms costs of production - therefore increasing the profits and partly private investments driven by those - it also caused a drop in the aggregate demand and therefore in the aggregate production. The negative effects on the wage bills and the positive ones on distributed profits affected in the same direction the workers and capitalists' personal income and so their investible and overall wealth too. In that way, while the aggregate demand, the aggregate production and employment levels were not restored, the social classes became more polarized than in the pre-crises situation decreasing the workers' consumption and augmenting the capitalists' one. Because of the higher EF impact of the latter respect to the former, the consequent drop of the workers EF was more than compensated by the increase of capitalists' EF. The overall EF level became in that way higher than the pre-crises levels.

In the 0BD scenario, as soon as the crises hit the economy, it negatively affected the aggregate demand and production, generating a similar effect on the employment as in the BL. As a consequence, the wage bill and even partly the profits decreased and that caused a decrease in the taxes collected by the government. In that situation, and trying to achieve a 0BD, the government spending in public investment demanded also decreased causing a further drop in the aggregate demand and production. The negative effects on the employment and the wage bill levels were in such a way reinforced and, since the last one was the major production cost, such wage bill drop enlarged the profits obtained by the firms and their owners. The increased wealth of the capitalists makes their investible wealth increase generating higher bills and bonds demand. Along with the endogenous money approach, such demand was completely satisfied, making the government debt increase further and, at the same time, increasing the government deficit because of the

interests to pay they carry on. In this way, while the GDP was not restored, the public debt increased making the final goal of a 0BD policy - the maintenance of the Public Debt to GDP ratio - frustrated. In such a scenario, the austerity measures caused a worst outcome in terms of restoration of the economic activity and employment with respect to the BL, with an even more polarized distribution between the social classes. Last but not least, the distribution of consumption between the social classes followed the even more polarized distribution of personal incomes. In fact, since the EF of the social classes was related to their consumption, the drop of workers EF was more than compensated by the increase of the capitalists one, without succeeding in reducing the overall EF. Actually, and despite the decreased overall aggregate consumption level, the overall EF is restored to the pre-crises levels with a tendency to increase further.

Finally, the pro-active government policy scenario was immediately able to support the drop in the economic activity boosting all the components of aggregate demand. It was able to stimulate both consumption and private investments too, more rapidly and effectively than the two scenarios previously examined. The government spending was able not only to rapidly restore aggregate demand but its fiscal policy was able also to have an effect on the consumption patterns to which the EF was linked. In fact, while slightly reducing the capitalists' and overall consumption, such coordinated policy allowed to support a growing pattern of both wages and profits, personal incomes and wealth. Moreover, in this last scenario, the economic activity was supported not only by the government spending but also by the high level of workers' wage and personal incomes. Such outcome not only was in line with a more sustainable social distributional effect but it also affected the composition of the government debt. In fact, in this case, the higher workers' wage and investible wealth caused their money demand to increase lifting the demand and supply of reserves too. This increased only partially the government debt without the interest payment related to the reserves supplied. In this way the budget deficit did not increase further for interest payments and the overall Government Debt to GDP ratio was stabilized with a tendency to decrease. Beyond tackling a more sustainable social distributional effect, the redistribution in personal income and in consumption, supported the aggregate demand and made the overall EF decreasing both with respect to all the previous policy scenarios and with respect to the pre-crises situation. In such a framework, the government was then able not only to rapidly support the economy, but it succeeded also in achieving that goal with a more socially sustainable and ecological way.

This paper focused on investigating the policies and the space of manoeuvre that a government has to support an economy hit by a crisis. In doing so, different policies are examined. Ideally, those policies carried out by the government should take care of leading such a recovery path in a social and ecological sustainable way, namely trying to reduce the social classes polarization - preferably making both worse off – and decreasing the natural resources consumed in the production process - measures of which the Ecological Footprint is the proxy.

The analysis is carried out using a Stock Flow Consistent (SFC) model which takes into account all the monetary connections of the economy among the sectors and between the two social classes, too. While few SFC explicitly consider an economy formed by two social classes, no one - to our knowledge - consider the impacts of the Kaleckian temporal lags among demanded, produced and concluded private investments in such a framework. That is not the only novelty of our work. In fact, while SFC models generally consider the government sector, extremely few ones consider its role in demanding and producing social public investments that, together with the private ones, form the overall capital endowment of such an economy.

Most importantly, combining those Kaleckian hints with the Keynesians ones about the ways in which a Government can restore the economy through government spending and taxes, we highlight how the investment such as the consumption patterns might be steered to ensure an economic and social recovery in a sustainable ecological way.

The results of the simulations carried out with our model show how a government that does not change its government expenditure policy to support the economy - "passive government" – might not be able to reverse the downward trend in the short run in terms of economic activity, employment and ultimately letting the polarization between the social classes increase. The results obtained in the short run might have long-lasting effects even after the crisis happened while the greater polarization in wealth and consumption of the social classes might not decrease the overall ecological impact of the (lower) economic activity.

The second scenario under analysis - "0BD" - shows how, after a crisis, a Government the aim of which is to maintain in parity its budget deficit with the final goal of not letting the public debt/GDP ratio increase, might easily strengthen the negative impacts of the recession by reducing the government spending. It is highlighted how the stronger drop in the economic activity might cause a higher level of unemployment and a further polarization of social classes. The dynamics are quite similar to the passive government scenario having even stronger negative impacts in terms of the long run economic activity, of increasing the polarization of the social classes and in terms of increasing both the public debt/GDP ratio and the ecological footprint with a tendency to increase further.

Finally, the simulations carried out show how a proactive government policy might effectively and rapidly support the economic activity with a functional finance approach stimulating and steering the economy toward a recovery path. That is done contemporarily by publicly investing in the economy and actively managing the tax rates of the social classes. Such combined tools might in fact increase both social classes personal incomes and wealth while decreasing the overall ecological impact of the economy. While the recovery is favoured in such an ecological pattern, the unemployment and the social polarization is effectively lowered with respect to the previous scenarios.

Further investigations might be led to research the space for monetary or combined policies able to achieve a similar social, economic and ecological sustainable scenario.

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- Chapter V –
Concluding remarks

> *The crisis has clearly demonstrated, if such a demonstration were needed after the failure of the Washington Consensus just a few years earlier, that there is something drastically wrong with the dominant theory that has provided such a bad advice to the decision-makers… In view of these failures, it is our social duty as economists, a duty that should have a high social rate of return, to develop an alternative outlook of the economic system.*
>
> (Lavoie, M., 2014: 4)

This work aims to explore the effects of a crisis on the distribution and employment and the space of manoeuvre of the government for supporting and reverting the negative shock produced by such a crisis.

The mainstream approach, beyond neglecting the social classes issue through analysing the society in terms of average representative agents, supports the idea of the government as an institution that might possibly help the economic recovery in the short run but the intervention of which has ultimately a negative impact in the medium and long run disincentivizing private investments. The government is therefore explicitly or implicitly asked and suggested not to intervene while leaving the economy spontaneously go back to its *natural* levels in terms of production and employment.

Considering the previous analysis, the high level of European unemployment after the crisis is often explained by the mainstream point of view (Blanchard, et al., 2010) mainly by a too generous system of unemployment insurance, a too high degree of employment protection laws, too high minimum wages and too long extensions agreements. All the previous aspects would maintain a too high bargaining power of workers' unions making them unwilling to accept a lower wage rate and, in this way, causing high levels of unemployment.

Our analysis starts considering one of the most undeniable aspect and a very relevant stylized fact of all the OECD economies such as a divided society characterized by an increasing income and wealth inequality. Together with the polarized social classes, we considered other stylized facts such as the temporal lag between production and sales of products by firms and the temporal lag between income received by the social classes and their expenditure.

In chapter II we considered the social and economic implications of such a crises allowing a non-equilibrium mechanism between the aggregate production and the aggregate demand. There

we argued that even if Post-Keynesians models focused their attention on output growth, employment and income distribution suggesting a stronger intervention of the state, they all (even the canonical Kaleckian model) overlooked the adjustment - or non-adjustment - dynamics from the ultra-short run to the short run period.

We argued that the equilibrium assumption between the aggregate demand and the aggregate production plays a key role in obtaining the standard Kaleckian conclusions regarding the relation between effective demand, employment levels and the distribution of surplus product between the social classes. Even if the main conclusions of the canonical Kaleckian model were in general confirmed, one conclusion was mainly potentially undermined. In fact, it was argued that the increase in the real wage alone might not guarantee a straight increase of the employment level when the interaction of desired and produced inventories, demand expectations and different marginal propensities of consumption are taken into consideration, as that might give rise to an unstable disequilibrium path. In such a situation, and exactly because of such a possible unstable scenario, the need of an autonomous institution was invoked to let the real wage increase have a positive effect on the employment level. The government was suggested as the emblematic figure for that role since its actions are moved not from expectations but from the achievement of a more stable and sustainable growth path.

Chapter III was constructed upon chapter II adding two further important characteristics of realism, namely the gestation period of the investments and the government presence into the model. In this way, the space of manoeuvre of the government for supporting and reverting the negative shock produced by such a crisis was investigated. In line with the “functional finance” it was claimed that the Government "can and should be called upon as a key part of the remedy" (Fazzari, 1994) to ensure a high level of economic activity whenever the private sector is unable to do so by itself. It was discovered that an unstable path due to the mismatching between aggregate production and aggregate demand might develop because of “wrong” oversensitive firms expectations regarding the production of consumption goods. In this scenario it was argued and showed that the Government has the tools to revert the path and stabilize the unstable economic scenario caused by the crises. In fact, the presence and clear commitment of the government can effectively reduce the uncertainty about the future and, in that way, shrink the corridor of expectations.

It was also discovered that even if the presence of the Government spending in public investments could prevent the economy to drop below a certain threshold, its “moderate intervention” might not be sufficient to obtain an economic recovery. The attempt of the Government to achieve a constant zero budget deficit policy tackling the “burden on future

generation" argument would depress the economy even more, through a constant reduction of the public resources allocated to the public investments. In such a situation, only a proactive government intervention with an attitude of "functional finance" might ensure to achieve a pre-crisis aggregate demand and employment levels, or the targeted ones. Together with such an approach, also a proactive taxation system has demonstrated to have the twin role of stabilising the economy while reducing the gap between the social classes.

However, chapter III was still supposing the commercial banks were providing funds on demand to firms for financing their investments according to the endogenous money theory but an exact and precise track of all the monetary transactions was not carried on. This was the main aspect focused on in our last chapter, chapter IV.

The model built in *Chapter IV* named "The distributive monetary analysis of a sustainable ecological economy" was the natural evolution of the models developed in Chapters II and III. As Chapter III, chapter IV focused on a crises situation and the way in which a Government can revert the declining economic path and stabilize the unstable economic scenario exactly triggered by the crises itself. Ideally, the policies carried out by the government should take care of leading such a recovery path in a social and ecological sustainable way, namely trying to reduce the social classes polarization - preferably making both worse off – and decreasing the natural resources consumed in the production process. The Ecological Footprint was used as the proxy for such a depletion of natural resources.

In chapter IV, all the stylized facts of chapters II and III are contained, namely the temporal lag between production and sales of products by firms, the one between income received by the social classes and their expenditure, the gestation period of the investments and, finally, the intervention of the government. The most important difference with respect to those chapters is its overall monetary and ecological framework. In fact, for simplification purposes the previous chapters were assuming that, in line with a horizontalist approach, commercial banks were providing funds on demand to firms for financing their investments. However, the explicit relations among all the sectors of our economy were not fully exposed. In chapter IV, Graziani's endogenous money theory was used and we developed a Post-Keynesian Stock Flow Consistent (SFC) model to track all the economic relations, both real and monetary. We used a SFC model since it ensured that "there are no black holes - every flow comes from somewhere and goes somewhere" (Godley W. , 1996) through a rigorous accounting framework, which guarantees a correct and comprehensive integration of all the flows and the stocks of an economy.

In particular, in chapter IV we analysed three different policy scenarios as a reaction to an exogenous shock in the aggregate demand as a fall in the private investments demanded. As

baseline scenario (BL) we considered the one where the government does not change its government spending despite the negative exogenous shock while the second scenario (OBD) was one where the Government tried to obtain a zero budget deficit with the final aim not to let the Public Debt to GDP ratio increase. Finally, the third one was a pro-active policy scenario where the Government implemented its main fiscal policies - the government spending and the tax one - to support the economic activity following a functional finance approach.

In the BL, even though the government did not decrease its demand of public investments, it was unable to avoid and reverse the negative impacts caused by such a negative shock. The following fall in the employment caused the workers to lose its bargaining power and, together with a decrease of wage, that made the wage bill fall. While such a drop in the wage bill translated into a reduction of firms costs of production - therefore increasing the profits and partly private investments driven by those - it also caused a drop in the aggregate demand and therefore in the aggregate production. The negative effects on the wage bills and the positive ones on distributed profits affected in the same direction the workers and capitalists' personal income and so their investible and overall wealth too. In that way, while the aggregate demand, the aggregate production and employment levels were not restored, the social classes became more polarized than in the pre-crises situation decreasing the workers' consumption and augmenting the capitalists' one. Because of the higher Ecological Footprint (EF) impact of the latter respect to the former, the consequent drop of the workers EF was more than compensated by the increase of capitalists' EF. The overall EF level became in that way higher than the pre-crises levels.

In the 0BD scenario, as soon as the crises hit the economy, it negatively affected the aggregate demand and production, generating a similar effect on the employment as in the BL. As a consequence, the wage bill and even partly the profits decreased and that caused a decrease in the taxes collected by the government. In that situation, and trying to achieve a 0BD, the government spending in public investment demanded also decreased causing a further drop in the aggregate demand and production. The negative effects on the employment and the wage bill level were in such a way reinforced and, since the last one was the major production cost, such wage bill drop enlarged the profits obtained by the firms and their owners. The increased wealth of the capitalists made their investible wealth increase generating higher bills and bonds demand. Along with the endogenous money approach, such demand was completely satisfied, making the government debt increase further and, at the same time, increasing the government deficit because of the interests to pay they carry on. In this way, while the GDP was not restored, the public debt increased making the final goal of a 0BD policy - the maintenance of the Public Debt to GDP ratio - frustrated. In such a scenario, the austerity measures caused a worst outcome in terms of

restoration of the economic activity and employment with respect to the BL, with an even more polarized distribution between the social classes. Last but not least, the distribution of consumption between the social classes followed the even more polarized distribution of personal incomes. In fact, since the EF of the social classes was related to their consumption, the drop of workers EF was more than compensated by the increase of the capitalists one, without succeeding in reducing the overall EF. Actually, and despite the decreased overall aggregate consumption level, the overall EF is restored to the pre-crises levels with a tendency to increase further.

Finally, the pro-active government policy scenario was immediately able to support the drop in the economic activity boosting all the components of aggregate demand. It was able to stimulate both consumption and private investments too, more rapidly and effectively than the two scenarios previously examined. The government spending was able not only to rapidly restore aggregate demand but its fiscal policy was able also to have an effect on the consumption patterns to which the EF was linked. In fact, while slightly reducing the capitalists' and overall consumption, such coordinated policy allowed to support a growing pattern of both wages and profits, personal incomes and wealth. Moreover, in this last scenario, the economic activity was supported not only by the government spending but also by the high level of workers' wage and personal incomes. Such outcome not only was in line with a more sustainable social distributional effect but it also affected the composition of the government debt. In fact, in this case, the higher workers' wage and investible wealth caused their money demand to increase lifting the demand and the supply of reserves too. This increased only partially the government debt without the interest payment related to the reserves supplied. In this way the budget deficit did not increase further for interest payments and the overall Government Debt to GDP ratio was stabilized with a tendency to decrease. Beyond tackling a more sustainable social distributional effect, the redistribution in personal income and in consumption, supported the aggregate demand and made the overall EF decrease both with respect to all the previous policy scenarios and with respect to the pre-crises situation. In such a framework, the government was then able not only to rapidly support the economy, but it succeeded also in achieving that goal with a more socially sustainable and ecological way.

In this way, the results of the simulations carried out with our model show how a government that does not change its government expenditure policy to support the economy - "passive government" – might not be able to reverse the downward trend in the short run in terms of economic activity, employment and ultimately letting the polarization between the social classes increase. The results obtained in the short run might have long-lasting effects even after the crisis

happened while the greater polarization in wealth and consumption of the social classes might not decrease the overall ecological impact of the (lower) economic activity.

The second scenario under analysis - "0BD" - shows how, after a crisis, a Government the aim of which is to maintain in parity its budget deficit with the final goal not to let the public debt/GDP ratio increase, might easily strengthen the negative impacts of the recession by reducing the government spending. It is highlighted how the stronger drop in the economic activity might cause a higher level of unemployment and a further polarization of social classes. The dynamics are quite similar to the passive government scenario having even stronger negative impacts in terms of the long run economic activity, of increasing the polarization of the social classes and in terms of increasing both the public debt/GDP ratio and the ecological footprint with a tendency to increase further.

Finally, the simulations carried out show how a proactive government policy might effectively and rapidly support the economic activity with a functional finance approach stimulating and steering the economy toward a recovery path. That is done contemporarily by publicly investing in the economy and actively managing the tax rates of the social classes. Such combined tools might in fact increase both social classes personal incomes and wealth while decreasing the overall ecological impact of the economy. While the recovery is favoured in such an ecological pattern, the unemployment and the social polarization is effectively lowered with respect to the previous scenarios.

In conclusion, the whole work presented here focused mainly on the role of the Government in reverting a negative path after an economic crises and in steering such a path while containing potential instability problems. Beyond all the real relations, chapter IV mainly took into account the monetary ones. However, the role of the Central Bank in changing the interest rate or in trying to manipulate the monetary variables was not considered. Further investigations might enquire into the space for monetary policies or combined fiscal and monetary policies able to achieve a similar social, economic and ecological sustainable scenario.

Chapter IV took into account, in a very simplified way, the ecological impact of production and consumption. Even if the Ecological Footprint is a good indicator of the ecological impact of the economic process, other variables might be considered too and all the ecological links might be studied more in detail to observe if the conclusions obtained in Chapter IV are still preserved.

Finally, a line of further investigation should consider a model of an open economy. In fact, even if the results obtained here might be maintained even in an open economy scenario, the analysis of the fiscal and monetary policies effects might reveal interesting and different dynamic paths.