UNIVERSIDADE ESTADUAL DE CAMPINAS

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LÍDIA BROCHIER

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Gasto autônomo endógeno em um modelo supermultiplicador stock-flow consistent: uma avaliação dos efeitos de crescimento e distribuição

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Prof. Dr. Antonio Carlos Macedo e Silva– orientador

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Resumo

O modelo supermultiplicador (Serrano, 1995a; Bortis, 1997) tem ganhado espaço no debate pós-keynesiano. Na sua versão mais recente, o modelo combina o gasto autônomo, que cresce a uma taxa dada exogenamente, com o comportamento harrodiano das firmas (Freitas and Serrano, 2015; Allain, 2015b; Lavoie, 2016). Isso permite que a capacidade se ajuste à demanda no longo prazo, com o grau de utilização retornando ao seu nível considerado normal. O pressuposto de que o crescimento do gasto autônomo é exógeno exclui, quase que por definição, a possibilidade de que alterações na distribuição de renda e nos gastos induzidos (nas propensões a gastar) tenham efeitos permanentes de crescimento. Além disso, tais modelos são, em sua maioria, modelos de fluxo que omitem os determinantes financeiros do gasto autônomo e as implicações das interações entre fluxos e estoques na economia.

Levando isso em consideração, a tese se propõe a avaliar os resultados do modelo supermultiplicador quando o pressuposto original - de que o crescimento do componente autônomo de demanda é completamente exógeno - é relaxado. A tese ainda busca analisar as características do modelo supermultiplicador quando estendido a uma estrutura financeira mais complexa, que considere não apenas os fluxos e o estoque de capital, mas também os estoques financeiros. Adota-se para tal a metodologia Stock-Flow Consistent, que permite conciliar ambos objetivos.

Procura-se mostrar que a endogeneização do gasto autônomo altera alguns resultados de longo prazo do modelo original. Isso significa que, assim como nos modelos neo-kaleckianos, é possível que, no modelo supermultiplicador, mudanças na distribuição de renda, assim como a expansão da demanda via propensões a gastar, tenham efeitos permanentes de crescimento. Os efeitos de crescimento são ainda reavaliados em uma estrutura que incorpora (a) o conflito distributivo entre trabalhadores e capitalistas, o crescimento endógeno da produtividade do trabalho e o emprego; (b) a interação entre duas economias semelhantes sob diferentes regimes cambiais.

No capítulo 2, *A Supermultiplier Stock-Flow Consistent model: the "return" of the paradoxes of thrift and costs in the long run?*, o gasto autônomo é endogeneizado (consumo a partir da riqueza) e os paradoxos da poupança e dos custos são avaliados no longo prazo. Os resultados das simulações numéricas indicam que o paradoxo da poupança permanece válido e que uma parcela de lucros mais baixa pode estar associada a taxas mais elevadas de acumulação de capital, embora com taxas de lucro mais baixas. No capítulo 3, *Conficting-claims and labour market concerns in a Supermultiplier model*, o modelo do capítulo 2 é estendido para dar conta da dinâmica do mercado de trabalho. A inflação é incorporada no modelo via conflito distributivo entre trabalhadores e capitalistas e o crescimento endógeno da produtividade do trabalho é introduzido, configurando a endogeneização da distribuição de renda.

No capítulo 4, *Growth and distribution in a Two-Country Supermultiplier Stock-Flow Consistent model*, o modelo do capítulo 2 é estendido para um sistema de dois países com características semelhantes. Os resultados das simulações numéricas indicam que tanto uma redução no mark-up das firmas quanto o aumento na propensão a consumir a partir da renda têm efeito positivo de crescimento sobre as duas economias em ambos os regimes de câmbio, fixo e flutuante. Além disso, se a condição de Marshall-Lerner for válida, a economia que expande sua demanda doméstica ganha relativamente mais do que a economia parceira (aumenta a sua participação no estoque de capital do sistema). O regime de câmbio ainda influencia, além da distribuição de renda, a distribuição de riqueza entre as economias. Por fim, um estímulo coordenado à demanda faz ambas economias crescerem a uma taxa mais elevada em comparação a um choque isolado à demanda em uma das economias.

Palavras-chave: Supermultiplicador; SFC; Paradoxo da poupança; Paradoxo dos custos; teorias de crescimento heterodoxas

Abstract

The supemultiplier model (Serrano, 1995a; Bortis, 1997) has been recently brought to the post-Keynesian debate. In its most recent version, the model combines an autonomous expenditure component, which grows at an exogenously given rate with a Harrodian behaviour of firms (Freitas and Serrano, 2015; Allain, 2015b; Lavoie, 2016). This allows capacity to adjust to demand while capacity utilization rate converges back to a normal level or range. The assumption of an exogenous growth rate for autonomous expenditures rules out, almost per se, the feasibility of permanent growth effects caused by changes in income distribution and induced expenditures (propensities to spend). Besides, these models are mostly flow models which disregard the financial determinants of autonomous expenditures and the implications of stock and flow relations.

Based on this, the thesis proposes to evaluate the supermultiplier model results when the original assumption - exogenous autonomous expenditure - is lifted. The thesis still addresses the supermultiplier model features when extended to a more complex financial framework, dealing not only with flows and real capital stock but also with financial stocks, which allows for a conciliation of both aims.

The thesis intends to show that making the autonomous expenditure component endogenous changes some long run results of the original model. This means that, as in neo-Kaleckian models, it is possible that in supermultiplier models changes in income distribution, as well as demand expansions through propensities to spend, may have permanent growth effects. Growth effects are also reassessed in a framework which includes (a) conflicting-claims between workers and firms, endogenous productivity growth and employment; (b) the interaction between two similar economies under different exchange rate regimes.

In chapter 2, A Supermultiplier Stock-Flow Consistent model: the "return" of the paradoxes of thrift and costs in the long run?, autonomous expenditures are made endogenous (consumption out of wealth) and the paradoxes of thrift and costs are addressed in the long run. The numerical simulations results suggest that the paradox of thrift holds and that a lower profit share may be associated with a higher accumulation rate, though with lower profit rates.

In chapter 3, Conflicting-claims and labour market concerns in a Supermultiplier model, the model built in chapter 2 is extended to take into account the labour market dynamics. Inflation is introduced via conflicting-claims between workers and firms and labour productivity growth is also made endogenous, completing the set for an endogenous income distribution.

In chapter 4, Growth and distribution in a Two-Country Supermultiplier Stock-Flow Consistent model, the model proposed in chapter 2 is now extended to a two-country system with similar features. The numerical simulation results suggest that both a reduction in firms' mark-up and an increase in the propensity to consume out of income have positive growth effects on both economies under flexible and fixed exchange rate regimes. In addition to this, if the Marshall-Lerner condition holds, the economy which expands its domestic demand gains relatively more than its partner economy (its share on the system's capital stock will be larger). The exchange rate regime still plays a role on wealth distribution across countries (besides the one on income distribution). At last, coordinated stimuli to demand make both economies grow at a faster pace in comparison to an isolated shock to demand in one of them.

Keywords: Supermultiplier model; SFC; Autonomous expenditures; Paradox of thrift; Paradox of costs; Heterodox growth theories

List of Figures

List of Tables

Contents

Chapter 1

Introduction

Autonomous is not exogenous: an apparently trivial statement which is still able to generate a fuss among heterodox authors. Maybe because we have been used to depict autonomous expenditures as exogenous in theoretical models for a while. Maybe because these concepts naturally get mixed up in the grey zone they intercept. Interestingly enough, when it comes to empirical studies such an assumption does not make us so uneasy.

We could also guess that the challenges inherent to treating "non-capacity" creating autonomous expenditures as, at least, partially endogenous in theory have kept us in safe distance. In the words of one of the Supermultiplier approach pioneers:

> The virtual impossibility of deriving formally a general 'endogenous' trend for the autonomous components of demand seems to have led the vast majority of multiplier-accelerator theorists to ignore the role of this component of aggregate demand in the explanation of long-run trends of capital accumulation. (Serrano, 1995a, p.84)

There is no doubt that the Supermultiplier approach dared to think outside the box, emphasizing the role of other-than-private-business-investment autonomous expenditures as leaders of growth in the long-run, thereby opening a new horizon for demand-led growth models.

A strong feature of these models is their ability to reproduce well-know stylized facts, such as the apparent stability of the average capacity utilization in the long run (Skott, 2010; Allain and Canry, 2008; Nikiforos, 2016) and the positive correlation between changes in the economy's growth rate and changes in the investment to output ratio (Girardi and Pariboni, 2015).

Besides that, some recent papers try to capture econometrically the causality from the growth of autonomous expenditures to the growth of GDP. Wen (2007) finds some evidence that, for the post-second world war US data, there is a causality that goes from consumption growth to output growth and then to business investment growth. Girardi and Pariboni (2015) also provide evidence that an increase in the growth rate of autonomous expenditures – exports, government expenditures, residential construction – induces an increase in the investment-to-output ratio, not only for the US case, but also for some European countries. More recently, Girardi et al. (2017) find that an expansion of autonomous expenditures (public expenditures and exports) have a permanent positive effect on GDP, on capital accumulation and on the employment rate for 34 OECD countries. In a somewhat different fashion, Fiebiger (2017) defends an independent role for autonomous expenditures as a driver of demand and cyclical patterns

based on the US evidence, which shows that household investment and debt-financed personal consumption expenditures are business cycles leading indicators.

Despite the fact that Supermultiplier models brought autonomous expenditures to the centre of the stage, these components of demand are, as a rule, assumed to grow at an exogenously given rate. Of course, this is just a simplifying assumption since "(...) no one believes that the growth rate of the semi-autonomous expenditures would be a constant value in the real world, even on average."(Fiebiger and Lavoie, 2017, p.5)

As with most simplifying assumptions, this one is not inconsequential. The first consequence is that the determinants of autonomous expenditures and, ultimately, of growth remain unexplained. Secondly, changes in effective demand and income distribution are not allowed to permanently affect the path taken by the economy.

We can argue a similar case for the lack of financial assets and of the interactions between real and financial sides of the economy in Supermultiplier models. A higher growth rate of autonomous expenditures can be associated with higher or lower debt ratios of households, firms and the government. In addition to this, the feasibility of different outcomes – regarding the accumulation and distribution of debt among the institutional sectors – according to which autonomous expenditure component is leading growth should be accounted for.[1]

We propose to take a very first step in this direction. The broad aim of the thesis is to assess the interactions between growth and income distribution when the assumption of an autonomous expenditure growing at an exogenously given rate is lifted in the Supermultiplier model. The thesis still addresses the model features when extended to a more complex financial framework, dealing not only with flows and real capital stock but also with financial stocks. For such task, we adopt the Stock-Flow Consistent methodology, which allows us to conciliate both goals: making autonomous expenditures endogenous through household consumption out of wealth and analysing the real-financial side interactions. To assess the results we run numerical simulation experiments, which we acknowledge are not enough to reach quite general conclusions, but given the complex nature of the models they enable us to draw useful insights.

The thesis intends to show that making the autonomous expenditure component endogenous changes some long run results of the original model – in a good way, in our opinion. That is, as in neo-Kaleckian models, it is possible that in Supermultiplier models changes in income distribution, as well as demand expansions through the propensities to spend, may have permanent growth effects. Growth effects are also reassessed in a framework which includes (a) conflicting-claims between workers and firms, endogenous productivity growth and employment; (b) the interaction between two similar economies under different exchange rate regimes.

Besides this introduction, the remainder of the thesis is organized as follows. In chapter 2 – *A Supermultiplier Stock-Flow Consistent model: the "return" of the paradoxes of thrift and costs in the long run?* – autonomous expenditures are made endogenous (consumption out of wealth) and the paradoxes of thrift and costs are addressed in the long run. The numerical simulations results suggest that the paradox of thrift holds and that a lower profit share may be associated with higher accumulation rate, though with lower profit rates.

In chapter 3 – *Conflicting-claims and labour market concerns in a Supermultiplier model* – the model built in chapter 2 is extended to take into account the labour market dynamics.

[1] "On our part, we would query any explanation of growth and cycles that excludes channels for financial-real interactions and external markets".(Fiebiger and Lavoie, 2017, p.13)

Inflation is introduced via conflicting-claims between workers and firms and labour productivity growth is also made endogenous, completing the set for an endogenous income distribution.

In chapter 4 – *Growth and distribution in a Two-Country Supermultiplier Stock-Flow Consistent model* – the model proposed in chapter 2 is now extended to a two-country system with similar features. The numerical simulation results suggest that both a reduction in firms' mark-up and an increase in the propensity to consume out of income have positive growth effects on both economies under flexible and fixed exchange rate regimes. In addition to this, if the Marshall-Lerner condition holds, the economy which expands its domestic demand gains relatively more than its partner economy (its share on the system's capital stock will be larger). The exchange rate regime still plays a role on wealth distribution across countries (besides the one on income distribution). At last, a coordinated stimuli to demand makes both economies grow at a faster pace in comparison to an isolated shock to demand in one of them.

At last, in chapter 5 we make a general assessment of the results obtained in previous chapters and share some ideas on prospects for future research.

Chapter 2

A Supermultiplier Stock-Flow Consistent model: the "return" of the paradoxes of thrift and costs in the long run?

Supermultiplier models, as conceived by Sraffian authors (Serrano, 1995a; Bortis, 1997), keep the "Keynesian hypothesis" (Lavoie, 2014, p.359), emphasizing the idea that growth can be demand-led even in the long run. This is made possible through the introduction of a "non capacity creating" autonomous expenditure which grows at an exogenously given rate and towards which capital accumulation rate will converge in the long run, as business investment is completely induced by income. One of the consequences of these assumptions is that, since both capital accumulation and utilization rates converge to given exogenous values, the paradox of thrift and the paradox of costs are no longer valid in terms of growth effects in the long run, but only in short and medium runs. That is to say growth rates can be higher during the traverse period, but not in the fully adjusted position of the system, when utilization rates reach the normal level.

Supermultiplier models have been recently brought to the post-Keynesian debate by Allain (2015b) and Lavoie (2016). Besides, some empirical evidence for their main results is provided by Girardi and Pariboni (2015). However, these models still do not properly account for the interactions between financial stocks and flows, which - as we sustain here - could lead to different results regarding the paradoxes in the long run.

The aim of the chapter is to verify whether these key results of the supermultiplier model – that is, that the paradoxes only hold for level effects in the long run – remain valid in a more financially complex economic framework with interactions between financial stocks and flows. To accomplish this we propose to build a Stock Flow Consistent model keeping the supermultiplier approach essentials – namely, the autonomous expenditure component, induced business investment and the Harrodian investment behavior through which firms react to the discrepancies between actual and desired utilization rates. We adopt a consumption function found in most post-Keynesian models, in which households consume a proportion of their wages and of

their wealth. The consumption out of wealth is the autonomous expenditure component of this economy and since the dynamics of household wealth is endogenous to the system, we can say that at least part of the autonomous expenditure component is also endogenous to the model.

We call "autonomous" the expenditure decisions that cannot be directly deduced from the circular flow of income (Serrano, 1995b), following (Freitas and Serrano, 2015, p. 4) when they state that consumption has an autonomous component (in their case, loosely related to credit and not functionally connected to wealth, as in our model) "unrelated to the current level of output resulting from firms' production decisions". Endogeneizing a specific component of autonomous expenditures[1] means that its contribution to the system's dynamics will be conditioned by the way it interacts with other variables and parameters, which may contribute to further explore the implications of supermultiplier models.

Besides this introduction, the chapter is organized as follows. Section 2.1 briefly reviews the heterodox growth models literature debate over the utilization rate and the consequences of each model, culminating in the proposal of these alternative (mainly supermultiplier) growth models. We further discuss the features and results of the recent supermultiplier models and highlight the lack of financial complexity, which motivates the building of the model in section 2.2.1. In section 2.2, we present the framework of the model as well as short and long run equilibrium conditions. Following this, in section 2.3 three numerical simulation experiments are carried out. The experiments are a reduction in firms' mark-up; an increase in the propensity to consume out of wages; and, finally, an increase in the autonomous expenditure component (an increase in the propensity to consume out of wealth). Still in this section (**??**), we make a general assessment of the shared results of the shocks. The last section concludes the first chapter.

2.1 Heterodox Demand-led growth models

Heterodox growth theories, as well as the neoclassical model of growth[2], have emerged as an attempt to get around the instability presented by Harrod's model (Kregel, 1980; White, 2008; Fazzari et al., 2013; Cesaratto, 2015). One of the issues raised by Harrod (1939) is that the *steady growth state* of the model is unstable because deviations of the growth rate of the economy from the "warranted growth rate" will make the path explode or collapse (Fazzari et al., 2013).

Accordingly, the models based on the Cambridge equation (Kaldor, 1961; Robinson, 1962) avoided instability assuming endogenous income distribution, what makes it possible for the system to reach the exogenously given utilization rate in the long run. However, in these models,

[1] Fiebiger and Lavoie (2016) and Fiebiger (2017) call these expenditures 'semi-autonomous' since it would be unrealistic to consider that any of the effective demand components could be fully autonomous in the real world.

[2] As we focus on heterodox growth theories, namely theories in which growth is led by demand and in which autonomous components of demand can also play a role in the long run, we do not deal with neoclassical growth theories.

a higher profit share was associated with higher accumulation and profit rates[3], which means that getting around instability had come at the cost of not reproducing the stylized fact that a higher capital accumulation rate can be accommodated through an increase in the utilization rate without changing income distribution between wages and profits (Cesaratto, 2015).

During the 1980s, some central features of Cambridge models began to be more fiercely questioned, such as full employment, the endogenous income distribution and the contradiction between short and long run dynamics (Lavoie, 2014).[4] These controversies originated the first neo-Kaleckian models, as put forward by Rowthorn (1981), Dutt (1984) and Amadeo (1986), which extended the effective demand principle to the long run without assuming full capacity utilization and price mechanisms to bring about the adjustment between investment and savings (Amadeo, 1987; Skott, 2010; Hein et al., 2012).

These neo-Kaleckian models considered income distribution to be exogenous, so changes in the capital accumulation rate would take place through the endogenous capacity utilization rate, even in the long run. They came up with two particularly interesting features at the same time: the paradox of thrift and the paradox of costs. The paradox of thrift says that an increase in the saving rate [5] would lead to lower capital accumulation, profit and utilization rates in the new equilibrium. The paradox of costs - in the version initially presented by Rowthorn (1981) - means that an increase in real wages after a fall in firms' mark-up would boost consumption and lead to a higher utilization rate and, consequently, to higher capacity accumulation and profit rates (Dutt, 2011; Lavoie, 2014). One could say that the paradoxes that emerge from the canonical neo-Kaleckian model are dynamic paradoxes or paradoxes in terms of "growth effects". The initial paradox of thrift as presented by Keynes (1936) referred to the negative effect of a higher propensity to save on the level of output. Likewise, the paradox of costs as put forward by Kalecki (1969) considered only the static effect of a decrease in wages on firms' level of profit (Lavoie, 2014).

The neo-Kaleckian approach, despite its predominance among post-Keynesian authors, has been repeatedly criticized for not dealing with the Harrodian instability issue. The point is: since the utilization rate is endogenous in the long run it could be permanently higher or lower than the normal or planned utilization rate. In neo-Kaleckian models, long run accumulation is ultimately exogenous, so a higher utilization rate does not affect investment plans and, consequently, firms do not revise the trend growth of sales even with a persistently higher or lower demand. For authors from other heterodox strands, as some Sraffians, deviations between actual

[3]While a higher propensity to save would reduce them both, in consonance with the paradox of thrift.

[4]Contradiction between short run and long run behavior of the economy refers to the fact that in the short run quantities change to adjust output to demand, through the endogenous utilization rate, while in the long run, capacity is at its full level, so prices must change to equal output to demand (Lavoie, 2014, p. 347-359).

[5]Since in most neo-Kaleckian models, as a simplification, workers spend all their income and only capitalists save, they usually refer to the saving rate of capitalists.

and normal utilization should foster changes in growth expectations and in investment decisions, giving rise to Harrodian instability. (Hein et al., 2011a, 2012; Lavoie, 2014).[6]

As an alternative to neo-Kaleckian models, Serrano (1995a) and Bortis (1997) proposed the so-called "Sraffian" supermultiplier model, in which long run growth is demand-led and capacity utilization converges towards the normal or planned levels, by means of the adjustment of the marginal propensity to invest of private firms. This is made possible by the introduction of an autonomous demand component growing at an exogenously given rate while private business investment is assumed to be induced by income without losing the Keynesian causality of investment to savings. The full inducement of private business investment addresses the criticism that firms must reevaluate their expected long run growth rate, when the utilization rate diverges from the normal one. The approach solves a previously impossible trinity, harmonizing the Keynesian hypothesis, exogenous income distribution and the long run balance between productive capacity and the aggregate demand (Cesaratto, 2015).

The first versions of the supermultiplier model (Serrano, 1995a; Bortis, 1997) lacked a clear depiction of the endogenous mechanism by means of which the utilization rate tends towards its normal rate. However, a Harrodian mechanism through which the propensity to invest becomes endogenous and changes according to the discrepancy between the actual utilization and the normal one was included in a recent version of the supermultiplier by Freitas and Serrano (2015), which means at least a conditional solution to the Harrod's knife-edge instability problem (Allain, 2015b; Lavoie, 2016). In a similar fashion to this latest version, the supermultiplier model was brought to the post-Keynesian debate, within the neo-Kaleckian framework, by Allain (2015b,a) and by Lavoie (2016). They both combine a "non-capacity creating" autonomous expenditure component – which grows at an exogenously given rate towards which the rate of capital accumulation will converge in the long run – and the Harrodian adjustment mechanism.

These supermultiplier models bring into the scene a whole new spectrum of demand-led models, which could enrich the post-Keynesian literature, since in most neo-Kaleckian models, private business investment is the demand component which leads growth, while there is no reason why this should always be the case.[7] From the canonical version of the neo-Kaleckian model (Dutt, 2011; Hein et al., 2011a) to its most popular variant, the "post-Kaleckian" (Lavoie, 2014) model of Bhaduri and Marglin (1990), this remains as a predominant feature. This also applies to the more financially complex stock-flow consistent (SFC from now on) models. To

[6] "(...) It seems unrealistic to assume that the growth rate of sales expected by firms, which is captured by the parameter γ in the investment function, stays at the same value forever. Overtime, it should slowly adjust to past changes in the growth rate of sales (...)" (Nah and Lavoie, 2017a, p. 14).

[7] The recent U.S. experience suggests that consumption, for instance, can autonomously grow in relation to current income to a large extent and for a considerable period of time (Guttmann and Plihon, 2008; Cynamon and Fazzari, 2008; Barba and Pivetti, 2008; Bibow, 2010; Lavoie, 2014; Allain, 2014). The "*funding effect*" (see Brown, 2007) of some institutional arrangements put forward by financial innovation, as well as consumer credit with real estate collateral, are good examples of how consumption can grow independently of current income growth. In Fazzari et al. (2013)'s words: "(...) the rising importance of finance for consumer spending strongly suggests that consumption dynamics could play a much more important role in demand growth than is the case with the passive income based consumption (...) (Fazzari et al., 2013, p. 19).

Table 2.1: Balance sheet of Supermultiplier models

Assets	Households	Firms	Government$^{\diamond}$	$\sum$
1. Fixed Capital		$+K_f$		$+K_f$
2. Equities†	$+E$	$-E$		0
3. Govt. Bills$^{\diamond}$	$+B$		$-B$	0
4. Net worth	V_h	V_f	$-B$	$+K_f$

Note 1: The papers considered in this table are the following: Allain (2015b,a); Freitas and Serrano (2015); Dutt (2016); Lavoie (2016); Hein (2016); Nah and Lavoie (2017a).
Note 2: The white cells are part of the models in all papers considered in this table.
† Equities are included only in Hein (2016).
$^{\diamond}$ Government bills are included only in Dutt (2016) and Hein (2016).
Source: Author's elaboration.

be fair, we can find some models in which government expenditures assume the leading role of growth, as in chapter 11 of Godley and Lavoie (2007)'s book. However, to our best knowledge, only recently the implications of different growth-regimes – as for, instance, consumption-led ones – started to be explored.[8]

In the next subsection, we deal with these recent supermultiplier growth models and how they still need to add some financial complexity to the economic framework to do justice to the post-Keynesian debate about the roles of money and finance on the dynamics of capitalism.

2.1.1 The lack of financial determinants in supermultiplier growth models

According to Lavoie (2010), one of the main reservations of post-Keynesians about the supermultiplier approach is that it does not include the financial features of the economy, differently from several neo-Kaleckian models, which in the 1990s begun to link the financial and real sides of the economy (Lavoie, 2006; Dutt, 2011).[9] This has not been significantly altered by recently published papers such as Freitas and Serrano (2015); Lavoie (2016); Allain (2015a).

So far these supermultiplier growth models rely on quite simple economies in order to obtain analytical solutions. Most of them have only two or three sectors, firms and households (investment and consumption) and, more recently, government or the foreign sector; they typically feature only one kind of real asset (the capital stock) and one kind of financial asset (government debt), if at all. In tables 2.1 and 2.2, in which we present respectively the balance sheet and the transactions flow matrix of the recent models in this literature, we can notice they are mainly flow models, not paying enough attention to the interaction between stocks of financial assets and income flows.

We are aware that increasing complexity and dealing with both the real and the financial sides of the economy might not have been the goals of these models so far. Yet the inclusion

[8] Apart from the balance of payment constrained growth models, in which net exports lead growth. However, these models are too partial: most of them do not even include investment decisions (see Blecker, 2009).

[9] For more on how neo-Kaleckians include financial issues in their models see Dutt (2011) and on how neo-Kaleckians deal with the impacts of financialization on these models see Hein et al. (2011b).

Table 2.2: Transactions flow matrix of Supermultiplier models

	Households	Firms		Government†	Foreign sector⋆	$\sum$
		Current	Capital			
1. Consumption	$-C$	$+C$				0
2. Investment		$+I$	$-I$			0
3. Govt. expenditures†		$+G$		$-G$		0
4. Exports⋆		$+X$			$-X$	0
5. Imports⋆		$-M$			$+M$	0
6. Wages	$+W$	$-W$				0
5. Taxes†	$-T$			$+T$		0
7. Profit	$+FD$	$-F$	$+FU$			0
8. Interest◇	$+iB$			$-iB$		0
9. Subtotal	S_h	0	S_f	S_g	S_{ex}	0

Note 1: The models considered are the same ones of table 2.1.
Note 2: The white cells are part of the models in all papers considered in this table.
† The Government sector and government expenditures are included in Allain (2015b,a), Dutt (2016) and Hein (2016). Taxes are included in Allain (2015b); Dutt (2016), but not in Hein (2016).
⋆ The foreign sector and exports and imports are included only in Nah and Lavoie (2017a).
◇ Interest payments on bills are included only in Dutt (2016) and Hein (2016).
Source: Author's elaboration.

of financial determinants and the analysis of debt and deficit dynamics is starting to gain momentum (see Dutt, 2015; 2016 and Hein, 2016). In Allain (2015b) government expenditures lead growth in the long run, but the government budget deficit is balanced, so there is neither government debt nor interest payments accruing from government bills. On the other hand, Dutt (2015, 2016) and Hein (2016) address the effects of debt dynamics on income inequalities in a system where government plays the leading role of growth.

Dutt (2016) highlights how the supermultiplier mechanism impacts public debt[10]: an increase in the growth rate of autonomous government expenditures leads to a higher accumulation rate during the transition, which means a reduction in the government deficit to capital ratio and consequently leads to a reduction in the debt to capital ratio, due to the increase in income and taxation, reducing the financial needs of the government. The lower debt to capital ratio also means a reduction in the financial income received by capitalists as a share of capital, thus reducing income inequality; in turn, Hein (2016) does not deal with taxation issues, focusing on the ambiguous effect of an increase in the debt to capital ratio on the pre-tax functional distribution of income: a higher deficit pushes activity, thus increasing production and income from real activity (reducing the financial income share). On the other hand, the consequent increase in government debt to capital ratio increases the financial income share received from interest payments.

[10] Dutt (2016) also shows how debt dynamics changes long run stability conditions – the growth rate of government expenditure should be lower than the normalized saving rate and higher than the after tax interest rate for stability to hold.

In table 2.3, we exhibit the main features and results of these models. The ultimate source of growth varies: it is consumption out of credit [11] in Freitas and Serrano (2015), it is the capitalists' consumption in Lavoie (2016) and government expenditures in Allain (2015b). In Allain (2015a), the author proposes an interesting model in which subsistence consumption, through a redistributive mechanism between employed and unemployed workers, works as the autonomous variable growing at the exogenous population growth rate.[12] Most of these models explicitly deal with the Harrodian instability problem, by means of an adjustment mechanism of the expected trend growth rate of sales or, of the propensity to invest (in the case of Freitas and Serrano (2015)), which makes the utilization rate converge to the normal rate. In both adjustment mechanisms presented, Harrodian instability is needed for the utilization to converge to the normal one, as long as it is not too strong. Therefore, the adjustment of the expected trend growth rate (or propensity to invest) by firms must be slow.

Despite conciliating the autonomous expenditure component with some financial complexity – through government debt dynamics – it is important to stress that neither Hein (2016) nor Dutt (2016) deeply discuss the Harrodian instability issue. Hein (2016) assumes that the normal utilization is not precisely defined in a world of uncertainty or that it adjusts endogenously to the actual utilization rate. Indeed, Hein (2016) keeps the usual neo-Kaleckian investment function, in which animal spirits is exogenous and capacity utilization adjusts endogenously to the changes in aggregate demand even in the long run. Differently, Dutt (2016) considers that firms have rational expectations and assume that the trend growth rate of sales equals the growth rate of the autonomous demand component chosen.

As far as we know, a more "complete" stock-flow consistent supermultiplier model, which deals with Harrodian instability issues and which is concerned with growth dynamics, is still rare. In Dos Santos and Zezza (2008), the authors already suggested that it could be interesting to study an investment function with a Harrodian mechanism, according to which firms would adjust their investment demand to stabilize the capacity utilization, within an SFC framework. More recently, we can find three papers which include an investment function of the accelerator type in an SFC framework. Both Bortz (2014) and Leite (2015) provide an investment function which makes investment endogenous and dependent on income but they rely on the assumption that government expenditures are completely exogenous, so the dynamics of their models will be closely related to the supermultiplier models described in the present section. Pedrosa and Macedo e Silva (2014) also provide a model in which investment is endogenous and in which government expenditures are a fraction of the capital stock, thus the dynamics of their model is closely related to the one presented by the model proposed here. However, the purpose of the

[11] Girardi and Pariboni (2015) find some evidence that consumption out of credit bears a close correlation to the GDP and that GDP growth precedes the increase in household consumption credit. Based on this, they question whether this variable should be considered autonomous in the long run.

[12] In this paper, Allain claims to have a solution also to the second of Harrod's problem since the growth rate in the long run also matches the natural rate of growth.

authors is to analyse the government debt dynamics and its relation to the private sector debt, which is not our focus here.

As Freitas and Serrano (2015) acknowledge it, it is essential to focus on the financial determinants and on the dynamics of the different "non-capacity creating" components of autonomous demand which could take on the leading role on growth. Allain (2015b) also suggests that the results of supermultiplier models may vary according to the autonomous expenditure chosen as the growth engine. Hein (2016) stresses that the insights provided by his model should be examined and assessed in "(...) more complex models, which might include taxes and thus the post-tax distribution of income, more complicated investment functions, explicitly considering the issue of investment finance for example, wealth-based and debt-based consumption, or a foreign sector" (Hein, 2016, p. 20).

However, in the (still too simple) supermultiplier models summarized in table 2.3, the choice of the engine of growth seems to be inconsequential. The accumulation rate will converge to the exogenously given growth rate of the leading variable, whatever it is. A decrease in the propensity to save, for instance, will increase the *level* of output but will not permanently effect the growth rate of the economy, since the capital accumulation rate will converge towards the exogenously given growth rate of autonomous consumption or government expenditures. The same applies to the paradox of costs. In the case of (e.g.) a reduction in the profit share, the level of output and the level of profits will be higher as a consequence of the increase in household expenditures, but the rate of profits will be lower since the utilization rate converges to the normal utilization rate. [13] [14]

As mentioned by Lavoie (2016), although the paradoxes of thrift and costs are lost as growth effects in supermultiplier models, they still hold if redefined as level effects. This also means that during the traverse from one steady state to the other, growth rates change, being higher or lower on *average*. However, the disappearance of the growth effects reflects the assumption that "non-capacity creating autonomous expenditures" are completely exogenous. A different picture may emerge if, by means of a more complete description of the feedbacks between financial stocks and flows, one allows for a specific engine of growth to become partially endogenous to the model. This is what we propose in sections 2.2 and 2.3.

2.2 A Supermultiplier Stock-Flow Consistent model

Based on the brief review of the previous section, we propose to build an SFC model in which the "non-capacity creating" autonomous expenditure component is the consumption out of

[13] To be fair, in Nah and Lavoie (2017a) there are some different short and medium run effects, as the sensitivity of the real exchange rate due to changes in income distribution may give rise to wage or profit-led regimes (table 2.3).

[14] Dejuán (2014) also proposes a supermultiplier model in which net exports lead growth but, differently from Nah and Lavoie (2017a), does not analyze the impacts of the sensitivity of real exchange rates to income distribution, which could change the short and medium run results of the model.

Table 2.3: Supermultiplier models features and results

Model	Y	Z	Investment behavior	Results of a decrease in s		Results of a decrease in π	
				Y	g_k, g_y,u	Y	g_k, g_y,u
Allain (2015b)	$C+I+G$	Government expenditures	Harrodian instability mechanism	Permanent +	Transient +	Permanent +	Transient +
Allain (2015a)	$C+I$	Subsistence consumption	Harrodian instability mechanism	Permanent +	Transient +	Permanent +	Transient +
Dutt (2016)	$C+I+G$	Government expenditures	Rational expectations	Permanent +	Transient +	Permanent +	Transient +
Hein (2016)	$C+I+G$	Government expenditures	Animal spirits, endogenous u	Permanent +	Transient +	Permanent +	Transient +
Freitas and Serrano (2015)	$C+I$	Consumption financed by credit	Harrodian instability mechanism	Permanent +	Transient +	Permanent +	Transient +
Lavoie (2016)	$C+I$	Capitalist's consumption	Harrodian instability mechanism	Permanent +	Transient +	Permanent +	Transient +
Nah and Lavoie (2017)	$C+I+XL$	Net exports	Harrodian instability mechanism	Permanent +	Transient +	Permanent +/-	Transient +/-

Legend: Y is for output, Z for the autonomous expenditure component, g_k for capital accumulation rate, g_y for outuput growth, u for utilization rate, s for propensity to save and π for the profit share.
Source: Author's elaboration.

household wealth and in which private business investment is totally induced. Since household wealth is endogenous to the model, it follows that the autonomous expenditure component is also endogenous.[15] Firms follow the Harrodian investment behaviour and adjust their propensity to invest when the utilization rate seems to significantly deviate from the desired utilization rate or band. Our aim at first is to analyse whether some of the supermultiplier model results still hold when the autonomous expenditure component is endogenous in the long run and how the interaction between stocks and flows can influence these results.

In the next subsections we present the framework of the model, the short run equilibrium condition, the dynamics equations and the long run equilibrium conditions.

2.2.1 Framework of the model

In the present subsection, we describe our SFC model that attempts to incorporate some of the Supermultiplier approach features. Table 2.4 presents the balance sheet of the four institutional sectors featured: households, firms, government and banks. The model deals with a pure credit closed economy without inflation (price level is stable and equals the unity). This is so because introducing a Central Bank and/or inflation would make the model unnecessarily complex for the initial purpose we have in mind. Of course, we allow for the price of equity to change in order to account for household capital gains or losses.

Banks lend to firms and receive deposits from households. As banks do not make profits, deposits earn the same interest rate of loans granted to firms. Firms sell equities to households and are not credit constrained, for banks grant all demand for loans. As prices are held constant, one can assume that a monetary authority determines the real interest rate, as in Ryoo and Skott (2013). *Households* in this economy hold three kinds of assets. They buy equity from productive firms and bills issued by the government and hold the rest of their wealth in the form of deposits at banks.

[15] While the notion of exogeneity vs. endogeneity to the model can be clearly defined, the notion of autonomy vs. inducement seems to be somewhat arbitrary. In supermultiplier models, investment is not necessarily induced by *current* income. In Cesaratto et al. (2003, p. 42), induced investment is a function of the "expected average rate of growth of normal effective demand over the life of the investment that is currently being installed".

Table 2.4: Balance sheet matrix model chapter 2

Assets	Household	Firms	Banks	Government	$\sum$
1. Deposits	$+M$		$-M$		0
2. Loans		$-L$	$+L$		0
3. Fixed capital		$+K_f$			$+K_f$
4. Equities	$+pe.E$	$-pe.E$			0
5. Government Bills	$+B$			$-B$	0
6. Net worth	V_h	V_f	0	$-B$	$+K_f$

Note 1: We obtain the net worth for both household and firms sectors summing up lines 1 to 5 of the respective columns: $V_h = M + peE + B$ and $V_f = K_f - L - peE$.

Table 2.5: Transactions and Flow of Funds matrix model chapter 2

	Household	Firms		Banks	Government	$\sum$
		Current	Capital			
1. Consumption	$-C$	$+C$				0
2. Investment		$+I$	$-I$			0
3. Government expenditures		$+G$			$-G$	0
4. Wages	$+W$	$-W$				0
5. Taxes	$-T$				$+T$	0
6. Profit	$+FD$	$-F$	$+FU$			0
7. Deposits interest	$+i_r.M_{-1}$			$-i_r.M_{-1}$		0
8. Loans interest		$-i_r.L_{-1}$		$+i_r.L_{-1}$		0
9. Bills interest	$+i_r.B_{-1}$				$-i_r.B_{-1}$	0
10. Subtotal	S_h	0	S_f	0	S_g	0
11. Δ Deposits	$-\Delta M$			$+\Delta M$		0
12. Δ Loans			$+\Delta L$	$-\Delta L$		0
13. Δ Equity	$-pe.\Delta E$		$+pe.\Delta E$			0
14. Δ Bills	$-\Delta B$				$+\Delta B$	0
15. $\sum$	0	0	0	0	0	0

Table 2.5 shows the transactions between institutional sectors in its first part and the flow of funds in the second part. At this point we can describe the transactions of each sector and the behavioural assumptions.

Government issues bills to finance its expenditures that are not covered by taxation of household income.[16] Besides, government bills, firms' loans and household deposits yield the same interest rate. Government expenditures are a fraction of aggregate income at the beginning of the period (equation 2.2).[17] In equation 2.1, which shows how government debt evolves over time, i_r is the real rate of interest, G is the government expenditure, T is the taxation of household income and B_{-1} is the stock of bills issued by the government and held by households at the beginning of the period. In equations 2.2 and 2.3 respectively σ represents the ratio of

[16] As in Heron and Mouakil (2008) the government only taxes household (not firms) income.

[17] Since many countries pursue austerity measures and we are not focusing on fiscal policy, considering government expenditures as procyclical should not be a problem, as in Heron and Mouakil (2008).

government expenditures to past income [18] and τ represents the ratio of taxes on household income.

$$B = B_{-1} + G - T + i_r.B_{-1} \tag{2.1}$$

$$G = \sigma.Y_{-1} \tag{2.2}$$

$$T = \tau.Y_h \tag{2.3}$$

Household income comprehends wages and financial income (interest on deposits and bills and dividends) (equation 2.4). The wage share of income is defined by equation 2.5, in which π is firms' profit share. Household disposable income is defined as the after-tax household income (equation 2.6). Households consume a fraction (α_1) of their after-tax wages and a fraction (α_2) of their stock of wealth at the beginning of the period (equation 2.7), as in Dos Santos and Zezza (2008). Consumption out of wealth represents the autonomous expenditure component. Despite being autonomous (in relation to current income), it is endogenous to the model, since it depends on household wealth, so we can analyse its dynamics through household wealth dynamics. Household savings are defined by equation 2.8. In the model, financial income does not affect consumption directly, but through its effect on wealth.

$$Y_h = W + FD + i_r.(B_{-1} + M_{-1}) \tag{2.4}$$

$$W = (1 - \pi).Y \tag{2.5}$$

$$Y_d = (1 - \tau).Y_h \tag{2.6}$$

$$C = \alpha_1(1 - \tau).W + \alpha_2 V_{h_{-1}} \tag{2.7}$$

$$S_h = Y_d - C \tag{2.8}$$

Following Dos Santos and Zezza (2008), we suppose that the proportion of household wealth allocated in equities (λ) depends positively on the given expectation of return (λ_0) and

[18] Since we are building the model in a discrete time framework, one may wonder whether the stability of the model would depend on the lagged effect of income on government expenditures. We have tested the model for government expenditures based on current income (results can be provided upon request). If government expenditures depended on current income, the short run effects of the supermultiplier on the model would be amplified. This means the model would present a higher growth rate, requiring a slower adjustment of the trend growth of sales or the propensity to invest to keep instability away. This is the same effect observed in the models of Allain (2015a); Lavoie (2016); Freitas and Serrano (2015): a higher growth rate requires a lower speed of adjustment of investment. In Appendix **??**, we provide the short-run utilization rate and the long run growth equations for case in which government expenditures depend on current income.

negatively on the real interest rate (equation 2.9). The stock of equities issued is decided by firms. As households buy all equities issued by firms, the price of equities (pe) comes into play to clear the market (equation 2.10).[19] To avoid indetermination, since bills and deposits have the same remuneration rate, we suppose that households buy all government bills (Ryoo and Skott, 2013; Pedrosa and Macedo e Silva, 2014).[20]

$$\lambda = \lambda_0 - i_r \tag{2.9}$$

$$pe = \frac{\lambda.V_h}{E} \tag{2.10}$$

The stock of wealth changes due to household savings and due to capital gains (equation 2.11). As households are assumed to buy all bills issued by the government, deposits share in wealth must be treated as a residual (equation 2.12)

$$V_h = V_{h\_1} + S_h + \Delta pe.E_{-1} \tag{2.11}$$

$$M = M_{-1} + S_h - pe.\Delta E - \Delta B \tag{2.12}$$

Firms decide the mark-up (μ) on wage costs. The mark-up on costs defines functional income distribution (Lavoie and Godley, 2001), as in traditional neo-Kaleckian models (equation 2.13). Firms must also make their investment decisions and this is where the supermultiplier approach comes properly into the scene. Aggregate investment of firms is induced by output (equation 2.14) (Serrano, 1995a; Freitas and Serrano, 2015). Firms as a whole have a marginal propensity to invest out of income (h), which is endogenous to the model and reacts to discrepancies between the utilization rate (u) and the normal utilization rate (u_n) (equation 2.15), following a Harrodian adjustment mechanism (see Lavoie, 2016; Freitas and Serrano, 2015), in which γ represents the speed of adjustment of the propensity to invest to the discrepancies between the actual utilization rate and the desired utilization rate.

$$\pi = \frac{\mu}{(1+\mu)} \tag{2.13}$$

$$I = h.Y \tag{2.14}$$

[19] We use the same simplification of the Tobinesque set of asset demand equations presented in Lavoie and Godley (2001) and proposed by Dos Santos and Zezza (2008). A more detailed examination of household wealth composition would require an explicit and full Tobinesque portfolio choice framework.

[20] We assume, as Ryoo and Skott (2013), that short run government bonds and bank deposits are perfect substitutes. For the purposes of the model, the assumption of different rates of return of deposits and bills would make the deduction of the dynamic equations more complicated without affecting substantially the results. However, it is important to highlight that this simplifying assumption would have to be lifted and a more realistic description of the financial instruments would have to be introduced, if we were to analyse firms' or household financial fragility.

$$\Delta h = \begin{cases} h_{-1}.\gamma.(u - u_n), & \text{if } |u - u_n| > \chi \\ 0, & \text{otherwise} \end{cases} \tag{2.15}$$

Since we agree with Sraffian and Classical authors when they say that the utilization rate cannot be "anywhere" in the long run, but also agree with the neo-Kaleckians when they point that there is no reason for firms to choose a specific number for the utilization rate, we believe that adopting a range, out of which the propensity to invest reacts, is a satisfying option, as suggested by Hein et al. (2012). As highlighted by Dutt (2011), in a world of uncertainty, firms may want to keep their investment strategy unchanged if the capacity utilization is within a reasonable band. This corridor is represented by the parameter χ (equation 2.15).

The change in the stock of capital is given by equation 2.16 and differs from the flow of investment because we include capital depreciation in the model (δ). The actual utilization rate is given by the ratio of output to full-capacity output (equation 2.18) and full-capacity output (equation 2.17) is determined by the ratio of the initial capital stock to the given capital-output ratio (v). From these equations, we can draw the actual rate of growth of the capital stock (equation 2.19).

$$K = K_{-1} - \delta K_{-1} + I \tag{2.16}$$

$$Y_{fc} = \frac{K_{-1}}{v} \tag{2.17}$$

$$u = \frac{Y}{Y_{fc}} \tag{2.18}$$

$$g_k = \frac{hu}{v} - \delta \tag{2.19}$$

Firms must still decide how they will finance their investment. We suppose firms finance their investment through retained earnings, equity issuance and bank loans, which are assumed to clear firms' demand for funds (equation 2.20).[21]

Equities are a fixed proportion (ζ) of the capital stock at the beginning of the period (equation 2.21). Firms retain a fraction of their profit (s_f) discounting the payment of interest on loans (equation 2.22) and distribute the rest of net profit to households in the form of dividends (equation 2.23). Total net profits are given by gross profit less interest payment on the opening stock of loans (equation 2.24). Gross profit is given by equation 2.25.

$$L = L_{-1} + I - FU - pe.\Delta E \tag{2.20}$$

[21] As in many SFC models (see Lavoie and Godley, 2001; Godley and Lavoie, 2007; and Zezza, 2008; among others), we present firms' loans as the buffer of the sector, considering, as a matter of simplification, that firms exhaust their internal funds before recurring to external funding for investment. However, this simplification is not suitable for analysing the firms' process of increasing debt and their likelihood of becoming more fragile.

$$E = \zeta.K_{-1} \tag{2.21}$$

$$FU = s_f(\pi.Y - i_r L_{-1}) \tag{2.22}$$

$$FD = (1 - s_f)(\pi.Y - i_r.L_{-1}) \tag{2.23}$$

$$F = \pi.Y - i_r.L_{-1} \tag{2.24}$$

$$F_g = \pi Y \tag{2.25}$$

Normalizing equation 2.24 by the stock of capital at the beginning of the period, we get what we can call a net profit rate (equation 2.26). Gross profit rate (equation 2.27) is attained through the same procedure for equation 2.25.

$$r_n = \pi\frac{u}{v} - i_r\frac{l_{-1}}{(1 + g_{k-1})} \tag{2.26}$$

$$r_g = \pi\frac{u}{v} \tag{2.27}$$

After presenting the framework of the model, we can move on to the short run goods' market equilibrium and to the dynamic equations of the system.

2.2.2 Short-run goods market equilibrium

In our closed economic system, real output is the sum of household consumption, firms investment and government expenditures (equation 2.28). If we substitute equations 2.7, 2.14 and 2.2 in equation 2.28, normalize it by the opening stock of capital and make some algebraical rearrangements, we get the short run equilibrium utilization rate (equation 2.29). The term $\alpha_2 v h_{-1}$, which represents the normalized consumption out of wealth or capitalist consumption, is the truly autonomous expenditure component of this system (the z component). The supermultiplier appears on the RHS of equation 2.29 within the parenthesis and shows the effect of induced consumption, induced investment and government expenditures on the level of output. The essence of the supermultiplier approach is maintained as the level of output and the utilization rate in the short run are determined by an autonomous component of demand, which is not private business investment, times the supermultiplier (see Freitas and Serrano, 2015).

$$Y = C + I + G \tag{2.28}$$

$$u = \left(\frac{1}{(1+g_{k-1})\left[1-h-\alpha_1(1-\tau)(1-\pi)-\frac{\sigma}{1+g_{y-1}}\right]} \right) \alpha_2 v_{h-1} v \tag{2.29}$$

Assuming, as in neo-Kaleckian models, that the model presents Keynesian stability, savings should react more than investment to changes in output and capacity, which means that for the denominator of equation 2.29 to be positive the following condition should be satisfied:

$$1-\alpha_1(1-\tau)(1-\pi)-\frac{\sigma}{(1+g_{y-1})} > h \tag{2.30}$$

2.2.3 Dynamic equations and Steady State ratios

We can now obtain the dynamic equations of government debt, household wealth and firms' loans normalized by the capital stock [22] at the beginning of the period. This step is important in order to give us the long run equilibrium ratios, or the steady growth ratios of the stocks. Dividing equation 2.1 by the lagged capital stock and making some algebraic manipulation, we get the normalized stock of *government debt* (equation 2.31). We can notice that the stock of government debt, in the short run, depends positively on the stock of debt at the beginning of the period and on the after-tax interest rate (which remunerates bills held by households). It also depends positively on the government propensity to spend and on the profit share, since retained profits are not taxed. On the other hand, the taxation of distributed profits, firms' normalized stock of loans at the beginning of the period and the capital accumulation rate have a negative effect on government debt to capital ratio. The current capital utilization rate also has a negative on the normalized stock of government debt, considering that the taxation of distributed profits assumes positive values ($\tau(1-s_f\pi)$). The intuition is that since in the short run government expenditures depend on past income, past capacity utilization should have a positive effect on government debt to capital ratio but not the current capacity utilization, which increases government revenues.[23]

$$b_t = \frac{b_{-1}[1+i_r(1-\tau)]+\sigma u_{-1}-\tau i_r s_f l_{-1}}{(1+g_{k-1})} - \tau(1-s_f\pi)\frac{u}{v} \tag{2.31}$$

The same procedure is applied to firms' loans. We divide equation 2.20 by the lagged capital stock and get equation 2.32. Firms' loans to capital ratio depends positively on the loans at the beginning of the period, on the interest rates they pay on this initial stock and on the propensity

[22] The normalized stocks of government and firms' debt will also be referred to respectively as government bills to capital ratio and firms' loans to capital ratio, since bills and loans are the sole components of these institutional sectors' debts.

[23] The effects presented here are drawn based on reasonable and positive values for the parameters, as well as on the assumption that the model presents Keynesian stability and that the steady growth ratios converge to a stable equilibrium, which requires as a necessary condition for the denominator of the equilibrium ratios to be positive.

to invest. As long as the propensity to invest is larger than the retained earnings share, the effect of capacity utilization will also be positive. Firms' loans relate negatively to retained profits and to the capital accumulation rate. If the growth rate assumes positive values, which is the case in normal times, the portion of wealth in the form of equities exerts a negative impact over firms' loans.

$$l_t = \frac{(1 + s_f i_r) l_{-1} + \lambda v_h}{1 + g_{k-1}} + (h - s_f \pi)\frac{u}{v} - \lambda v_h \tag{2.32}$$

When it comes to the normalized stock of household wealth, the algebra gets slightly more complicated. The normalized stock of wealth (equation 2.33) is obtained by the division of equation 2.11 by the lagged capital stock. The short run stock of wealth is positively affected by the stock of wealth at the beginning of the period, by the after-tax dividend income, by the after-tax savings out of wages, by the interest households receive over the stock of government bills and by the amount of interest firms pay on loans (which is the same they receive on deposits). The normalized stock of wealth negatively relates to the consumed portion of wealth at the beginning of the period and to the consumed portion of after-tax wages. The equities share on wealth has an ambiguous and transient effect, since its effects vanish in the long run. The effect of the capital accumulation rate on the normalized stock of wealth depends on the value of the parameters of the model.

$$v_h = \frac{(1 - \alpha_2 - \lambda) v_{h-1} + (1 - \tau)[(1 - \alpha_1 + \pi(\alpha_1 - s_f))\frac{u}{v}(1 + g_{k-1}) + s_f i_r l_{-1} + i_r b_{-1}]}{1 + g_{k-1} - \lambda} \tag{2.33}$$

As we are testing whether the supermultiplier results hold in a more complex economic system, we have to deal with long run equilibrium normalized stocks, in which all growth rates follow the growth rate of the autonomous expenditure component (2.34) and in which the utilization rate converges to the normal utilization rate, or gets into the inertia zone (2.35).

$$g^* = g_k = g_{v_h} = g_b = g_l \tag{2.34}$$

$$u^* \simeq u_n \tag{2.35}$$

Given conditions 2.34 and 2.35, and thus considering that all stocks grow at the same rate, normalized stocks at the beginning of the period equal normalized stocks at the end of the period (thus $\Delta b_t = 0$) in the long run. The normalized government debt (2.31) can be rewritten as:

$$b^* = \frac{[\sigma - \tau(1 - s_f \pi)(1 + g^*)]\frac{u_n}{v} - \tau i_r s_f l^*}{g^* - i_r(1 - \tau)} \tag{2.31A}$$

We notice that, *cet.par.*, an increase in the propensity to spend of the government (σ) increases the steady state value of the debt to capital ratio. The same is true for the profit share (π). While

the firms' loans steady state ratio affects negatively the government debt - which means that when the government diminishes its debt, firms increase their leverage -, the normal utilization level has a positive effect on the government debt ratio, as long as the term between brackets – $[\sigma - \tau(1 - s_f\pi)(1 + g^*)]$ – is greater than zero. We consider this is the case, assuming as an stylized fact that both government and firms' debt are positive.

Following the same steps for firms, we arrive at the long run normalized stock of loans:

$$l^* = \frac{(1 + g^*)[(h - s_f\pi)\frac{u_n}{v}] - g_k\lambda v_h}{g^* - s_f i_r} \tag{2.32A}$$

In the steady state, as in the short run, firms need less borrowed funds to finance the same amount of investment, the larger the proportion of household wealth (λ) allocated in equities. The opposite happens with the utilization rate, *cet.par.*, a higher normal utilization rate implies a larger ratio of loans. The greater the propensity to invest and the smaller the profit share, the greater will be the firms loans to capital ratio in the long run.

The equilibrium stock of household wealth-to-capital ratio (from equation 2.33) is negatively influenced by the propensity to consume out of wealth (α_2) and by the propensity to consume out of after-tax wages (α_1). The higher is firms' debt ratio, the higher will be the wealth ratio, because of the higher financial income received by households, which will also increase with the interest rate on bills and deposits. The same applies to the government debt ratio. Other things equal, higher values for the normal utilization rate and for the profit share also translate into a higher steady state ratio of wealth. As in the short run, the effect of the growth rate on the steady state ratio of wealth depends on the combination of the parameters of the model.

$$v_h^* = \frac{(1 - \tau)[(1 - \alpha_1 + \pi(\alpha_1 - s_f))\frac{u_n}{v}(1 + g_k) + i_r b + s_f i_r l]}{g_k + \alpha_2} \tag{2.33A}$$

Solving equation 2.29 for equilibrium values, considering that conditions 2.34 and 2.35 are satisfied and, consequently, $\Delta h = 0$, we come to the equation for the long run growth rate of this economy:

$$g^* = \frac{\alpha_2 v_h^* v + u_n\sigma}{u_n[1 - h^* - \alpha_1(1 - \tau)(1 - \pi)]} - 1 \tag{2.36}$$

In equation 2.36, we can observe that income distribution (π) as well as the other components of the supermultiplier – propensity to invest (h), propensities to consume (α_1, α_2) and propensity to spend of the government (σ) – can have permanent effects on growth. Accordingly, the normalized consumption out of wealth also influences the rate of growth ($\alpha_2 v_h$).

After presenting the level and the dynamic equations and the short and long run equilibrium conditions, we can move on to the simulation experiments to test for the long run effects of the model.

Table 2.6: Effects of the shocks

	Reduction in $\mu(\pi)$		Increase in α_1		Increase in α_2	
	Short run	Long run	Short run	Long run	Short run	Long run
g	$+$	$+$	$+$	$+$	$+$	$+$
u	$+$	$=$	$+$	$=$	$+$	$=$
r_g	$-$	$-$	$+$	$=$	$+$	$=$
r_n	$-$	$-$	$+$	$-$	$+$	$-$

2.3 Experiments

From the *steady growth state*, we run some simulation experiments to evaluate the long run features of the model. The first shock is a decrease in the mark-up, which means an increase in the wage share, in order to assess whether the paradox of costs holds in terms of level and growth effects, considering the initial values and parameters of the model.[24] The second shock is an increase in the propensity to consume out of after-tax wages (α_1) (a reduction in the propensity to save) in order to assess whether the paradox of thrift holds in terms of level and growth effects. At last, we shock the autonomous consumption component, through an increase in the propensity to consume out of wealth (α_2), to analyze how it changes the dynamics of the economy in the long run. The results of the shocks are summarized in table 2.6.[25]

2.3.1 The paradox of costs

A decrease in the mark-up raises the wage share and leads to a higher consumption out of wages, which translates into a higher income and activity level. The increase in capacity utilization following the increase in consumption and income makes firms change their expectation of growth, which raises their propensity to invest, increasing the rate of capital accumulation as we can see in figure 2.1(a). We also observe that as the rate of growth of household wealth during the transition is lower than the capital accumulation rate (figure 2.1a), the ratio of household wealth to capital will be lower in comparison to the baseline (figure 2.2a). As in the original supermultiplier model (Serrano, 1995a), as investment increases in relation to output, through a higher propensity to invest h (figure 2.1c), the autonomous expenditure component (consumption out of wealth) z loses relative weight on output (figure 2.1d). From figure 2.1(b), we note that the utilization rate converges towards the desired rate in the long run, through the adjustment of the propensity to invest.

From equations 2.31 and 2.31A, we know that the reduction in the profit share contributes directly to reduce government debt ratio. Besides that, a reduction in the normalized stock of bills contributes to reduce itself further since the amount of interest the government pays on

[24] The parameters and long run values of the variables are presented in table A.1 in Appendix A.

[25] All numerical simulations were computed using R and Eviews 9 software. The programming codes of the simulations are available upon request.

bills (to households) also decreases. The increase in the utilization rate following the boost in activity at the same time raises the ratio of bills to capital (since government spends a constant fraction of output) and has a negative effect on that ratio through the increase on taxes (figure 2.2a). In the short run, the government budget deficit falls sharply but as output increases it stabilizes at a higher level compared to the baseline (figure 2.2c). The increase in firms loans and the higher accumulation rate also contribute to reduce the government bills to capital ratio.

In the case of firms, the higher loans to capital ratio is due to the increase in the propensity to invest along with the lower amount of wealth to capital which reduces total equities as a source of finance in comparison to the baseline (figure 2.2d). These effects compensate the impact of a higher accumulation rate in reducing firms loans - through the increase in profit income (figure 2.2a).

Household wealth to capital ratio is negatively influenced by the initial reduction in the profit share, which diminishes the financial income accruing from firms' dividends and diminishes the immediate need for the government to issue bills since taxation from household wage income increases. This more than compensates the effect of the increase in the interest payments households receive from deposits (figure 2.1a). The growth rate of wealth is higher in comparison to the baseline due to the overall increase in income and activity following the higher wage share (figure 2.2a).

Regarding the gross and net profit rates of firms (figure 2.2b), it is clear that since the utilization rate converges to a desired rate or range, both rates decrease in relation to the baseline. In the short run, the positive effect of an increase in income and utilization is not enough to compensate the reduction of firms profit share. However, gross and net profit levels increase in relation to the baseline [26].

Based on these results, we realize that income distribution can influence growth in the long run, even if the utilization rate converges to the desired rate or range. This is made possible by the inclusion of the endogenous autonomous expenditure component in the model, which means that there are factors other than the utilization rate through which income distribution can affect output growth. Yet the profit rate cannot increase in the long run, since the profit share decreases and the utilization rate goes back to its normal range. In this case, even if the model only presents the paradox of costs in terms of level effects, it is still possible to say that income distribution has a permanent impact on growth in the long run.

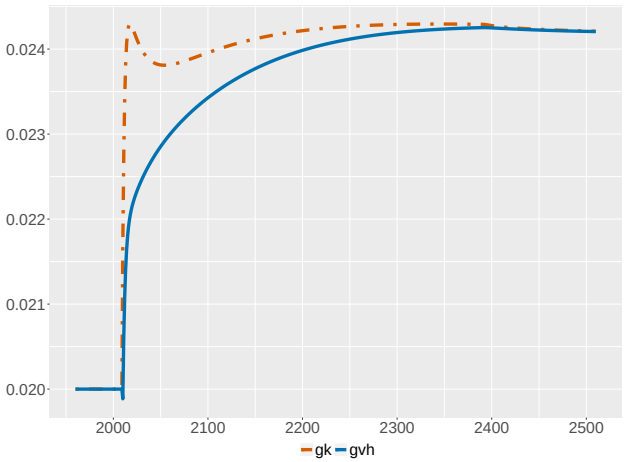
2.3.2 The paradox of thrift

Following an increase in the propensity to consume out of wages (α_1), consumption increases and leads to an increase on output and capacity utilization. This leads to an increase in the

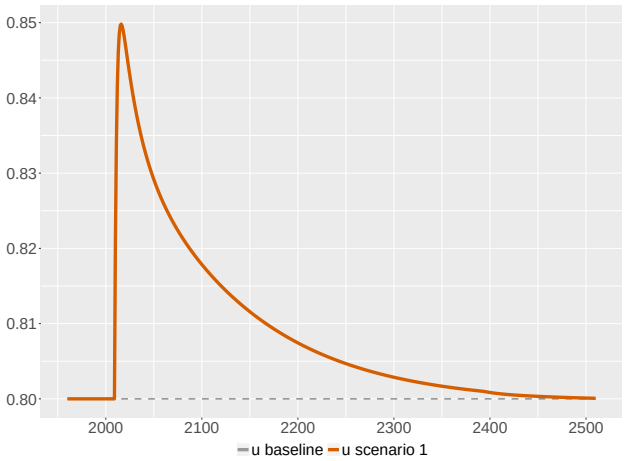
[26] One could say that, as firms have more than one goal in the long run, they may be willing to cut profit rates in order to grow and to increase their market shares (Lavoie, 2014).As pointed by one of anonymous referees, the results regarding the rate of profit could also be related to a fallacy of composition between the decisions of firms at the micro level and aggregate macro results. For more on this, see Hein and Van Treeck (2008).

Figure 2.1: Effects of an increase in real wages (reduction in μ)

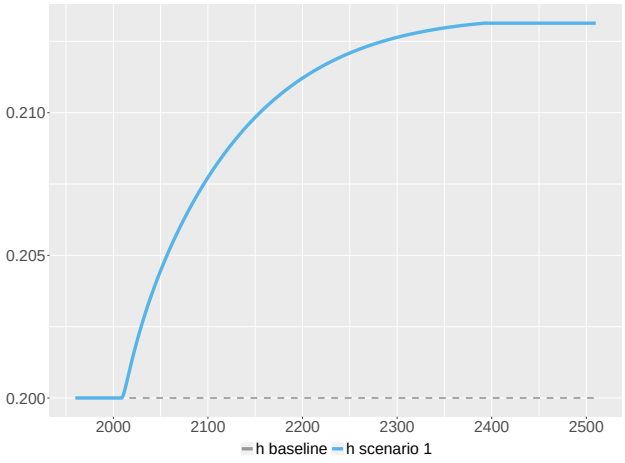
(a) Growth rates of capital and household wealth



(b) Capacity utilization rate



(c) Firms propensity to invest



(d) Autonomous expenditure component to income

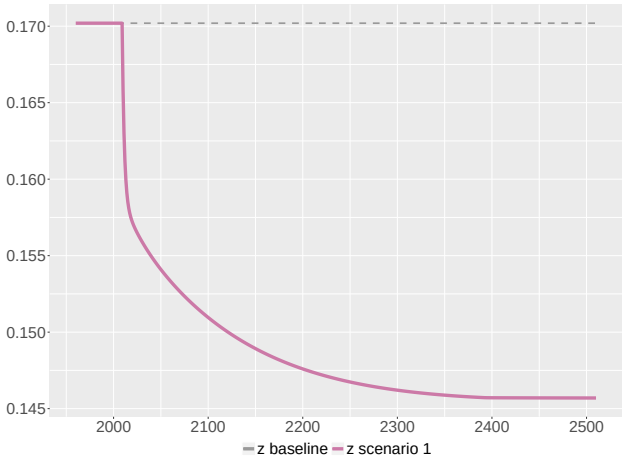
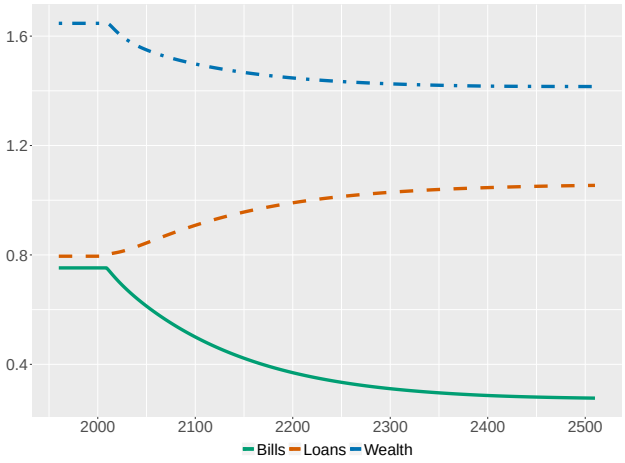
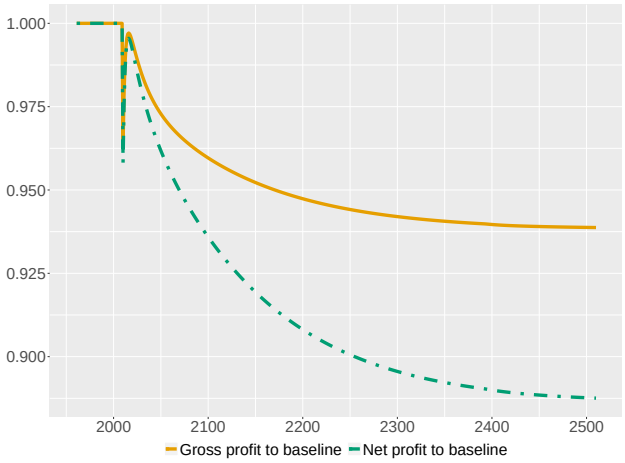


Figure 2.2: Effects of an increase in real wages (reduction in μ)

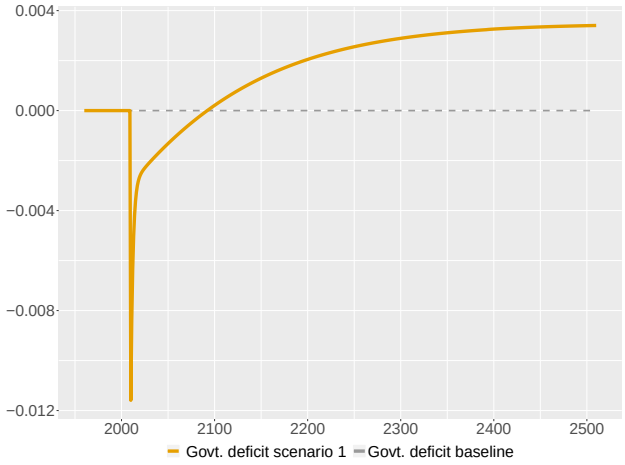
(a) Steady growth state ratios



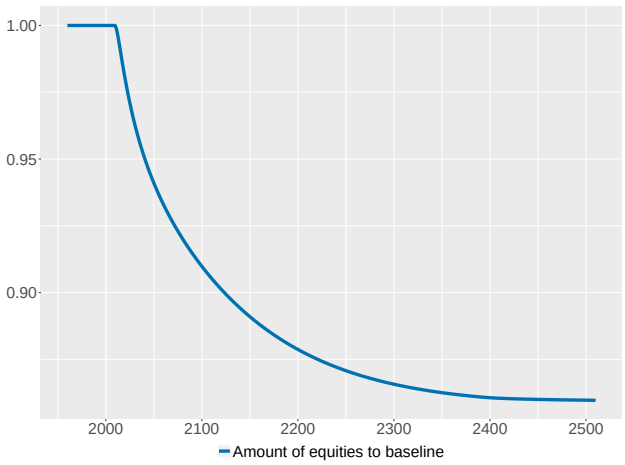
(b) Profit rates



(c) Government budget deficit



(d) Amount of equities



propensity to invest of firms and in the capital accumulation rate (figures 2.3a,2.4c). Consumption out of wealth loses participation in income (figure 2.4d), with capital accumulation growing faster than wealth, as in the first simulation experiment. The difference here is that in the short run, the reduction in workers' propensity to save impacts negatively households savings and, consequently, their wealth (figure 2.3a). However, as soon as consumption affects activity, the higher income will raise the financial income received by households, which contributes positively to wealth growth.

The government debt to capital ratio also decreases as household income - due to an increase in dividend payment and wages -, taxation and capital accumulation increase. In the short run, as firms' loans ratio decreases, the debt ratio falls at a slower pace. In the long run, the reduction in the payment of interest to households, due to the lower debt ratio, and the higher accumulation rate together with a higher loans to capital ratio make the debt to capital ratio decrease even further (figures 2.3a, 2.3c).

Differently from the previous experiment, in this case, firms' loans to capital ratio falls in the short run and stabilizes at a higher ratio in the long run in comparison to the baseline. As firms slowly increase their propensity to invest as a reaction to the higher level of activity, the sharp increase in the accumulation rate negatively impacts the loans to capital ratio, compensating the increase in the propensity to invest and the decrease in the amount of equities due to the lower ratio of household wealth to capital (figures 2.3a, 2.4a, 2.4c). Still, in the long run, since the accumulation rate converges towards the growth rate of wealth, stabilizing at lower position in comparison to the initial shock (higher than the baseline), the value it assumes is not enough to cover the effects of the propensity to invest and of the amount of equities on the loans to capital ratio.

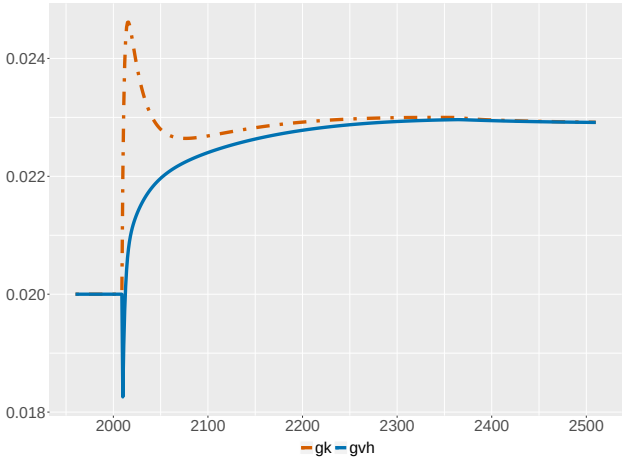
Household wealth to capital suffers the negative impact of the lower normalized stock of government bills, since interest payments decrease, and also the negative impact of the lower interests on deposits, as a result of lower firms' loans ratio. However, as income and capacity utilization increase, they have a positive effect on wealth, even if wealth grows at a lower rate than capital accumulation. In addition to this, in the long run, as firms' loans attain a higher position in comparison to the baseline, they positively influence wealth (figures 2.3a, 2.4b).

Gross and net profit rates increase in relation to their baseline values due to the temporary increase in the utilization rate. As the utilization rate converges to its desired level, and there are no changes in the profit share, the gross profit rate goes back to its baseline value. The net profit rate decreases as the ratio of loans to capital rests at a higher level, which means that a larger part of profits is destined to the payment of interest on loans (figure 2.3d).

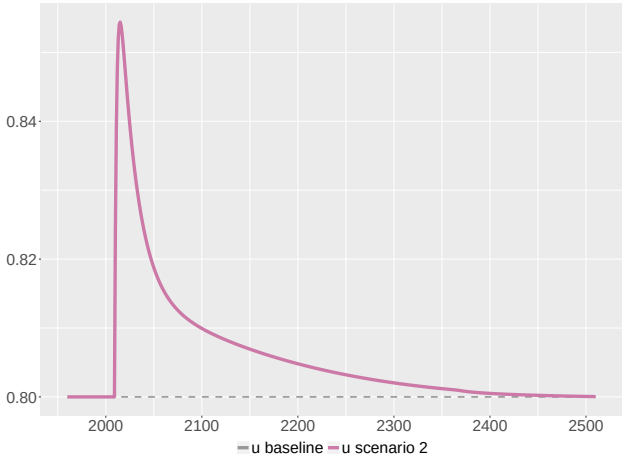
In sum, we observe that the paradox of thrift in terms of growth effects is still valid in the long run in this framework in which there is an autonomous expenditure component working as an "attractor" to growth and with the utilization rate converging to a desired range. This happens because the reduction in the propensity to save stimulates the economy, boosting consumption from wages, which entails both a higher output level in relation to the baseline, and a

Figure 2.3: Effects of an increase in the propensity to consume out of income (α_1)

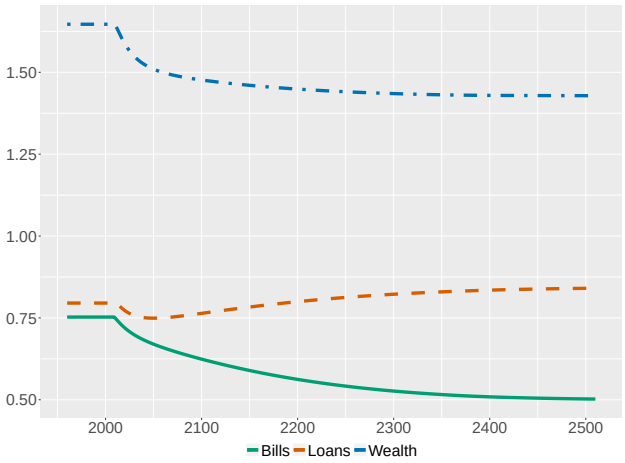
(a) Growth rates of capital and household wealth



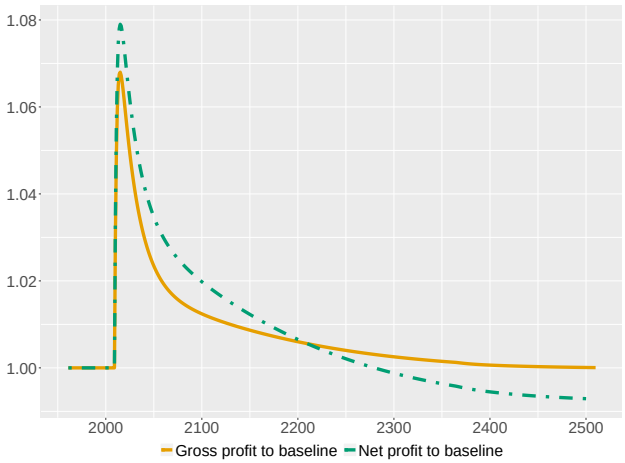
(b) Capacity utilization rate



(c) Steady growth state ratios



(d) Profit rates



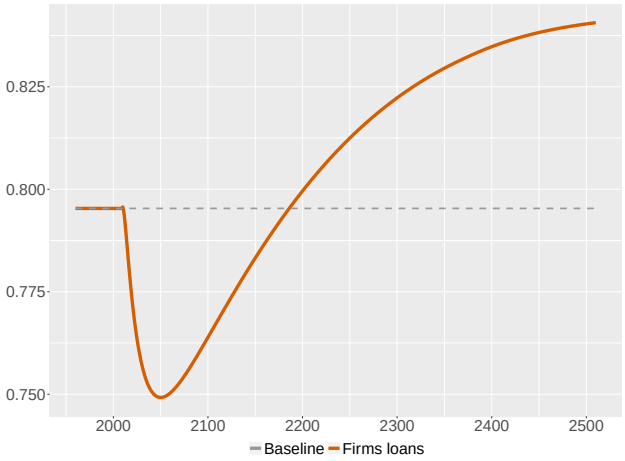
higher growth rate in the long run, through the supermultiplier. Differently from neo-Kaleckian models, in which the effect happens through the utilization rate, raising the level of activity and the accumulation rate, in this model the effect happens through the utilization rate in the short run; however, the accumulation rate depends on the output, which ultimately depends on the autonomous expenditure component (consumption out of wealth) and on its multiplier which is permanently increased, raising the overall rate of growth of the economy.

2.3.3 A shock to the propensity to consume out of wealth

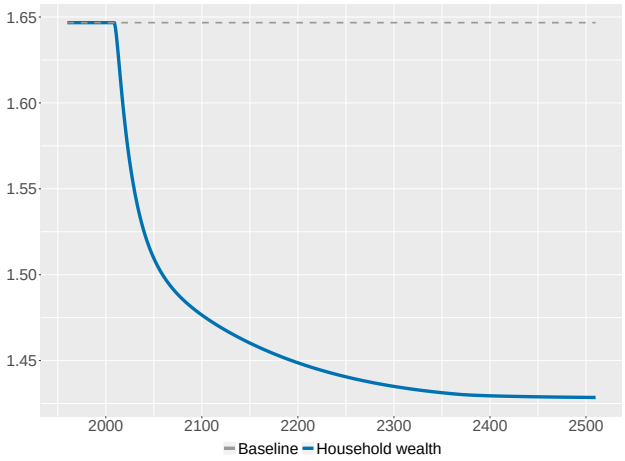
An increase in the propensity to consume out of wealth increases consumption, which reduces household savings and, consequently, household wealth in the short run. Differently from the previous experiment, the autonomous component of demand increases relatively to income, but as soon as the effect on capacity kicks in, consumption out of wealth decreases in relation to output (figure 2.5d). As in earlier experiments, the higher utilization rate (figure 2.5b) leads

Figure 2.4: Effects of an increase in the propensity to consume out of income (α_1)

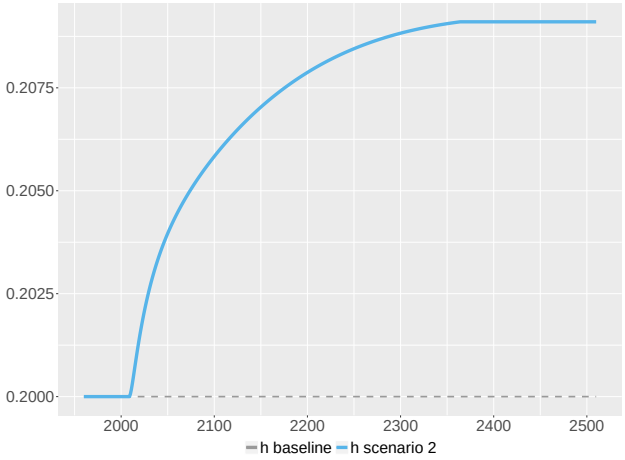
(a) Firms loans ratio



(b) Household wealth to capital ratio



(c) Propensity to invest



(d) Autonomous expenditure component to income

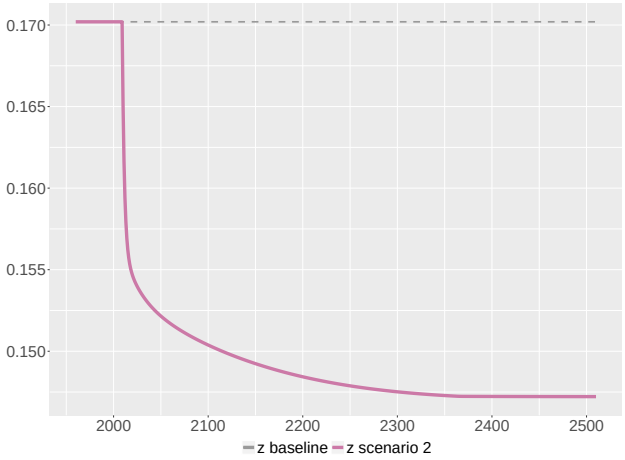
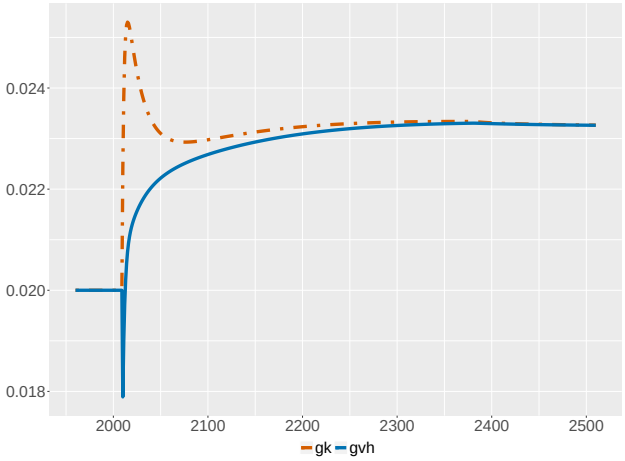
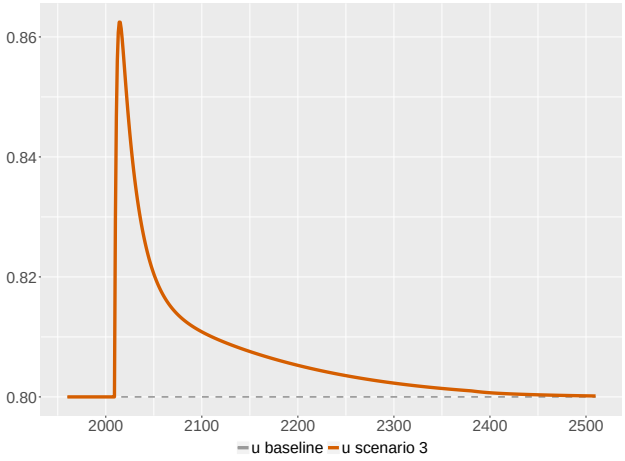


Figure 2.5: Effects of an increase in the autonomous expenditure component (increase in α_2)

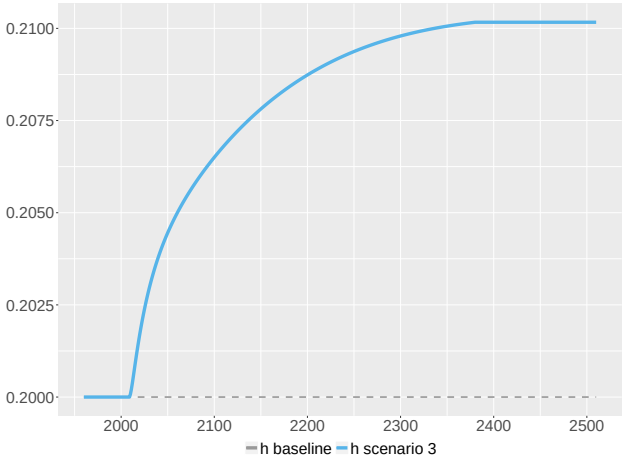
(a) Growth rates of capital and household wealth



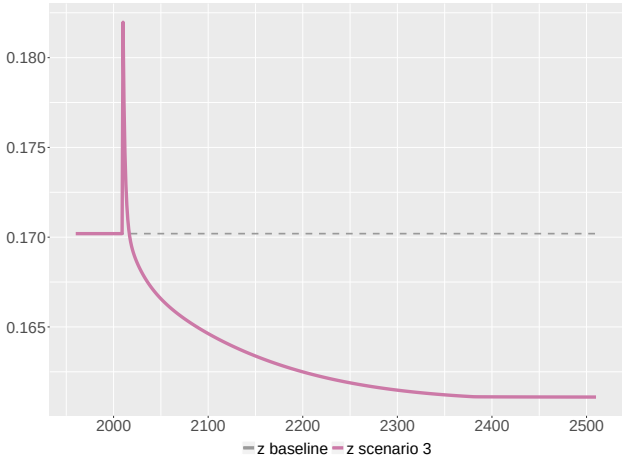
(b) Capacity utilization rate



(c) Firms propensity to invest



(d) Autonomous expenditure component to income



firms to increase their propensity to invest, which increases the accumulation rate at a faster pace than that of household wealth (figures 2.5a, 2.5c). The effects on the ratios of government bills to capital, firms loans to capital and household wealth to capital are very similar to the effects of a shock in the propensity to consume out of wages. Government bills and household wealth to capital ratios stabilize at lower positions in comparison to the baseline, while the firms loans ratio decreases in the short run but increases in the long run. The gross profit rate increases in the short run but goes back to its baseline rate while the net profit rate decreases as the amount of interest payment on loans increases in the long run.

2.3.4 An assessment of the shocks

All the scenarios have in common the fact that changes in exogenous parameters alter (directly or indirectly) the supermultiplier, and thus affect the long run growth rate as well. Therefore, as long as the autonomous expenditure component is endogenous to the model, the effects of

the shocks are not restricted to the transition period. The experiments then show that while the utilization converges back to its desired level or range, the adjustments of a shock to income distribution or to the propensity to save can be absorbed through an endogenous change in the growth rate. It is worth mentioning that this happens without the loss of the Keynesian causality, since the adjustment of capacity to demand occurs through changes in the autonomous component of demand, whose share in income falls when investment rises.

It goes without saying that most of the results of our experiments were only made possible by the adoption of an SFC framework. In the original supermultiplier approach, autonomous demand growth is given once and for all – or until it is exogenously changed. This exogeneity makes it impossible to establish the connections between a change in the propensity to invest and the determinants of the autonomous expenditure (household wealth, in the case of this paper). Moreover, the omission of financial variables prevents the evaluation of the effects of an increase in capital accumulation and in the autonomous expenditure growth rate on the financial stocks of the economy (loans, bills, household wealth). It also prevents understanding that a permanent (say) increase in the supermultiplier allows for a permanent increase in the growth rate of wealth in the same direction despite the reduction of the household wealth to capital ratio.

2.4 Final remarks

As we have seen, so far supermultiplier models do not deal properly with financial issues. They do not take into consideration the interactions between financial stocks and flows and how such interactions could impact growth in the long run. Since the growth rate of the autonomous expenditure component is exogenously given, these models do not allow for the emergence of the paradoxes of thrift and costs in terms of growth effects. It does not matter which “non capacity creating" autonomous expenditure is leading growth in the long run, whether consumption, government expenditures, or net exports, only the level effects of changes in income distribution and in the propensity to save will last. However, when we allow for the autonomous expenditure component to be endogenous, as in the model we built here, which depends on household wealth, we also allow for feedbacks between financial income and financial stocks, as for feedbacks between the latter and the capital stock. Changes in income distribution and in the propensity to save will permanently affect the growth rate of the economy, through the supermultiplier, and through the dynamics of household wealth to capital ratio.

The main results obtained through the experiments of section 4 can be summarized as follows:

(i) An essential claim of the Supermultiplier approach is that a higher growth rate of the autonomous expenditure component is associated with a higher investment to income ratio. This assumption still holds for a more complex model even if the autonomous expenditure component is endogenous to the economic system. As the autonomous expenditure

component grows at a faster pace it increases the income which will stimulate more expenditures, say by increasing consumption out of wages, and these higher expenditures will boost investment, as the utilization of capacity rises. As investment accelerates induced by income, the investment share increases relatively to income while the reverse happens to the autonomous expenditure component share (Serrano, 1995b);

(ii) The paradox of costs is still valid in terms of level effects. A reduction in the mark-up of firms (lower profit share) leads to lower profit rate, but to a higher level of profits in the long run, as a consequence of the higher capital accumulation. However, differently from other supermultiplier models, a higher wage share has a permanent growth effect, through the supermultiplier mechanism. The discrepancy between actual and desired utilization rates promotes a permanent increase in the propensity to invest. This, along with the higher wage share, compensates the effect of a lower wealth-to-capital ratio on the growth rate of this economy;

(iii) The paradox of thrift is valid both in level and in growth terms in the long run. An increase in the propensity to consume out of after-tax wages permanently affects the growth rate of the economy in the long run through the supermultiplier;

(iv) The relation between stocks and flows matter, since an increase in the propensity to invest contributes to increase the stock of firms' debt to capital. This implies that the propensity to invest can find a constraint in the values it can assume, coming from the amount of loans firms borrow in order to finance this same investment and which also depends on the how the propensity to invest will impact the accumulation rate, in order to compensate the higher loans-to-capital ratio;

(v) The behaviour of the autonomous component reveals once more the centrality of stock and flow interactions, for consumption out of wealth is influenced by the government debt ratio, by firms' propensity to invest and by the capital accumulation rate;

Needless to say, the discussion presented here could be enriched in several ways. The first one concerns the generality of our conclusions, which should be evaluated by means of a stability analysis of the model and a sensitivity analysis of the parameters to verify for which range of (economically meaningful) parameters the paradoxes remain valid in the long run. Second, it would be important to move to an open economy setting; it is well known that the paradox of costs may not hold when international transactions are taken into account. Third, it would also be important to test the same hypothesis for an economy with a more complex financial system, for instance incorporating consumer credit and assuming a more "active" and profit-earning banking sector, including the possibility of credit rationing.

A final and possibly important front which would require further research refers to the implication of specific growth engines. There is no reason to assume that a consumption-led growth

regime will be as durable as (say) a government- or an export-led one. Each growth engine will feature specific interactions between stocks and flows, will face specific financial constraints and will present different stability conditions.

Chapter 3

Conflicting-claims and labour market concerns in a Supermultiplier model

The lower path of GDP growth since the 1970s has been followed by a lower trend of productivity growth. This tendency can be observed both in the US and in continental Europe, but seems to be more accentuated in European countries (Hein and Tarassow, 2009). The US experienced some periods of the recovery, however the financial crisis of 2007-08 brought both GDP and labour productivity growth down.

For real wage growth the movements are similar to those of GDP and productivity growth, once more the drop in real wage growth being more marked in Europe. That might indicate that wage moderation policies have been successful in increasing profit rates, but not in improving the macroeconomic performance of OECD countries, which fell short of Golden Age standards from the 1980s onwards (Naastepad, 2006).

From an empirical standpoint, this provides enough motivation to discuss the interactions between output, productivity and real wage growth rates. It is fair to say that the heterodox literature has shown some concern in discussing these issues both on empirical and theoretical grounds. Yet more often that not, a productivity regime is absent of theoretical growth models and an explicit account of the labour market is also missing. The latter has been repeatedly emphasized by Ryoo and Skott (2008, 2013); Skott (2017).

Even if we are to agree with neo-Kaleckian authors and we believe that labour does not seem to be a constraint to production in the real world, neither for developing nor developed countries (which can count on higher inflows of migrants), that does not mean we should not analyse how demand expansions will impact the employment rate and wages. Obviously depending on the interactions between income distribution, productivity and output, a positive shock to demand may have a larger or lower impact on the employment rate.

Aware of this, some authors concentrated efforts in analysing the effects of output growth on labour productivity and on unemployment in a Supermultiplier model – in which autonomous expenditures lead growth and capacity utilization converges to a normal level in the long run (Nah and Lavoie, 2016, 2017b; Fazzari et al., 2017). In these models, as productivity growth

depends on the exogenous growth rate of autonomous expenditures, changes in income distribution have no permanent effect on productivity growth. Similarly a change in the bargaining power of firms – in the case which conflicting-claims is included into the analysis (Nah and Lavoie, 2017b) – will only temporarily affect the capital accumulation rate.

Based on this, in chapter 3 we intend to further contribute to the supermultiplier literature, introducing both a conflicting-claims approach to inflation and a labour productivity regime into a supermultiplier stock-flow consistent model that combines an endogenous autonomous expenditure component with Harrodian behaviour of firms. The productivity regime depends on output and real wage growth rates – accounting, respectively, for the Kaldor-Verdoorn effect and for the Webb effect. The aim of the chapter is twofold: (i) to compare the results with those obtained for a model in which income distribution was exogenous and there were no labour market concerns (chapter 2); and (ii) to analyse the effects of a shock to demand and to the bargaining power of workers and firms on growth rates, income distribution and employment.

The remainder of this chapter is organized as follows. Section 3.1 revises the heterodox growth literature on conflicting-claims and labour productivity; the subsection 3.1.1 specifically deals with the supermultiplier approach take on these issues. In section 3.2 we present our model and its specific features (subsection 3.2.1). In what follows, the experiments based on numerical simulations are presented (section 3.3). The experiments are: (i) an increase in the propensity to consume out of after-tax real wages, analysed under two specifications besides the initial baseline scenario: a higher revision parameter of workers and firms income targets (subsection 3.3.1); (ii) an increase in workers' bargaining power (subsection 3.3.2) and (iii) firms' bargaining power (subsection 3.3.3). At last, the final remarks (section 3.4) sum up the main findings of the chapter.

3.1 Heterodox approaches to conflict inflation and labour productivity growth

From a post-Keynesian standpoint, inflation arises, among other reasons, due to opposing claims of social groups on the proper income distribution. Full employment or full capacity utilization are not requirements for inflation to happen (Lavoie, 2014).

A way to explicitly include this into the analysis of a growing economy is to abandon the assumption of a fully exogenous income distribution and to suppose a conflicting-claims approach of inflation. This approach is based on the idea that income claims made by firms and by workers tend to be inconsistent with each other and as a consequence of the "aspirational gap" (or real wage-resistance) inflation arises. Income claims are neither fully nor automatically satisfied. Labour unions will negotiate increases in the nominal wage based on the discrepancy between the desired/target real wage (or wage share) and the actual real wage and on the price inflation of the previous period (indexation). On the other hand, firms will try to compensate

surges in labour costs by increasing prices based on the discrepancy between their desired profit margin and the actual profit margin, giving rise to a wage-price spiral. In the literature, these targets may be assumed exogenous or endogenous, in the latter case they take into account the feedbacks from the real economy (Lavoie, 2014).

Following Rowthorn (1977, 1981), there have been some considerable theoretical efforts in the Kaleckian and neo-Kaleckian tradition to combine the theory of effective demand and the conflict theory of inflation (see Cassetti (2003, 2012); Dutt (1992); Lima (2005); Lavoie (1992, 2014); Godley and Lavoie (2007) among others).

Along these lines, Dutt (1992) proposes a model of inflation, distribution and accumulation to evaluate how the economy can experience a cyclical path of growth, alternating between periods of excess and full capacity – oscillations in real wages generate these cycles and they occur as a result of the changing conditions in the labour and in the goods' markets. Both firms' and workers' target real wages are endogenously determined. The real wage targeted by workers depends on the employment rate, reflecting the effect of labour market conditions. Firms' targeted mark-up depends on the state of the economy, rising (decreasing) in the level of capacity utilization. There is no technical progress in the model. In the long run, labour supply grows at an exogenously fixed rate.

In the same direction, Lima (2005) builds a macroeconomic model in which accumulation is a non-linear function of income distribution, and adopts the same target rules as Dutt (1992). The author also takes labour productivity as a constant and labour supply growth as exogenous.

Cassetti (2003) makes income distribution endogenous and models the determinants of the target income shares of different groups.[1] Based on this framework, his model analyses how the bargaining power of workers and firms will affect capital accumulation and inflation. Workers' target wage share changes according to changes in the rate of change of employment while firms' target wage share is exogenous. The model features are evaluated under two different productivity regimes: at first, labour productivity growth is considered to be completely exogenous; then, endogenous technical progress is introduced to account for the Kaldor-Verdoorn law and for the direct impact of income distribution on innovation.[2] In both cases, technical progress affects accumulation through two channels, increases in the depreciation rate and in new equipment investment. The paper confirms both the paradox of thrift and the paradox of costs. Yet it finds that increases in the growth rate of labour productivity have an ambiguous effect on growth by stimulating accumulation but reducing the wage share and, consequently, demand.

In Cassetti (2012), while analysing the implications of a conflicting-claims inflation in an open economy setting, the author also makes the firms' target mark-up endogenous and de-

[1] See also Taylor (1985).

[2] Since higher labour costs may induce firms to increase prices and also to accelerate the introduction of labour-saving technologies (Cassetti, 2003; Lavoie, 2014; Hein and Tarassow, 2009).

pendent on the capital accumulation rate à la Eichner (1976), but keeps productivity growth as exogenous.

We notice that most of these papers consider labour productivity to be constant or growing at an exogenously given rate. Nonetheless, an explicit account of the labour productivity regime can be found in many neo-Kaleckian models (Hein and Tarassow, 2009; Naastepad, 2006; Lavoie, 2014) and a more complete investigation of the relation between aggregate demand and technical progress – both theoretically and empirically – is to be found in Storm and Naastepad (2012). In the latter, the authors draw a productivity regime combining the different determinants of labour productivity growth, reflecting the stylized facts that productivity seemingly reacts to both output and real wage growth (and to labour market conditions).

While these latter papers make technical progress endogenous, they have different assumptions regarding income distribution. Hein and Tarassow (2009) assume income distribution to be exogenously given, evaluating just the effects of changes in income distribution on the productivity regime, not the feedbacks from productivity to real wages (and the wage share). In Naastepad (2006) and Storm and Naastepad (2012), real wage growth is exogenous, since the authors aim to evaluate the effects of wage suppression on productivity and output. In this case, income distribution will endogenously change due to the discrepancies between the growth rates of real wages and productivity, yet the feedbacks from productivity to nominal wage growth are not taken into account (be through employment or directly through productivity gains). Only in Cassetti (2003) productivity is affected by real wages (wage share) and also affects income distribution through the influence of the growth rate of employment on workers' target wage share.

As for the effect of increases in the real wage on productivity growth, there are two main reasonings. If firms are faced with higher labour costs they might be inclined to raise investment in labour-saving technologies (Cassetti, 2003; Hein and Tarassow, 2009). Higher real wages may also lead the least productive firms or units to close down due to higher costs. This is the Webb-effect according to Lavoie (2014).[3]

3.1.1 Conflicting-claims, labour productivity and employment in recent Supermultiplier models

In what concerns Supermultiplier models, there have been some initial efforts to include conflicting-claims inflation and to tackle endogenous technical progress, although not simultaneously so far (see table 3.1). Addressing one of the main criticisms usually directed towards neo-Kaleckian models (Ryoo and Skott, 2008; Skott, 2010), that is, the absence of the labour market[4], these models also discuss the determinants of the employment rate and allow for an endogenous adjustment of the natural rate of growth to the exogenous growth rate of autonomous expenditures.

[3] After Webb (1912), who highlighted this effect while arguing in favour of higher minimum wages.

[4] Usually, neo-Kaleckian models assume that labour supply is infinitely elastic so that increases in demand can always be accommodated by supply through higher employment (Ryoo and Skott, 2008).

In Nah and Lavoie (2016), technical progress is introduced in a supermultiplier model along with Kaldor-Verdoorn's law. Productivity growth, which is partially exogenous, will depend on the capital accumulation rate and at the same time will enter the capital accumulation function as a new argument. Exogenous increases in labour productivity are likely to have only positive transitory effects on economic growth – since the economy will converge back to the growth rate of the non-capacity creating autonomous expenditure component. This result is in line with Cesaratto et al. (2003).

In the long run, the growth rate of employment will depend positively on the growth rate of autonomous expenditures and negatively on the growth rate of labour productivity. Active population is constant, so there is no difference between the growth rate of employment level and the growth rate of employment rate. That said, an increase in the exogenous component of labour productivity growth will lead to a fall in the growth rate of employment owing to the fact that there is no feedback from labour productivity to the growth rate of output (in the long run), given the growth rate of autonomous expenditures. According to the authors, this could only be avoided if they assumed that "(...) faster technical change also generates increase in the growth rate of the non-capacity creating autonomous components of effective demand, for instance autonomous consumption because of the accelerated pace in the introduction of novel and fashionable products"(Nah and Lavoie, 2016, p.21).

Besides, since income distribution is exogenous (and there is no inflation) and the growth of real wages is not modelled, changes in labour productivity will neither have any effect on income distribution nor be affected by changes in real wages (the Webb-effect is not accounted for), only by the indirect (and temporary) effect of a higher growth rate of output. See table 3.1.

Fazzari et al. (2017) also build a very interesting supermultiplier model that fully integrates the supply side and supposes that both labour supply and productivity growth will endogenously adjust to demand led by autonomous expenditures through the unemployment rate. Productivity growth is assumed to depend positively on the capital accumulation rate and negatively on the unemployment rate.

Yet, supply constraints will bound the maximum feasible growth rate. That is, if full employment is reached, demand growth is limited (a g^*_{max} is reached). Another result of the model is that the stronger the response of supply to demand stimuli, the faster the unemployment rate will stabilize (supply catches up with demand at a faster pace). As in Nah and Lavoie (2016), an exogenous positive shock to labour productivity growth has only temporary effects on the growth rate of the economy and permanently raises unemployment (it will have a positive effect on the capital accumulation rate and a negative one on capacity utilization rate). Still, the model does not account for inflation and for the interactions between productivity growth and income distribution.

At last, Nah and Lavoie (2017b) integrate a conflicting-claims theory of inflation into a supermultiplier model with endogenous workers' target real wage depending on the growth rate of employment rate. However, interactions with labour productivity are ruled out since there

Table 3.1: Conflicting-claims, labour productivity and employment in recent Supermultiplier models

Models	Inflation	Labour productivity	Employment Active population
Nah and Lavoie (2016)	–	$g_{pr} = \eta_0 + \eta_1.g_z$	$g_e = g_z - g_{pr}$ Active population constant
Fazzari et al. (2017)	–	$g_{pr} = \eta_0 + \eta_1.(gk + \delta) - \eta_2.u_e$ Labour productivity depends on unemployment and replacement investment	$g_{LS} = \theta_0 - \theta_1.u_e$ Growth of labour supply depends negatively on unemployment
Nah and Lavoie (2017b)	$\pi_w = v_0 - v_1.g_e$ Conflicting-claims: workers' target depends on growth of employment rate	–	$g_n = \theta_0 + \theta_1.e$ Employment increases with output and decreases with growth of active population. If $g_z = g_n$, e constant

Legend: g_e is for the employment growth rate; g_n for the growth rate of active population; u_e for the unemployment rate; e for the employment rate; g_z for the growth rate of autonomous expenditures.
Source: Author's elaboration.

is no technical progress in the paper. On the other hand, the model accounts for the growth of active population in the long run, which, similarly to Fazzari et al. (2017), endogenously increases in the growth rate of employment, bringing the natural rate of growth towards the long run growth of the non-capacity creating autonomous expenditure component.

As employment converges to a stable rate in the long run, the inflation rate does not depend on the growth rate of employment rate. After an increase in the growth rate of autonomous expenditures in the long run, income distribution will remain unchanged as well as the inflation rate. The boost in demand brought about by the expansion of autonomous expenditures will be accompanied by a rising employment rate, which will increase workers' bargaining power, thus temporarily increasing the wage share. Nonetheless, the increase in the growth rate of active population in the long run (due to the increase in the growth of the employment rate) will bring down the employment rate, weakening workers' bargaining power, compensating for the initial increase in the wage share (Nah and Lavoie, 2017b).

To all of these Supermultiplier models, the point made in chapter 2 remains valid. There is no room – since the growth rate of autonomous expenditures is exogenously given – to evaluate the effects of productivity growth on the growth rate of autonomous expenditures nor to evaluate some of the interactions between income distribution, growth and employment.

3.2 Conflicting-claims and endogenous labour productivity growth in a Supermultiplier SFC model

Based on the issues raised in the previous section, we propose to extend the model built in chapter 2 to include inflation via the conflicting-claims between workers and capitalists and an endogenous labour productivity growth regime. For the sake of convenience we repeat the equations of the previous chapter, fitting the institutional sectors, but we detail in text only the added equations due to new assumptions and the needed modifications in any former equations.

3.2.1 Framework of the model

In chapter 2, as there was no inflation, variables in real and nominal terms were represented by the same symbols. Here all upper case variables indicate nominal values while lower case variables indicate real values, unless specified otherwise. Tables 3.2 and 3.3 present respectively the updated balance sheet matrix and the transactions and flow of funds matrix for variables in nominal terms. Since we explicitly include labour in the model, real wage is substituted by the nominal wage bill in table 3.3

Table 3.2: Balance sheet matrix model chapter 3

Assets	Household	Firms	Banks	Government	$\sum$
1. Deposits	$+M$		$-M$		0
2. Loans		$-L$	$+L$		0
3. Fixed capital		$+K_f$			$+K_f$
4. Equities	$+pe.E$	$-pe.E$			0
5. Government Bills	$+B$			$-B$	0
6. Net worth	V_h	V_f	0	$-B$	$+K_f$

Note 1: We obtain the net worth for both household and firms sectors summing up lines 1 to 5 of the respective columns: $V_h = M + peE + B$ and $V_f = K_f - L - peE$.

Government decisions remain the same in real terms, but nominal expenditures (and revenues) change accordingly to price changes. The monetary authority sets the nominal interest rate while the real interest rate varies due to changes in the inflation rate. See equations 3.1 to 3.6.

$$gd = \sigma.y_{-1} \tag{3.1}$$

$$t = \tau.yh_{-1} \tag{3.2}$$

$$G = gd.p \tag{3.3}$$

$$T = t.p \tag{3.4}$$

$$B = B_{-1} + G - T + i.B_{-1} \tag{3.5}$$

$$i_R = \frac{(1+i)}{(1+g_p)} - 1 \tag{3.6}$$

Households earn wages and financial income accruing from their held assets. Their real consumption expenditure comprises a fraction of real household wealth and a fraction of after-tax real wages, which now depends on nominal wages, employment and price levels (see sub-

Table 3.3: Transactions and Flow of Funds matrix model chapter 3

	Household	Firms		Banks	Government	$\sum$
		Current	Capital			
1. Consumption	$-C$	$+C$				0
2. Investment		$+I$	$-I$			0
3. Government expenditures		$+G$			$-G$	0
4. Wages	$+WB$	$-WB$				0
5. Taxes	$-T$				$+T$	0
6. Profit	$+FD$	$-F$	$+FU$			0
7. Deposits interest	$+i.M_{-1}$			$-i.M_{-1}$		0
8. Loans interest		$-i.L_{-1}$		$+i.L_{-1}$		0
9. Bills interest	$+i.B_{-1}$				$-i.B_{-1}$	0
10. Subtotal	S_h	0	S_f	0	S_g	0
11. Δ Deposits	$-\Delta M$			$+\Delta M$		0
12. Δ Loans			$+\Delta L$	$-\Delta L$		0
13. Δ Equity	$-pe.\Delta E$		$+pe.\Delta E$			0
14. Δ Bills	$-\Delta B$				$+\Delta B$	0
15. $\sum$	0	0	0	0	0	0

section on firms). The proportion of wealth allocated in equities now will vary with inflation, since households compare the expected rate of return of this asset with the real interest rate at the beginning of the period (equation 3.18).

$$Y_h = WB + FD + i.(B_{-1} + M_{-1}) \tag{3.7}$$

$$y_h = \frac{Y_h}{p} \tag{3.8}$$

$$Y_d = (1 - \tau).Y_h \tag{3.9}$$

$$y_d = \frac{Y_d}{p} \tag{3.10}$$

$$S_h = Y_d - C \tag{3.11}$$

$$s_h = y_d - c \tag{3.12}$$

$$c = \alpha_1.(1 - \tau).\frac{WB}{p} + \alpha_2, vh_{-1} \tag{3.13}$$

$$C = c.p \tag{3.14}$$

$$V_h = V_{h_{-1}} + S_h + \Delta pe.E_{-1} \tag{3.15}$$

$$vh = \frac{V_h}{p} \tag{3.16}$$

$$M = M_{-1} + S_h - pe.\Delta E - \Delta B \tag{3.17}$$

$$\lambda = \lambda_0 - i_{R_{-1}} \tag{3.18}$$

$$pe = \frac{\lambda.V_h}{E} \tag{3.19}$$

Firms' investment and financing decisions are given by equations 3.20 to 3.33. Firms invest based on the state of the economy and adjust their propensity to invest owing to the changes in the expected rate of growth of the economy. They take on loans to finance the part of investment plans that is not covered by retained earnings and equity issuance.

$$I = id.p \tag{3.20}$$

$$id = h.y \tag{3.21}$$

$$K = k.p \tag{3.22}$$

$$k = k_{-1} + id - \delta.k_{-1} \tag{3.23}$$

$$u = \frac{y}{yfc} \tag{3.24}$$

$$yfc = \frac{k_{-1}}{v} \tag{3.25}$$

$$\Delta h = \begin{cases} h_{-1}.\gamma_1.(u - u_n), & \text{if } |u - u_n| > \chi \\ 0, & \text{otherwise} \end{cases} \tag{3.26}$$

$$L = L_{-1} + I - FU - pe.\Delta E \tag{3.27}$$

$$F_G = Y - WB \tag{3.28}$$

$$F_N = Y - WB - i.L_{-1} \tag{3.29}$$

$$FD = (1 - s_f).F_N \tag{3.30}$$

$$FU = s_f.F_N \tag{3.31}$$

$$E = e.p \tag{3.32}$$

$$e = \zeta.k_{-1} \tag{3.33}$$

Production decisions by firms still entail a demand for labour, which depends both on output and on labour productivity levels (equation 3.34). Following Godley and Lavoie (2007), we assume that whenever the desired employment level (N^D) rises above the actual employment level (N), employment will increase (equation 3.35). The rate of employment (n) is actual employed labour force divided by the level of active population (N_{ap}) (equation 3.36).

$$N^D = \frac{y}{pr} \tag{3.34}$$

$$\Delta N = \theta.(N^D - N_{-1}) \tag{3.35}$$

$$n = \frac{N}{N_{ap}} \tag{3.36}$$

Actual employment multiplied by the nominal wage rate (W) composes the wage bill (WB) (equation 3.37). Unit cost of production is defined by equation 3.38 and increases in the nominal wage rate and decreases in the labour productivity. Nominal wages (equation 3.39) grow at a rate g_w (equation 3.40). Growth of nominal wages will depend on the speed of adjustment of unions (Ω) to the discrepancies between the desired workers' share on income (ω_w^T) and the actual wage share (ω) (Dutt, 1992; Lima, 2005; Cassetti, 2003, 2012; Lavoie, 2014; Nah and Lavoie, 2017b). The speed of adjustment (Ω) also represents the strength of workers' bargaining power since it defines the extent to which workers' demand for a higher wage share is taken into account in nominal wage negotiations. We assume that workers' target share on income depends on the rate of growth of employment.[5] [6] So whenever employment is increasing (decreasing),

[5] In this case, there is no difference between the rate of growth of the employment level and of the employment rate, since we consider active population to be a constant.

[6] Assuming that workers' target wage share depends on the growth rate of employment instead of depending on the employment level may be justified by the idea that what changes workers' bargaining power and aspirations is the fear of unemployment, which will rather react to the growth rate of employment (Cassetti, 2003).

workers' target wage share is also increasing (decreasing). Wage aspirations will remain still only when the rate of employment is constant. The parameter ξ reflects the rate at which the target will be continuously revised (equation 3.41).

$$WB = N.W \tag{3.37}$$

$$UC = \frac{WB}{y} = \frac{W}{pr} \tag{3.38}$$

$$W = W_{-1}.(1 + g_{w_{-1}}) \tag{3.39}$$

$$g_w = \Omega.(\omega_w^T - \omega) \tag{3.40}$$

$$\omega_w^T = \omega_{w_{-1}}^T + \xi.(g_y - g_{pr}) \tag{3.41}$$

We suppose that labour productivity grows at a rate g_{pr} (equation 3.42), which is influenced by output growth (η_1) – the Kaldor-Verdoorn effect (Kaldor, 1966) – be due to increasing returns of scale that come along a higher aggregate demand or to the more productive (vintages of) capital embodied in new investment (Naastepad, 2006; Storm and Naastepad, 2012; Lavoie, 2014); and also by the growth rate of real wages (η_2) due to the Webb effect (Lavoie, 2014). The exogenous component (η_0) in the productivity regime function could be interpreted as 'learning by doing' effects as highlighted by Hein and Tarassow (2009) (equation 3.43).

$$pr = pr_{-1}.(1 + g_{pr_{-1}}) \tag{3.42}$$

$$g_{pr} = \eta_0 + \eta_1.g_{y_{-1}} + \eta_2.g_{wp_{-1}} \tag{3.43}$$

In chapter 2, income distribution was assumed to be exogenously given by firms' mark-up pricing decisions. Firms' would decide an exogenous mark-up on unit costs and this mark-up would define the share of income pertaining to workers and to capitalists. This means firms would instantly respond to changes in wage costs keeping profit margins constant at their targeted levels (Cassetti, 2012; Lavoie, 2014). Here firms are on the other side of the rope pulling, trying to close the gap between their desired mark-up and the actual mark-up. This is represented in the model by equations 3.44 and 3.45, so that prices will increase whenever the wage share exceeds the wage share targeted by firms.[7]

[7]If we substitute equation 3.45 into equation 3.44 and make some arrangements, bearing in mind that the wage share equals the wage bill divided by the nominal output $\left(\omega = \frac{WB}{Y} = \frac{N.W}{p.y}\right)$, we can see that price changes are a function of the discrepancy between actual unit costs and desired unit costs: $p = p_{-1} + \psi.(UC - UC^T)$.

Following Rowthorn (1977); Dutt (1992); Lima (2005), we assume that firms' desired mark-up increases and thus their target wage (profit) share (ω_f^T) decreases (increases) as they attempt to take advantage of a booming economy, when capacity utilization is high. Contrariwise, when sales are low, firms will reduce their desired margins (increasing their target wage share) (equation 3.46). Another reasoning for this behaviour of firms, proposed by Eichner (1976), is that in times of expansion, when capital accumulation is accelerating, firms would require larger internal funds to finance investment.[8] ψ is the speed of adjustment of firms to changes in unit costs and represents firms' bargaining power; Ψ is rate at which firms will revise upwards (downwards) their mark-up target whenever the economy is accelerating (slowing down). This completes the conflicting-claims setting in the model so that income distribution is endogenously determined by the relative social strength of each group and by productivity growth.

$$p = p_{-1}.(1 + g_{p_{-1}}) \tag{3.44}$$

$$g_p = \psi(\omega - \omega_f^T) \tag{3.45}$$

$$\omega_f^T = \omega_{f_{-1}}^T - \Psi.(u - u_n) \tag{3.46}$$

3.3 Experiments

Differently from chapter 2, in this model the economy does not necessarily reach a steady growth state, meaning that not all growth rates will be the same in the long run. This happens because nothing guarantees that output and labour productivity growth rates will converge to the same stable path after a shock. As a result, the employment rate does not stabilize if the economy rests at a *quasi-steady growth state* [9], where the utilization rate converges back to the normal range but growth rates do not converge to the same path.

We run three main simulation experiments. Firstly, we assess the effects of an increase in the propensity to consume out of the after-tax real wages (α_1) and compare them with the results of this very same shock under two different initial conditions: when there is an increase in the rate at which workers' will revise their target wage share (ξ) and when there is an increase in the rate at which firms will revise their target wage share (Ψ). The second and third experiments are, respectively, an increase in workers' bargaining power (Ω) and in firms' bargaining power (ψ).

[8] See also Cassetti (2012).

[9] As we assume for now that active population is constant.

3.3.1 The paradox of thrift

A positive shock to the propensity to consume out of after-tax real wages will raise consumption, stimulating activity and thus leading to a higher capacity utilization rate in the short run. This, in turn, will make firms react through a higher propensity to invest, accelerating the capital accumulation rate (figures 3.1a, 3.1b and 3.1c). The higher output growth rate will feedback into labour productivity growth. However, as output grows at a faster pace than productivity, there is an increase in the employment rate (figures 3.1d and 3.1e). The growing employment rate will also have a positive impact on workers' target wage share, fastening nominal wages growth rate. Since wages accelerate more than inflation, there will be an increase in the real wage growth rate. Yet real wage growth rate falls short of the productivity growth rate and there will be a reduction in the actual wage share (figure 3.1f). Inflation decelerates in the very short run since there is a reduction in the gap between actual and firms' desired wage share, but as soon as the boost in activity makes firms desire a higher profit margin, the gap widens and inflation accelerates more than the growth of nominal wages, decreasing the real wage growth (figures 3.1f and 3.2a). These are the initial effects after the expansive shock to demand.

In the descending phase of the initial cycle, the fall in the wage share will slow consumption growth down reducing the pace of increase in the level of activity, reducing capacity utilization and thus leading firms to reduce their propensity to invest and to slow down capital accumulation. The lower growth of output will have a negative effect on labour productivity growth. As output suffers more than productivity, the employment rate will decrease. Workers fear being unemployed and thus accept a lower target wage share, reducing nominal wage growth. As the economy slows down, firms will also be willing to accept a lower profit margin – increasing the target wage share. As prices increments fall at a faster pace than nominal wages, real wage growth will accelerate. Since real wages grow faster than productivity, the wage share will increase and start a new cycle: stimulating consumption, raising capacity utilization and firms' investment. As the economy follows a path of damped oscillations, the secondary effects will be progressively smaller. It is important to highlight that in the long run, despite the cycles, growth rates will stabilize at a slightly higher path in comparison to the baseline.

We notice that government debt to capital ratio will be lower in comparison to the baseline. Primary government deficit to output decreases in the short run, since government expenditures are lagged, but it slightly increases in the long run (in comparison to the baseline), since household income in relation to total income will suffer a reduction due to the fall in the wage share and in the financial income share (interests on bills and deposits). The nominal deficit to output, however, decreases due to the higher inflation, which translates into lower real interests paid on bills (figures 3.2b and 3.2c).

Firms loans' to capital ratio will also decrease in relation to the baseline since the uplift in net retained earnings will be higher than firms' investment (with the exception of the very short run) (figure 3.3a). There will also be oscillations in total equities as a source of finance – in the

market value of newly issued equities. In periods of accelerating inflation the market value of newly issued equities will increase (figure 3.2d).

Gross and net profit rates oscillate with the changes in capacity utilization rate and in the profit share. They will increase after the initial shock, due both to a higher capacity utilization rate and to the increase in the profit share. As the utilization rate converges to the normal range, profit rates will be higher in comparison to the baseline while the profit share is also above the baseline level. Yet as the growth rate of real wages stabilizes at a higher level than the growth rate of labour productivity, the profit share presents a decreasing trend and eventually the profit rates will rest at a lower level in relation to the baseline (figure 3.3b).

As was the case for the model of chapter 2, a reduction in households' propensity to save out of after-tax real wages will have an initial negative impact on household wealth growth, which is reinforced by short run capital losses. Equity prices fall in the very short run due to the lower inflation rate – which increases real interest rates and thus reduces the desired ratio of equities in households' portfolio. As the inflation rate accelerates, households will desire to hold a larger share of equities in their portfolio, leading to an increase in prices and to subsequent capital gains. This contributes to the household wealth growth recovery, but this is not the sole factor which explains it. As the higher consumption rate fosters the utilization rate and firms are able to appropriate a larger profit share, distributed dividends will also make household wealth grow at a faster pace, anticipating the ascending phase of the next capital accumulation rate cycle. From figure 3.3d, we notice that peaks and troughs of household wealth growth precede peaks and troughs of capital accumulation rate.

A higher propensity to consume out of after-tax real wages in this model initially increases capital accumulation rate and profit rates. Since income distribution is endogenous, the economy will move along cycles generated by the interactions between real wages and labour productivity. In the long run, the economy will stabilize at a quasi steady growth state, where capacity utilization converges back to the normal utilization range, the employment rate is growing and output, productivity and real wages grow at higher rates. A higher accumulation rate will be associated with a slightly lower gross profit rate in the long run owing to the larger real wage growth rate in relation to the productivity growth rate (which explains the decreasing trend of the profit share) while the net profit rate remains above the baseline due to the reduction in firms' loans to capital ratio. This process is also accompanied by a higher (but stable) inflation rate owing to the larger gap between firms' desired and actual profit margins.

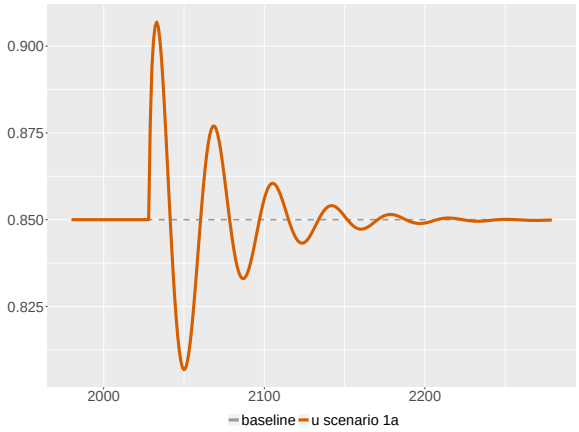
In what follows we compare the results obtained here with the results of the same shock changing respectively workers and firms parameters reflecting the revision of their income targets.

An increase in the propensity to consume assuming a higher parameter ξ

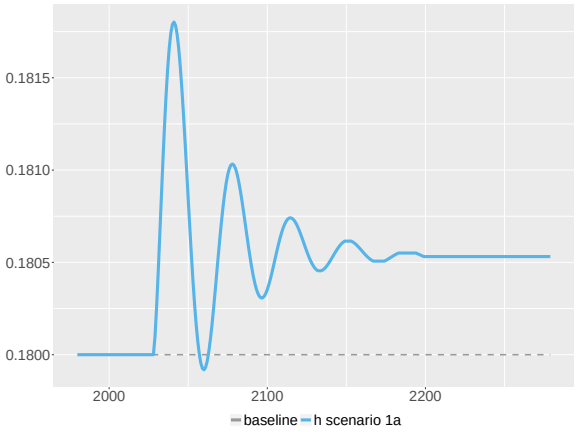
If workers revise their target wage share at a faster pace, this means that each increment in the employment rate will have a larger impact on nominal wages. As firms do not change their

Figure 3.1: Effects of an increase in the propensity to consume out of after-tax real wages α_1

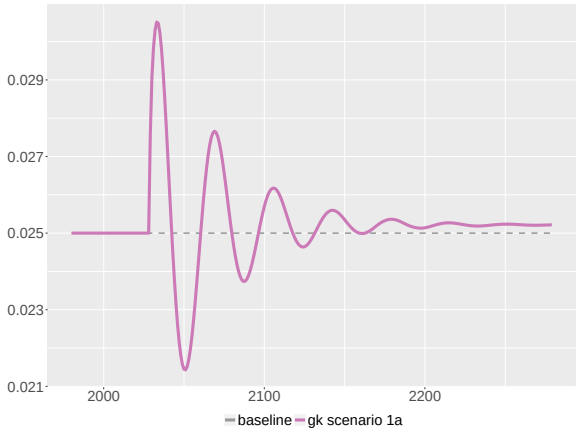
(a) Capacity utilization rate



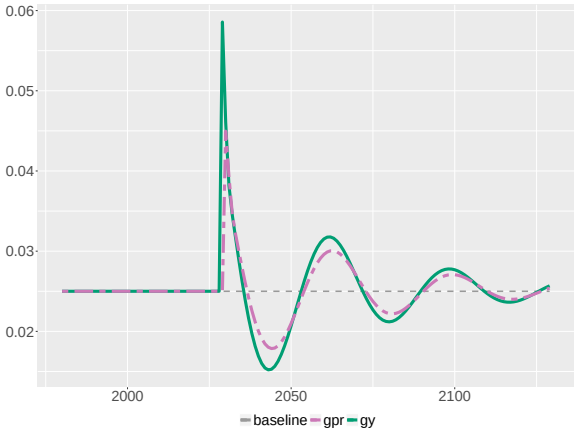
(b) Firms' propensity to invest



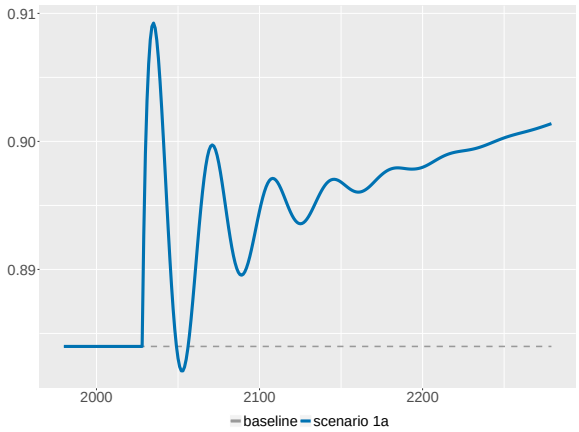
(c) Capital accumulation rate



(d) Output and labour productivity growth rates



(e) Employment rate



(f) Real wages and labour productivity growth rates

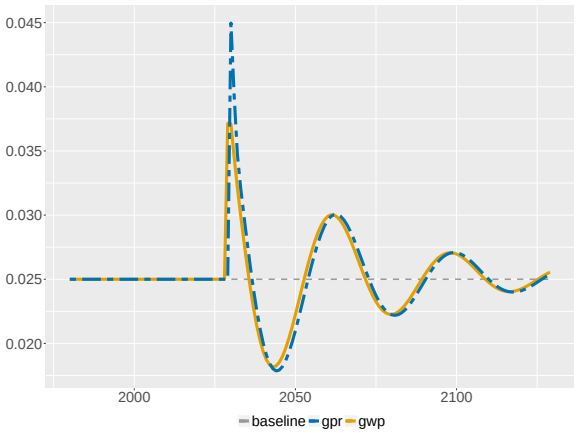
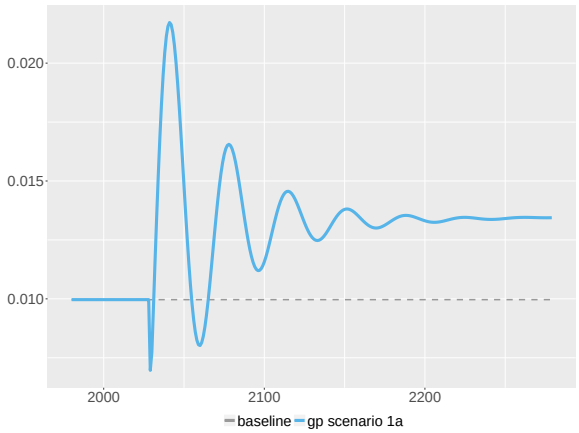
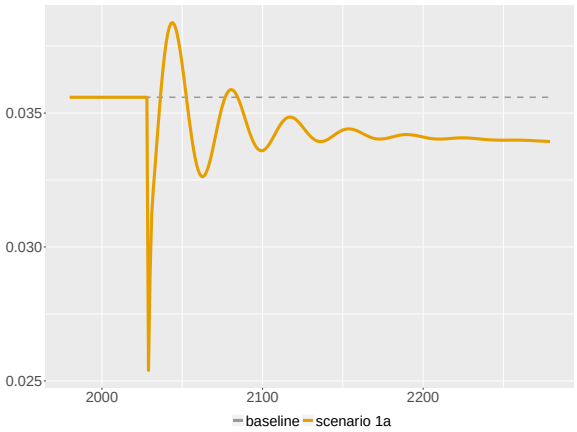


Figure 3.2: Effects of an increase in the propensity to consume out of after-tax real wages α_1

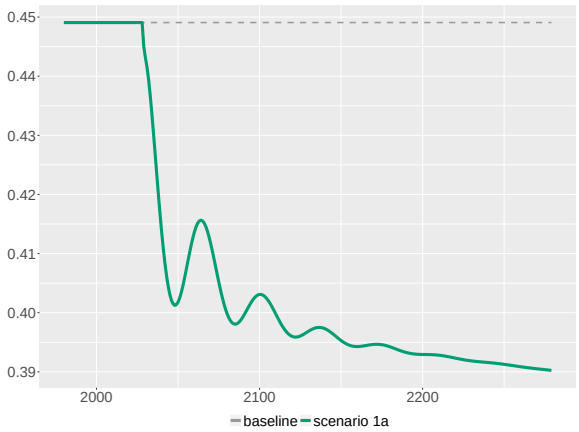
(a) Inflation rate



(b) Nominal government deficit to output



(c) Government debt to capital ratio



(d) Equities as source of finance

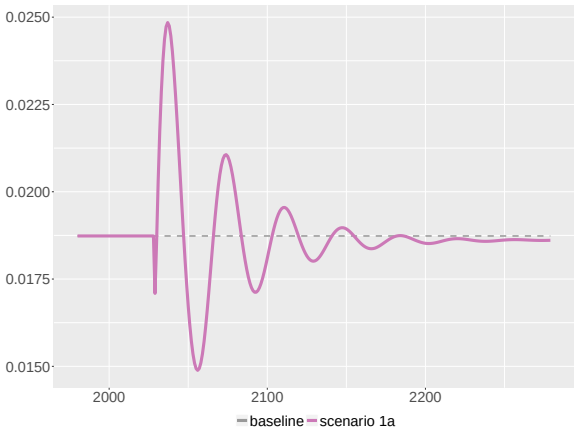
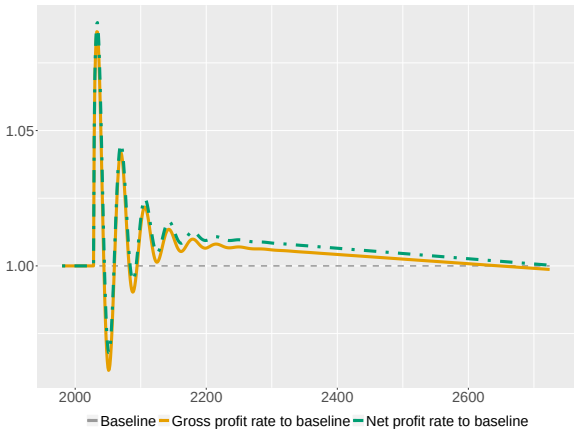


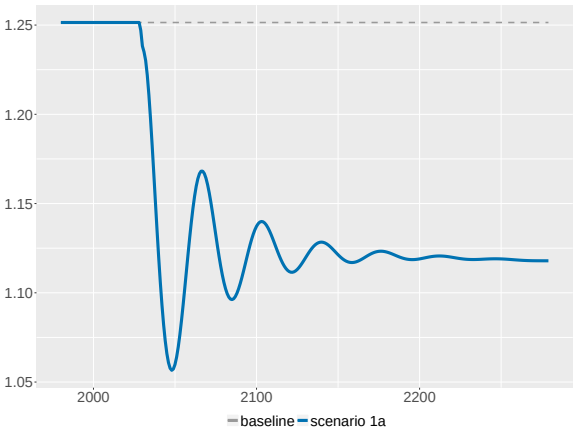
Figure 3.3: Effects of an increase in the propensity to consume out of after-tax real wages α_1

(a) Firms' loans to capital ratio

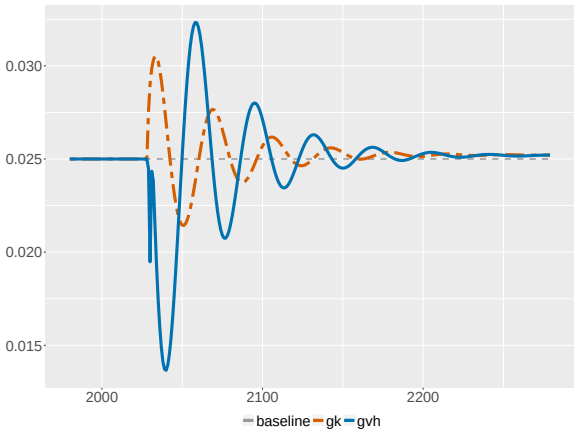
(b) Gross and net profit rates



(c) Household wealth to capital ratio



(d) Capital accumulation and household wealth growth rates



revision parameter, there will be a larger gap between workers and firms adjustment parameters. The same increase in the propensity to consume out of after-tax real wages will lead to a higher real wage growth rate after the initial shock to demand (figures 3.4a).

The higher real wage growth in the short run will also lead to a higher productivity growth which now follows more closely the growth rate of output (figure 3.4b). Thus, the same shock to demand will have a smaller effect on the employment rate in the very short run, during the transition oscillations and in the long run (figure 3.4c).

We also notice that as the actual wage share decrease to a lesser extent in the short run and surpasses the baseline level in the long run, there will be a permanently higher inflation rate in comparison to the results for the same shock with no changes in the revision parameter (even considering that firms' wage target stabilizes)(figure 3.4d). The higher inflation will also contribute to lower government debt and household wealth to capital ratios due to lower real interest payments. Household wealth to capital ratio is also negatively affected by the lower distributed profits ratio (in comparison to the previous scenario) and government debt to capital ratio by the higher household to total income ratio (figures 3.5a and 3.5c). In what firms are concerned, their loans to capital ratio will be higher than in the previous experiment due to the lower profit share and, consequently, lower net retained profits ratio (figure 3.5b).

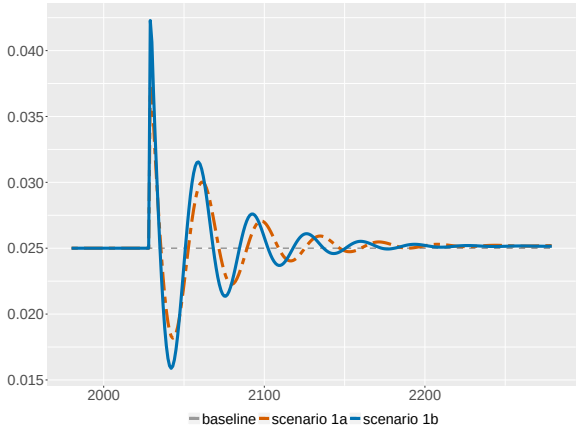
This experiment shows that the higher the surge in real wages after an expansive demand shock, the larger the productivity gains right after the shock and the smaller the increments in the employment rate both in short and long runs. In the long run, all growth rates will attain a lower level in comparison to the previous experiment but a higher level in comparison to the baseline. Only the inflation rate will stabilize at a higher level both in relation to the previous experiment and to the baseline. In this case, a higher propensity to consume out of after-tax real wages is still associated with a higher capital accumulation rate in the long run (figure 3.5d), but with higher profit rates in the short run and more marked lower profit rates in the long run both in relation to the previous scenario and to the baseline.

An increase in the propensity to consume assuming a higher parameter Ψ

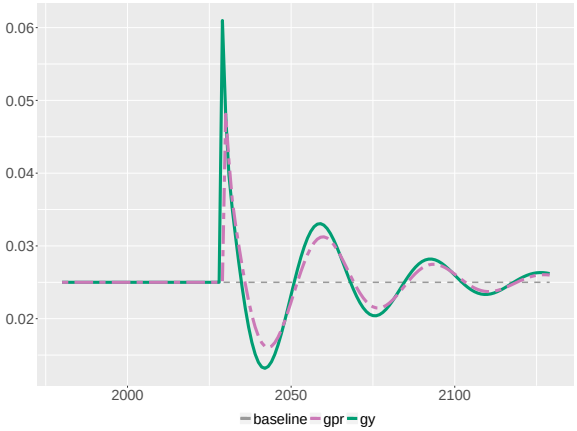
Supposing, contrariwise, that firms will revise their income targets at a faster pace, an increase in the propensity to consume out of after-tax real wages will generate larger oscillations in the economy (figure 3.6a). The initial boost in activity will accelerate inflation as firms increase their desired profit margins (and decrease their desired wage share) (figure 3.6b). As the actual wage share sharply falls partially reversing the initial effect of the shock (since productivity growth exceeds real wage growth), workers try to compensate for their losses (the gap between workers' target wage share and the actual wage share increases) and nominal wages temporarily speed up. The higher nominal wage growth rate compensates for the inflation rate and productivity growth, increasing the wage share (figure 3.6c). The boost in the wage share will stimulate the economy, raising the utilization rate and thus firms' target profit margins, which in turn will accelerate inflation again feeding back the wage-price spiral. Since in this scenario, the gaps

Figure 3.4: Effects of an increase in the propensity to consume assuming a higher parameter ξ

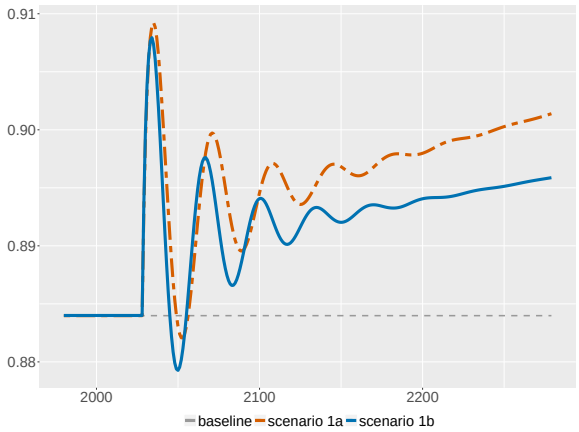
(a) Compared real wage growth rates



(b) Output and labour productivity growth rates



(c) Compared employment rates



(d) Compared inflation rates

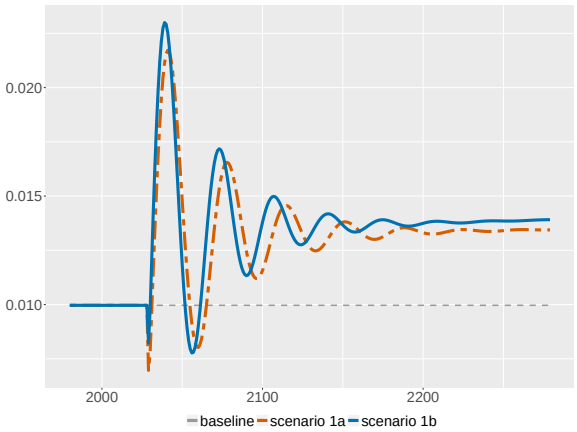
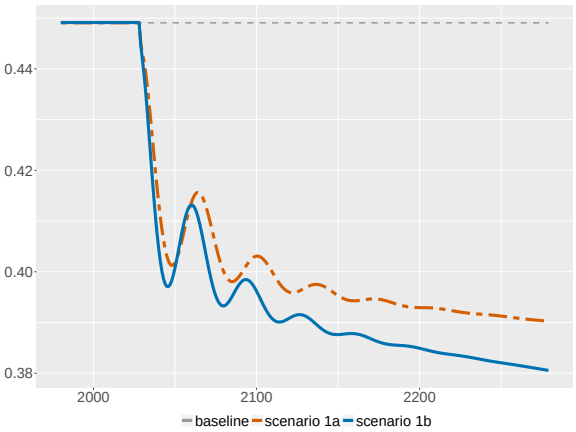
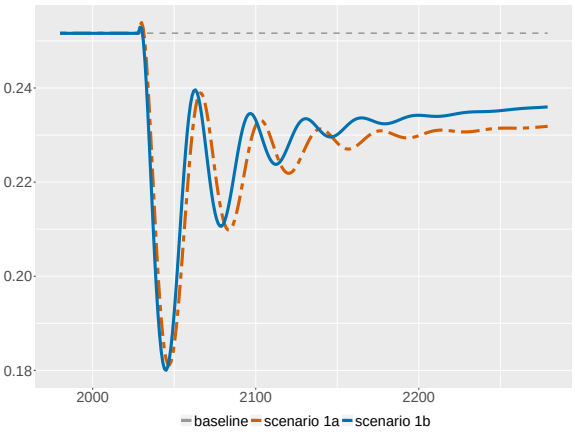


Figure 3.5: Effects of an increase in the propensity to consume assuming a higher parameter ξ

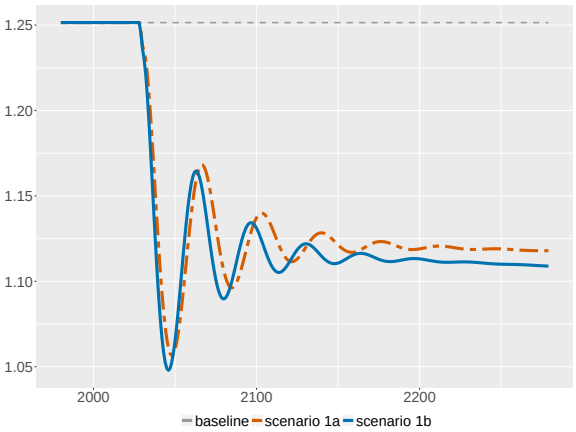
(a) Compared government debt to capital ratios



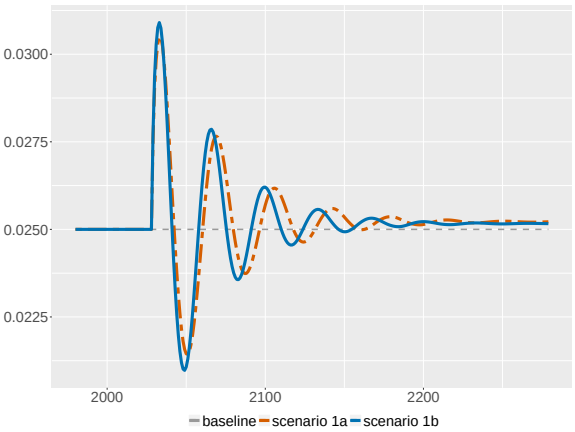
(b) Compared firms' loans to capital ratios



(c) Compared household wealth to capital ratios



(d) Compared capital accumulation growth rates



between output and productivity growth rates are larger (both in the peaks and through phases of the cycle) employment oscillations will also be larger (figures 3.6d and 3.6e).

In the long run, the capital accumulation rate will stabilize at a lower level in comparison to the previous experiments, but still at a higher level in relation to the baseline. The higher capital accumulation in relation to the baseline will be associated with higher gross and net profit rates in the long run owing to the larger profit share. Both the propensity to invest and the (growing) employment rate will also rest at a lower level in relation to previous experiments, though higher when the baseline is considered. Firms' loans to capital ratio will be lower than in previous experiments due to the higher profit share and thus retained earnings ratio. Government debt to capital ratio will be higher than in both previous scenarios due to the lower household income in relation to total income (higher primary deficit to output) and the higher real interest rates paid on (normalized) bills. At last, household wealth to capital ratio will be higher than in prior cases as result of the higher distributed dividends as a share of income and of the lower capital accumulation rate.

3.3.2 Workers' bargaining power

An increase in workers' bargaining power (Ω) will initially foster higher nominal wage growth. As the growth of nominal wages speeds up more than the rate of inflation, real wages gains will accelerate. Since the initial impact of a faster growth of real wages will be higher on wages than the feedback on labour productivity, there will be an increase in the wage share (figure 3.7a). The higher wage share, on the other hand, will accelerate inflation once it widens the gap between firms' desired and actual profit margins (figure 3.7b).

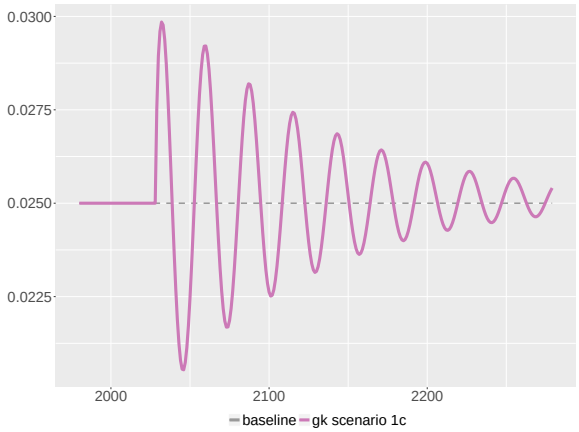
Since the surge of output owing to a higher wage share is smaller than the effect of higher real wages on productivity, the employment rate will fall (figures 3.7c and 3.7d). This will reverse the initial positive effect, reducing the utilization rate and thus firms' propensity to invest and capital accumulation rate (after the short-lived effect of a higher wage share)(figures 3.8a and 3.8b and 3.8c).

In the downward phase of this first cycle, the slowdown in activity will make workers willing to accept a lower wage (lower desired wage share), which will decrease the growth of nominal wages. The downturn of output growth will drag productivity growth down as well as the inflation rate. As nominal wage growth temporarily decelerates more than the inflation rate, real wage growth rate decreases. Once the gap between real wage and productivity growth rates is reduced, the wage share increments slow down until its upswing trend is reversed (see figure 3.7a). This happens once the increase in output growth pulls productivity growth up, surpassing real wage growth (figure 3.7c).

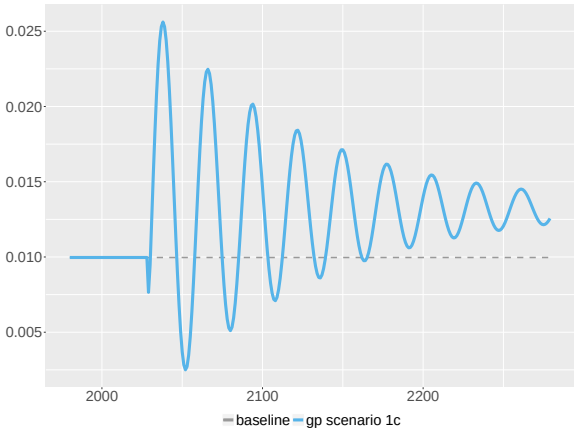
But how will the economy recover from the downturns? There seems to be a connection between the economy's upswings and household wealth growth, through autonomous consumption (figure 3.8d).

Figure 3.6: Effects of an increase in the propensity to consume assuming a higher parameter Ψ

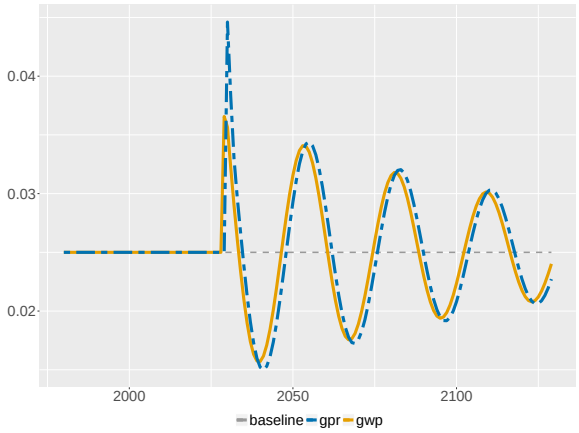
(a) Capital accumulation rate



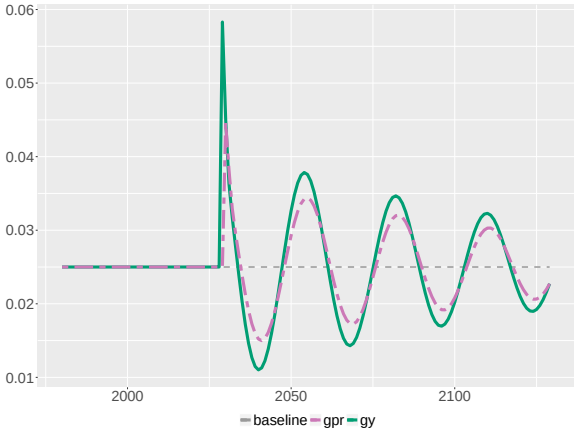
(b) Inflation rate



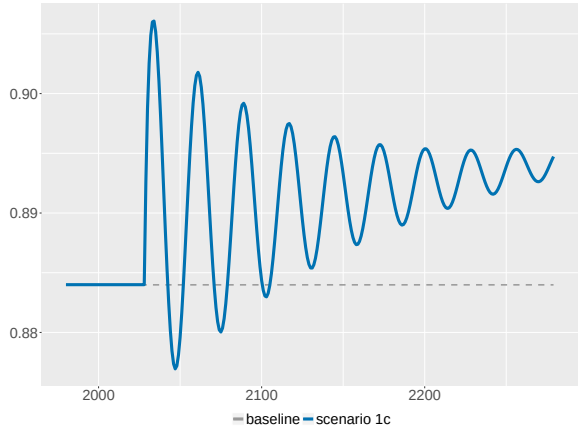
(c) Real wage and labour productivity growth rates



(d) Output and labour productivity growth rates



(e) Employment rate



We notice that household wealth grows at a slower pace in the short run mainly as a result of capital losses accruing from equities. Despite the increase in the desired share of equities in household portfolio due to a higher inflation rate, the reduction in household wealth to capital ratio will lead to a fall in equity prices (the supply by firms will exceed household demand). The opposite happens when capital accumulation starts to decelerate, accounting for capital gains: even if the desired ratio of equities in household portfolio decreases owing to higher real interest rates, prices increase due to the lower supply by firms in comparison to household demand (figure 3.9a).

Besides that, the increase in the household to total income ratio also contributes to fasten household wealth growth after the reduction in the capital accumulation rate. This implies a relatively larger consumption out of household wealth and a stimulus to firms' investment and capital accumulation in what follows. When the economy is growing at a slower pace, household wealth provides a floor to demand reversing the descending phases of the cycle.

Yet this effect is not enough to make firms increase their propensity to invest above the baseline level in the long run, thus leading to a permanently lower capital accumulation rate (figure 3.8c). Besides that, as labour productivity growth exceeds output growth, the unemployment keeps on rising (figure 3.7d).

In the short run, firms' loans to capital ratio decreases in relation to the baseline, even if investment increases more than retained earnings, owing to the temporarily higher market value of equities (figure 3.9b). In the long run, the increase in retained earnings will fall behind investment financing needs, even with the slowdown of the latter, culminating in a higher loans to capital ratio (figure 3.9c). Gross and net profit rates will both decrease in comparison to the baseline, once there is a permanent decrease in the profit share and capacity utilization converges to the normal utilization range (figure 3.9d).

Government debt to capital ratio will decrease as in the previous experiments as both primary and nominal deficits to output decrease – due to higher taxed household income to output and also to a higher inflation rate. Yet, in the long run we notice an upward trend of the government debt to capital ratio since the wage share is falling, reducing the taxed income ratio (figure 3.9e).

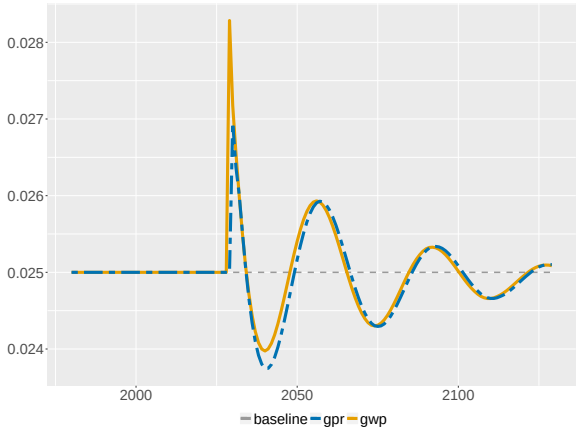
In a few words, a stronger bargaining power of workers will be associated with a higher, though falling, wage share and to a higher rate of inflation in the long run. Capital accumulation and employment rates will be lower in comparison to the baseline in the long run as well as government debt and household wealth to capital ratios. Among the financial assets, only firms' loans to capital ratio will stablish at a higher level in comparison to the baseline.

3.3.3 Firms' bargaining power

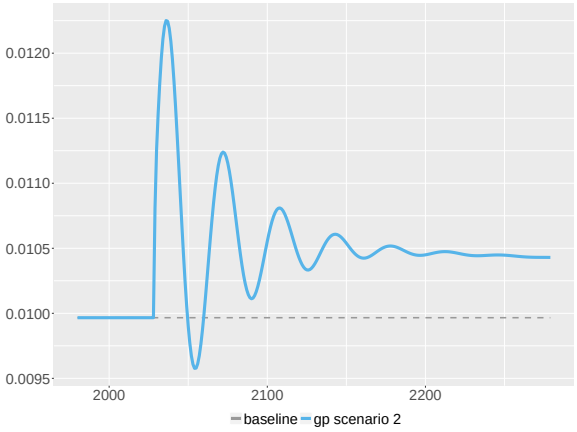
If there is an increase in firms' bargaining power (ψ), this will lead to a higher inflation rate in the aftermath of the shock, immediately reducing real wages growth rate (figure 3.10a). A slower

Figure 3.7: Effects of an increase in workers' bargaining power

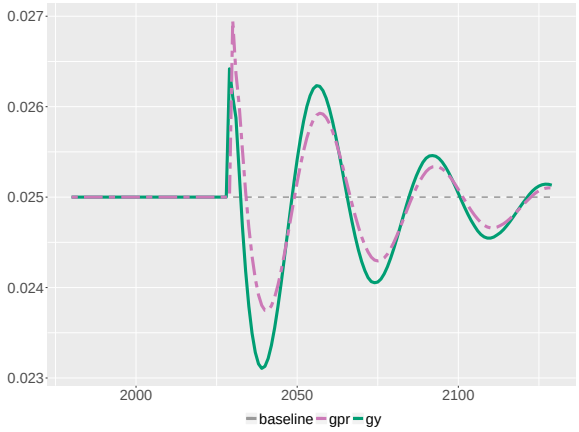
(a) Real wage an labour productivity growth rates



(b) Inflation rate



(c) Output and labour productivity growth rates



(d) Employment rate

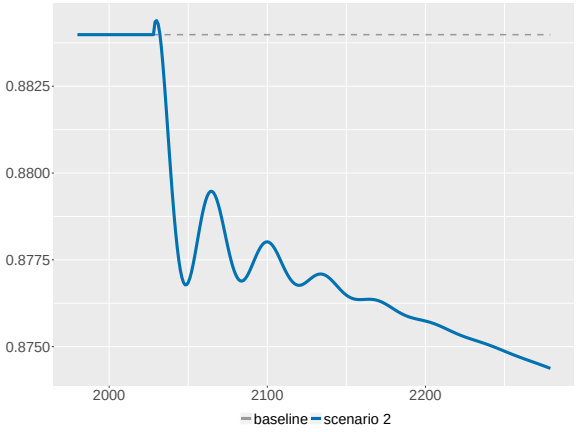
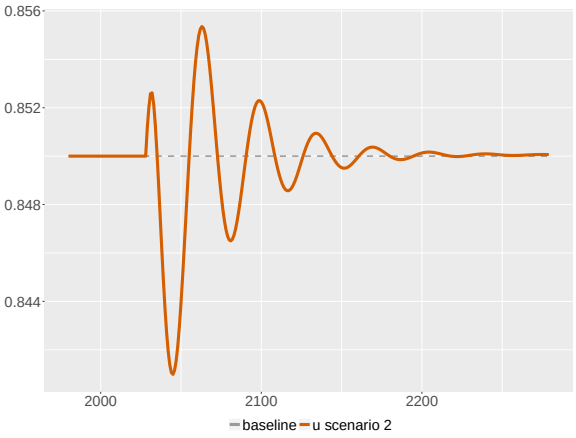
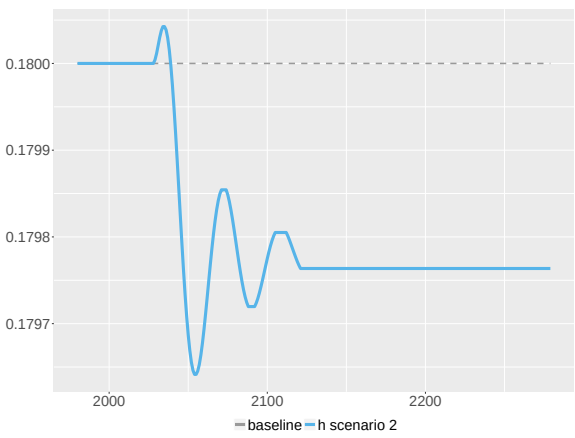


Figure 3.8: Effects of an increase in workers' bargaining power

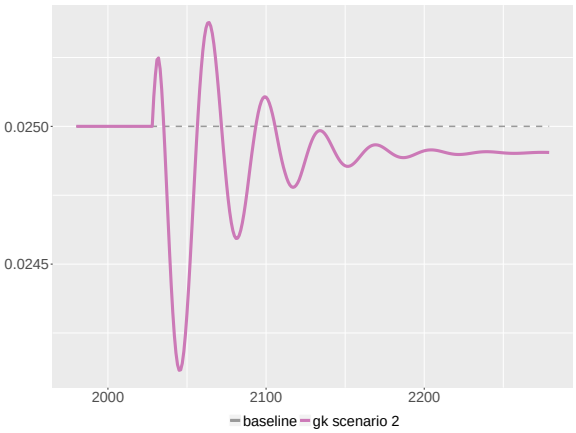
(a) Capacity utilization rate



(b) Firms' propensity to invest



(c) Capital accumulation rate



(d) Capital accumulation and household wealth growth rates

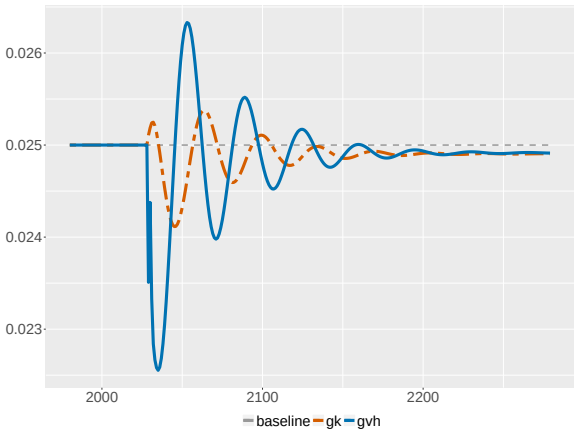
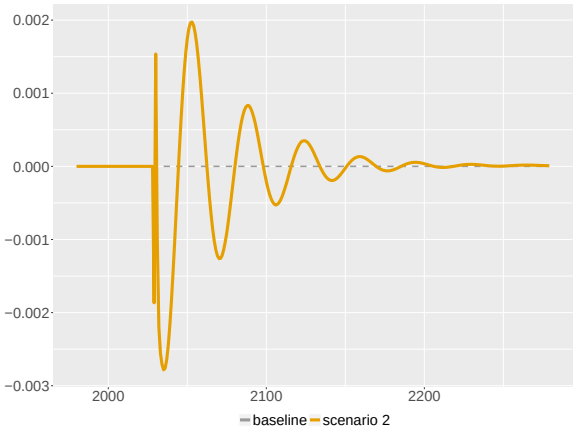
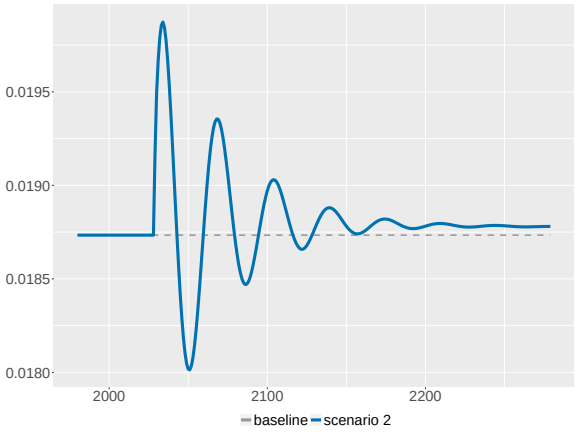


Figure 3.9: Effects of an increase in workers' bargaining power

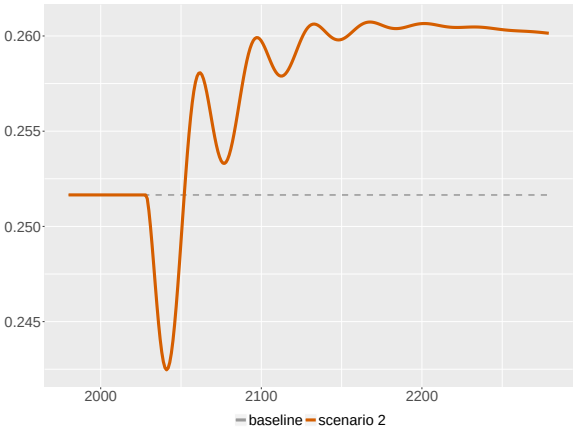
(a) Capital gains to output



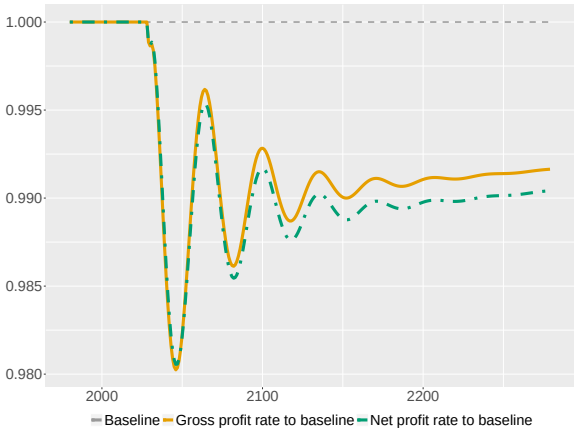
(b) Equities as source of finance



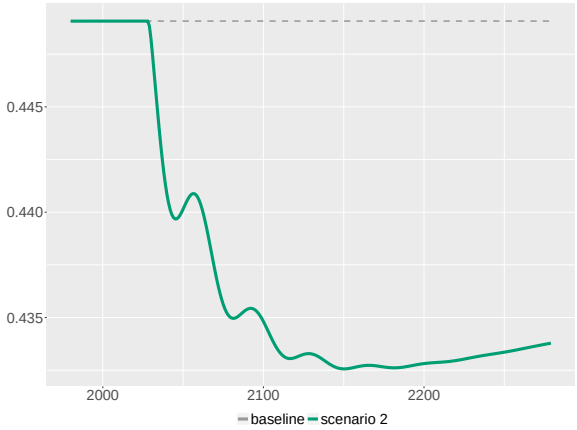
(c) Firms' loans to capital ratio



(d) Gross and net profit rates



(e) Government debt to capital ratio



real wage growth rate will negatively impact labour productivity growth (figure 3.10b). Yet as productivity grows at a faster pace than real wages, the wage share is pulled down. The fall in the wage share will decrease consumption growth and thus the utilization rate falls below the normal range, triggering firms' reaction: the propensity to invest and the capital accumulation rate decline (figures 3.10e, 3.10f and 3.11a).

On the one hand, the lower output growth will lead, as it initially falls more rapidly than productivity growth, to a decrease in the employment rate (figure 3.10d). The fear of unemployment makes the workers accept a lower target wage share, decreasing the nominal wage growth rate. On the other hand, the lower activity growth will also make firms reassess their desired profit margins, reducing price increases.

Since price inflation falls more rapidly than nominal wage changes, real wage growth will pick up again partially reversing the negative effect of the shock. The spur to real wages will feedback into labour productivity. As productivity growth lacks behind real wage growth, the wage share goes up. The higher wage share translates into higher consumption growth and utilization rate. As firms increase their investment, raising the capital accumulation and output growth rates, the employment rate increases again. As a result of firms' stronger bargaining power, the increase in firms' desired profit margins (due to faster economic growth) will have a larger impact on the inflation rate, which will reduce real wage growth, but to a lesser extent as the economy continues on the damped oscillation pattern.

Government debt to capital ratio will increase in the long run due to the higher primary deficit to output – since taxed income in relation to total income will decrease – and due to the higher real interest payments on government bills owing to the lower inflation rate (figure 3.11b).

Firms' loans to capital ratio will decrease in the short run since the increase in retained earnings (due to the higher profit share) will cover new investment financial needs. Yet as soon as investment increases more than the accumulated retained earnings – due to the temporarily increase in the wage share – firms will have to incur more intensively into debt. In the long run as the profit share increases and investment needs stabilize, firms' loans to capital ratio rests at a lower level in comparison to the baseline (figure 3.11c).

At last, household wealth to capital ratio will decrease in the short run due to capital losses from held equities. In the long run, household wealth to capital ratio increases and stabilizes at higher level in comparison to the baseline due to the higher financial income accruing from dividends – distributed profits to income ratio increases – and also due to the lower growth path of capital accumulation (figures 3.11a, 3.11d and 3.11e).

In the long run, the predominant effect of an increase in firms' bargaining power is a permanent reduction in the accumulation rate and in the inflation rate. Both the wage share and the employment rate will present a decreasing trend in the long run, as productivity growth stabilizes at a higher level than output and real wage growth rates. As for the financial assets ratio to

capital, both government debt and household wealth to capital ratios increase while firms' loans to capital ratio decreases.

3.4 Final Remarks

The literature on Supermultiplier models is quickly expanding its frontiers. We have seen that some of these models already account for a labour productivity regime, for a conflicting-claims approach to inflation and also for an endogenous growth of active population in the long run, being able to analyse the impacts of autonomous demand on the employment rate. Yet as autonomous expenditures are assumed to grow at an exogenously given rate in the long run, productivity growth is not allowed to suffer any permanent effect from a higher output growth (or real wage growth). Besides that, income distribution is usually assumed to be exogenous, so that changes in labour productivity will not affect the portion of income appropriated by workers and firms. The feedbacks to productivity, when income distribution responds to the conflict between groups, are also ruled out.

The model built in this chapter attempts to deal with both conflicting-claims inflation and a labour productivity regime in a Supermultiplier SFC model where autonomous expenditures are endogenous and firms investment decisions change accordingly to the discrepancies between the actual utilization rate and the normal one. This framework allowed us to deal with the interactions between labour productivity, output and real wages. The main findings of the chapter based on the numerical simulation experiments can be summarized as follows:

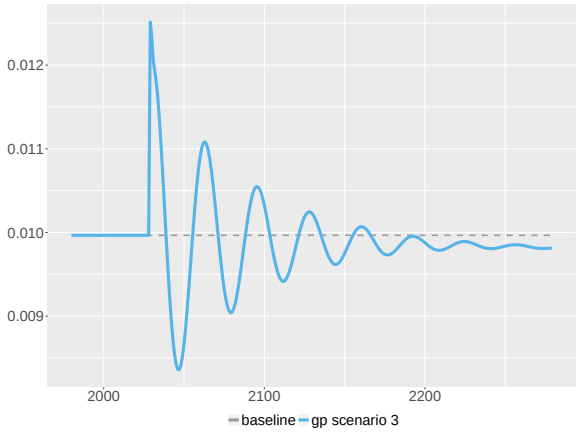
(i) An increase in the propensity to consume out of after-tax real wages is associated with a higher capital accumulation rate in the long run. Since income distribution is endogenous, the economy will move along cycles generated by the interactions between real wages and labour productivity. In the long run, the economy will stabilize at a quasi steady growth state, where capacity utilization converges back to the normal utilization range, the employment rate is growing and output, productivity and real wages grow at higher rates;

(ii) When productivity and real wages are endogenous to the model, higher capital accumulation rates may be associated either with higher or with lower profit rates, depending on the discrepancies between real wage growth and productivity growth;

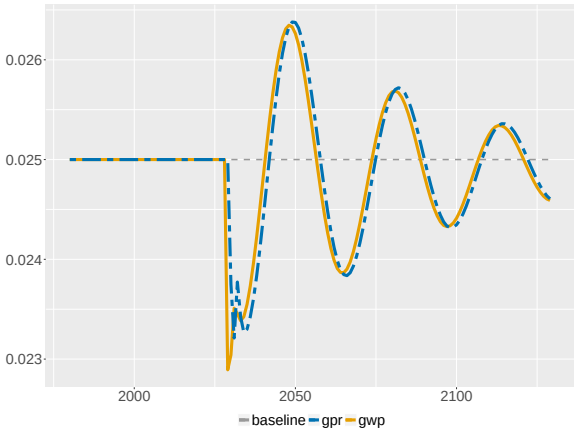
(iii) The same shock to demand might lead to a relatively higher or lower increase in the employment rate (and to a higher or lower growth of the employment rate) depending on the how firms and workers revise their endogenous income targets. For instance, the employment rate will increase at slower pace after the same positive shock to demand if workers' revise their desired wage share at a faster pace. This happens because a higher growth rate of real wages will feed back into productivity growth, reducing the increments in the employment rate;

Figure 3.10: Effects of an increase in firms' bargaining power

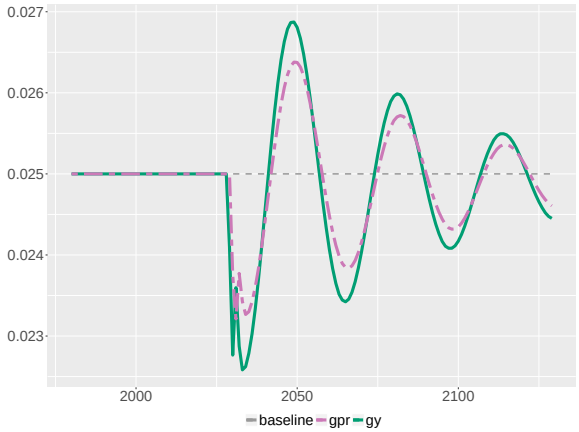
(a) Inflation rate



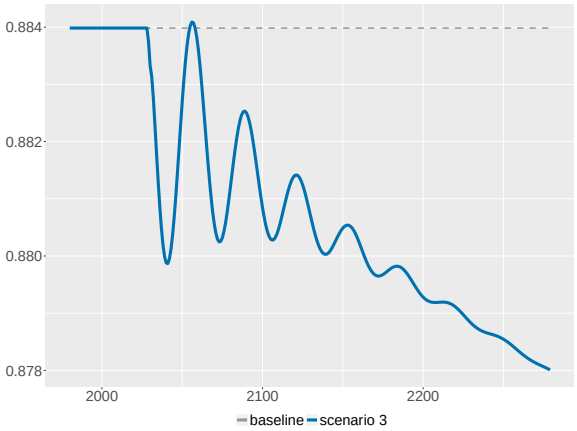
(b) Real wage and labour productivity growth rates



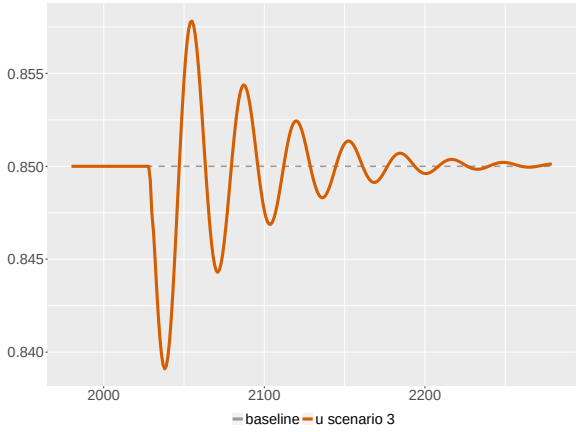
(c) Output and labour productivity growth rates



(d) Employment rate



(e) Capacity utilization rate



(f) Firms' propensity to invest

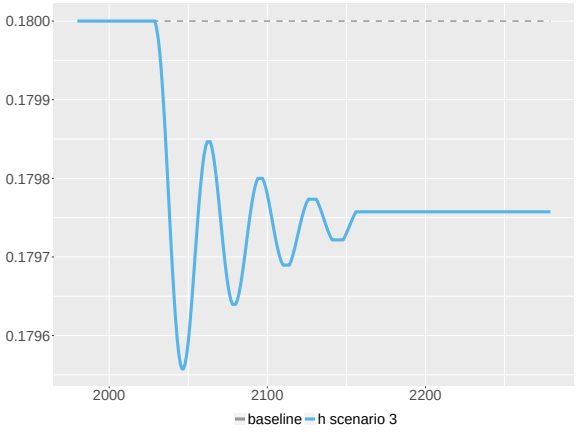
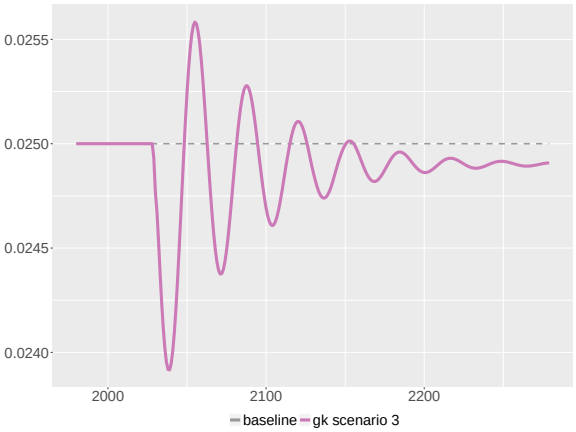
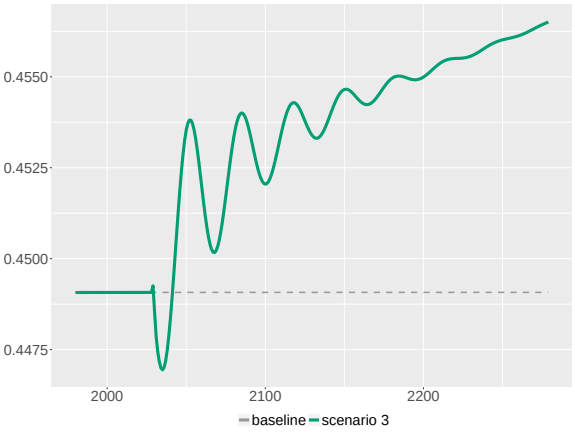


Figure 3.11: Effects of an increase in firms' bargaining power

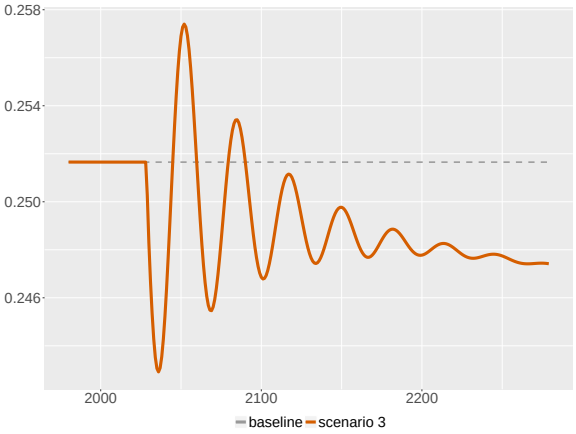
(a) Capital accumulation rate



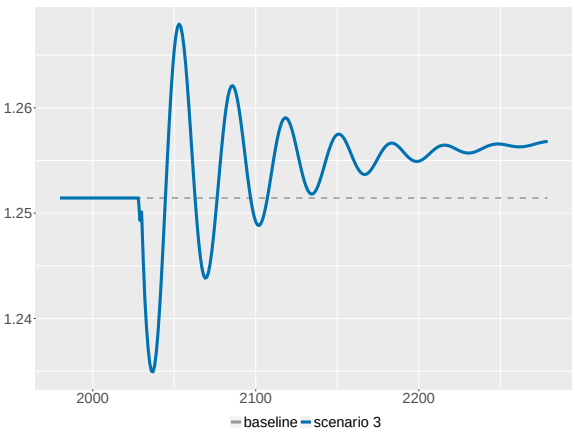
(b) Government debt to capital ratio



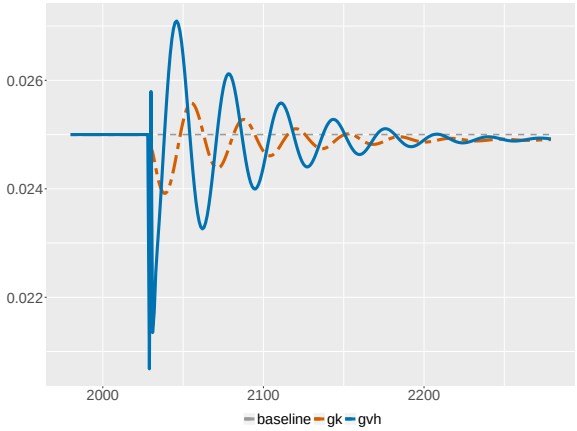
(c) Firms' loans to capital ratio



(d) Household wealth to capital ratio



(e) Capital accumulation and household wealth growth rates



(iv) For the initial parameters and variable values, both an increase in workers and in firms bargaining power will be associated with lower capital accumulation rates in the long run, independently of the level of inflation, since they both lead to a lower and decreasing employment rate. That said, changes in workers and firms bargaining power may have a permanent growth effect. Besides that, a higher bargaining power of firms is associated with higher profit rates.

(v) Differently from other supermultiplier models in which labour productivity growth is not permanently affected by income distribution, in our model, an increase in the growth rate of real wages will increase labour productivity growth in the long run. Yet, that does not mean this *ex post* higher labour productivity growth rate will be associated with a higher wage share;

(vi) At last, consumption out of household wealth seems to play an important role as a floor to demand. As capital accumulation decelerates and household to total income ratio increases, household wealth grows at a faster pace pulling investment up again.

The most obvious extension of the model presented here would be to take into account the growth rate of active population in the long run. Making the growth rate of active population endogenous would allow for the employment rate to be constant in the long run without requiring the convergence of output and labour productivity growth rates to the same path. Regarding the generality of our conclusions, a sensitivity analysis of the parameters should be conducted to verify for which range of (economically meaningful) parameters each set of results emerge. These issues are matter for future research.

Chapter 4

Growth and distribution in a Two-Country Supermultiplier Stock-Flow Consistent model

A common ground of the Supermultiplier approach (Serrano, 1995a; Bortis, 1997) and of the Balance-of-Payment Constraint growth theory as put forward by Thirlwall (1979) is the claim that growth is led (constrained) by demand factors in the long run. For the first approach, growth is exogenously given by autonomous expenditures and capital accumulation will adjust, through induced business investment, to match demand in the long run. As for the second approach, the ultimate limit to growth, which helps to explain why countries have different growth rates[1] in the long run, is to be found in the restriction to demand imposed by disequilibrium in the balance-of-payments.

We can see an intersection also in the origins of both approaches going back to (Kaldor, 1970), who argued that autonomous demand emanating from exports would lead growth in the long run and would have an impact on capital accumulation through the investment accelerator, representing the foreign trade multiplier in a dynamic framework.[2]

This said, it seems rather logical that Supermultiplier models – in its most recent versions (Freitas and Serrano, 2015; Lavoie, 2016; Allain, 2015b) characterized by a non-capacity creating autonomous expenditure component growing at an exogenously given rate and an endogenous expected trend growth of sales – should be extended to (and its results analysed under) an open economy framework. Nah and Lavoie (2017a) work in this direction bringing the supermultiplier model to a small open economy setting and evaluating the results of the model in terms of the paradoxes of thrift and costs once the effects of the profit share on the exchange rate are accounted for.

[1] Prebisch (1959) and other researchers from ECLAC, as Celso Furtado, were already concerned with the reasons why countries have different growth rates and found in the balance-of-payments a constraint to growth and development for underdeveloped countries.

[2] Lavoie (2014) explains that Kaldor when discussing development linked the ideas of Harrod (1933)'s trade multiplier and of Hicks (1950)'s supermultiplier with external demand coming from outside a region or country.

We intend to further contribute to the subject by addressing the supermultiplier features in a two-country Stock-Flow Consistent (SFC) model, in which both economies, with similar size and structure[3], are fully integrated. By fully integrated we mean that these economies trade both real and financial assets. The assumption of two fully integrated economies allows for exports to be endogenous and, consequently, for demand feedbacks from one economy to the other. The chapter innovates by making two components of the non-capacity creating autonomous expenditures endogenous, namely exports and consumption out of wealth in both economies. The system is analysed under both fixed and floating exchange rate regimes. The aim of this chapter is twofold: (1) to investigate the effects of a change in income distribution and in the propensities to spend on growth in the long run and (2) to compare the results with those obtained in a similar closed economy model (chapter 2).

The subsequent sections of the chapter are organized as follows. Section 4.1 reviews the heterodox literature on growth and distribution in open economy models in what they relate to the subject of this chapter. Section 4.2 presents the framework and main features of the model. Section 4.3 briefly describes the short and long run equilibrium conditions. In section 4.4, we run some simulation experiments to assess the long run results of the model. The shocks are a reduction in the firms' mark-up, an increase in the propensity to consume out of after-tax wages and a reduction in the propensity to import in one of the countries. At last, section 4.5 presents a general assessment of the results and concludes the chapter.

4.1 Income distribution and growth in heterodox open economy models

It is well-known that discussing income distribution is markedly more difficult to do in an open economy setting. Even more so if we are to take into account the relation between distribution and growth. The different sources of distributional shocks that arise in an open economy – which certainly may originate different feedbacks and results in terms of domestic and international demand – could help to explain why the literature under this scope is so scattered around different assumptions regarding firms' pricing decisions and exchange rates (Lavoie, 2014; Hein and Vogel, 2008).

A great deal of the post-Keynesian open economy literature on income distribution and growth has assumed a single economy setting with an exogenous rest of the world (Lavoie, 2014; Blecker, 2012). Within this apparatus, we are allowed to analyse just the response of domestic variables to an isolated increase (decrease) in external demand. That may be appropriate to deal with small economies, in the sense that they are not able to influence external demand,

[3]Both economies are identical for the case of flexible exchange rate regimes, but this cannot be said for the case of a fixed exchange rate regime, since we assume one of the economies accumulates international reserves.

being constantly submitted to shocks coming from fluctuations in world economy (Nah and Lavoie, 2017a).[4]

However, in a context of large openness and spillovers between countries, even the smaller ones may have an influence in the global economy, say, through a financial crisis. Thus, ignoring the feedbacks between countries in an open economy setting could be understood as a shortcoming of the analysis.

In a two-country model with the full accounting of international trade, the exchange rate becomes a distributive variable between two economies (La Marca, 2010; Rezai, 2015; Von Arnim et al., 2014). Besides that, the openness of a country to trade may have a stabilizing effect on each country's demand since part of the demand leaks from one country to the other (Blecker, 2012). Yet this is not the whole story provided that the leakage from one country can stimulate demand in the other country which might foster or further dampen domestic output in the former.

To be fair, in the Kaleckian approach there have been some efforts to extend closed or single economy models to two-country growth models. McCombie (1993) extends the Balance-of-Payment constraint growth theory to a system of two advanced countries and advocates for the complementarity of growth between two countries. This conclusion was based on the fact that the growing inter-linkages between advanced countries through trade could limit the scope for individual domestic policies to expand demand, which would translate into balance-of-payment constraints, depending on the income elasticities of exports and imports, and could also lead to competitive growth (one country growing at the expense of its partners). However, as usual in the Thrilwallian tradition, the model does not take capital accumulation into account.

Dutt (2002) builds a growth model with two different regions interacting in order to assess the convergence of growth rates between the economies. Region North grows with excess capacity and defines prices by mark-up, while region South produces at full capacity. Trade is balanced between the two regions, so capital flows and net financial transfers are ignored. Similarly to Dutt (2002), Vera (2006) also builds a model in which there are asymmetries between the two countries (or regions), but the analysis is focused on trade imbalances and the role of financial transfers between the two economies in the long run. The main finding of the paper is that changes in the rate of net financial transfers from the South to the North region may generate three different growth regimes – reinforcing contractionary, reinforcing expansionary or conflicting growth regimes.

More recently, there can be found some papers which try to assess the effects of a expansion in wages over domestic and global demand in a two-country growth model (Von Arnim et al., 2014; Capaldo and Izurieta, 2013). Rezai (2015) also analyses the relation between income distribution and output in a two-country model, but his analysis is restrained to the short run. Von Arnim et al. (2014) stress the likelihood of emergence of a fallacy of composition in a system of two countries: if both countries expand domestic demand (through a redistribution

[4]See Blecker (2012) for a survey on neo-Kaleckian open economy models.

towards labour), aggregate demand will be higher in both countries. If just one of the countries redistribute towards labour, again both countries will see an increase in their aggregate demand levels, however, the country which redistributes income may see a decrease in its share of the global demand. This would help to explain why countries would prefer to adopt a relative wage suppression, even if both economies end up in a lower growth path. Based on this, the authors also make the case for policy coordination, since both countries would be better off on such a scenario. Capaldo and Izurieta (2013) reach similar conclusions and stress that if countries pursue competitive flexibilization of labour markets, there may be a reinforcement of the contractionary effects on demand.

When it comes to the post-Keynesian SFC approach, open economy models with systems of two or three countries are more abundant. According to Caverzasi and Godin (2015b), the open economy modelling in this tradition can be divided in three phases: the first one identified with Godley's model of world imbalances; the second one which concentrates on establishing a formal representation of an open economy, summarized in the open economy chapters of Godley and Lavoie (2007); and a last phase, in which there are several papers analysing specific open economy issues based on the framework of the second phase. Among the issues addressed in the last phase, two can be highlighted: the effects of monetary and fiscal policies and the constraints of a monetary union (Duwicquet and Mazier, 2011, 2012; Khalil and Kinsella, 2010; Kinsella et al., 2012); and the concerns with world imbalances, exchange rates, foreign reserves (Lavoie and Zhao, 2010; Lavoie and Daigle, 2011; Carvalho, 2012; Mazier and Tiou-Tagba Aliti, 2012).

We notice that income distribution is hardly a major concern in post-Keynesian open economy SFC models. An exception is found in Bortz (2014) which addresses the growth and distribution implications of a country issuing debt in a foreign currency and embedded in a framework that allows domestic firms to get loans abroad. The author presents a model led by government expenditures growing at an exogenously given rate and in which firms' investment is based on the accelerator principle. This brings the model closer to the recent supermultiplier models under the neo-Kaleckian approach. However, the model does not deal explicitly with the Harrodian instability problem, since the utilization rate is endogenous and the expected trend growth rate of sales does not change with the changes in demand.

4.1.1 Perspective for Open Economy Supermultiplier models

Since supermultiplier models were brought to the neo-Kaleckian framework, Nah and Lavoie (2017a) is the major attempt to extend the model to an open economy setting. The authors deal with a single small open economy in which the autonomous exports grow at an exogenously given rate and address the paradoxes of thrift and costs. Regarding the results of the model, the paradox of thrift holds in level terms; whether the paradox of costs holds or not will depend on the sensitivity of the real exchange to changes in income distribution: if the real exchange rate

is not too sensitive to changes in income distribution, the paradox of costs is also likely to hold. The main drawback of the analysis, as acknowledged by the authors, is that it does not take into account the flows generated by financial assets and the feedbacks from changes in the exchange rates to income distribution.

Clearly, there is plenty of room to analyse the implications of supermultiplier models in more complex settings, as a two-country growth model which deals with financial assets. Provided that demand spillovers are allowed into the analysis, both capacity utilization and growth rates are interdependent, which might change or complement the results obtained in a supermultiplier model for a closed or single economy. Moreover, if the model is built adopting the SFC methodology, the implications of changes in the observed exchange rate – through the inclusion of financial assets internationally traded between the economies – on income distribution and growth can be more easily addressed. In what concerns long run growth, if in addition to this, autonomous expenditures are allowed to be endogenous, permanent growth effects may arise from demand expansions. A model along these lines is proposed in the next section.

4.2 A Two-Country Supermultiplier Stock-Flow Consistent growth model

We build a two-country Supermultiplier Stock-Flow Consistent (SFC) growth model in which autonomous expenditures – exports as well as consumption out of wealth – are endogenous to the system. We are assuming two advanced (large) and financially integrated economies with mostly the same features, there are no structural differences between them. For the system as a whole autonomous injections only arise from both countries' household wealth, considering that exports depend on firms' production decisions in the other country. However, at each country's level, autonomous expenditures comprise consumption out of household wealth and exports, since exports are independent from domestic firms' production decisions. The model combines these autonomous expenditures with induced business investment and Harrodian behaviour of firms in both countries, extending the essential features of supermultiplier models to an open economy setting.

In the following subsections we present the framework of the model, describe the behavioural assumptions of each sector and specify the fixed and flexible exchange rate regime closures.

4.2.1 Framework of the model

The model is composed by a system of two countries, Country One and Country Two, whose economies present five institutional sectors: Households, Firms, Banks, Government and Central Bank. Table 4.1 presents the balance sheet of these institutional sectors. To make the notation clear since the beginning, each i as a subscript of a stock or a flow in the matrices

Table 4.1: Balance sheet matrix model chapter 4

	Country 1					Country 2					
Assets	Household	Firms	Banks	Government	Central Bank	Household	Firms	Banks	Government	Central Bank	$\sum$
1. HPM	$+H_1$				$-H_1$	$+H_2$				$-H_2$	0
2. Deposits	$+D_1$		$-D_1$	$+D_{G_1}$	$-D_{G_1}$	$+D_2$		$-D_2$	$+D_{G_2}$	$-D_{G_2}$	0
3. Loans		$-L_1$	$+L_1$				$-L_2$	$+L_2$			0
4. Fixed capital		$+K_1$					$+K_2$				$+K_1 + K_2$
5. Equities	$+pe_1.E_1$	$-pe_1.E_1$				$+pe_2.E_2$	$-pe_2.E_2$				0
6. Government 1 Bills	$+Bh_{1,1}$		$+Bb_{1,1}$	$-B_1$	$+Bcb_{1,1}$	$+Bh_{2,1}$				$+Bcb_{2,1}$	0
7. Government 2 Bills	$+Bh_{1,2}$					$+Bh_{2,2}$		$+Bb_{2,2}$	$-B_2$	$+Bcb_{2,2}$	0
8. Advances			$-A_1$		$+A_1$			$-A_2$		$+A_2$	
9. Net worth	V_{h1}	V_{f1}	0	$-B_1 + D_{G_1}$	V_{cb1}	V_{h2}	V_{f2}	0	$-B_2 + D_{G_2}$	V_{cb2}	$+K_1 + K_2$

or in the following equations denotes the country that claims or holds the respective income or asset. The subscript j refers to country where the asset or income was issued or generated. For instance, $Bh_{1,2}$ accounts for the bills issued by government two and held by households of country one. The subscript (-1) accounts for stocks and flows at the beginning of the period.[5] Besides that, the equations will be firstly described considering a fixed exchange rate regime and the modifications regarding the flexible exchange rate regime will be presented afterwards.

Banks lend to firms and receive deposits from households. Banks may also take on advances at the central bank or accumulate government bills. *Households* make deposits at banks, hold money issued by the central bank, acquire domestic and foreign government bills and hold equities issued by firms. *Firms* accumulate capital, take on loans from banks and issue equities to the households. *Central banks* issue high powered money, receive deposits from the government, make advances to commercial banks and hold domestic government bills for monetary policy purposes. In the case of a fixed exchange rate regime, the central bank of country two also buys bills issued by government one (international reserves). *Governments* issue bills held by households from both countries, central banks and commercial banks and make deposits at central banks.

Table 4.2 shows the transactions between the sectors in the first part and the flow of funds in the second part. The equations and behavioural assumptions are presented below matching each institutional sector. As in chapter 3, variables in real terms are written in lower case while nominal variables are written in upper case, unless specified otherwise.

Government

Governments issue bills (4.1) to finance their expenditures (4.3) that are not covered by the taxation of household income (4.4) and by the transfers of Central Banks' profits and (if necessary) to provide the respective Central Bank the bills it must have to implement monetary policy (to be detailed in the section on central banks). Nominal government expenditures are defined as real government expenditures (4.2) multiplied by the domestic sales price level (p_{s_i}) (4.3).

$$B_i = B_{i_{-1}} + G_i - (T_i + Fcb_i) + i_i.B_{i_{-1}} - i_i D_{G_{i_{-1}}} + \Delta D_{G_i} \tag{4.1}$$

[5]For transactions involving just one of the countries, we use just the subscript i to simplify the notation.

Table 4.2: Transactions and Flow of Funds matrix model chapter 4

	Country 1							**Country 2**						
	Household	Firms		Banks	Govt.	CB	Ex. Rate	Household	Firms		Banks	Govt.	CB	$\sum$
		Current	Capital						Current	Capital				
1. Consumption	$-C_1$	$+C_1$						$-C_2$	$+C_2$					0
2. Investment		$+I_1$	$-I_1$						$+I_2$	$-I_2$				0
3. Government expenditures		$+G_1$			$-G_1$				$+G_2$			$-G_2$		0
4. Exports/Imports		$+X_1$					$.e_r$		$-IM_2$					0
5. Imports/Exports		$-IM_1$					$.e_r$		$+X_2$					0
6. Wages	$+W_1$	$-W_1$						$+W_2$	$-W_2$					0
7. Taxes	$-T_1$				$+T_1$			$-T_2$				$+T_2$		0
8. Profit	$+FD_1$	$-F_1$	$+FU_1$					$+FD_2$	$-F_2$	$+FU_2$				0
9. Profit of the CB					$+FB_1$	$-FB_1$						$+FB_2$	$-FB_2$	0
10. Deposits interest	$+i_1.D_{1_{-1}}$			$-i_1.D_{1_{-1}}$	$+i_1D_{G1_{-1}}$	$-i_1D_{G1_{-1}}$		$+i_2.D_{2_{-1}}$			$-i_2.D_{2_{-1}}$	$+i_2D_{G2_{-1}}$	$-i_2D_{G2_{-1}}$	0
11. Loans interest		$-i_1.L_{1_{-1}}$		$+i_1.L_{1_{-1}}$					$-i_2.L_{2_{-1}}$		$+i_2.L_{2_{-1}}$			0
12. Bills interest Country One	$+i_1.Bh_{1,1_{-1}}$			$+i_1Bb_{1,1_{-1}}$	$-i_1.B_{1_{-1}}$	$+i_1.Bcb_{1,1_{-1}}$	$.e_r$	$+i_1.Bh_{2,1_{-1}}$					$+i_1.Bcb_{2,1_{-1}}$	0
13. Bills interest Country Two	$+i_2.Bh_{1,2_{-1}}$						$.e_r$	$+i_2.Bh_{2,2_{-1}}$			$+i_2Bb_{2,2_{-1}}$	$-i_2.B_{2_{-1}}$	$+i_2.Bcb_{2,2_{-1}}$	0
14. Advances interest				$-i_aA_{1_{-1}}$		$+i_aA_{1_{-1}}$					$-i_aA_{2_{-1}}$		$+i_aA_{2_{-1}}$	
15. Subtotal	S_{h1}	0	S_{f1}	0	S_{g1}	0		S_{h2}	0	S_{f2}	0	S_{g2}	0	0
16. Δ HPM	$-\Delta H_1$					$+\Delta H_1$		$-\Delta H_2$					$+\Delta H_2$	0
17. Δ Deposits	$-\Delta D_1$			$+\Delta D_1$	$-\Delta D_{G_1}$	$+\Delta D_{G_1}$		$-\Delta D_2$			$+\Delta D_2$	$-\Delta D_{G_2}$	$-\Delta D_{G_2}$	0
18. Δ Loans			$+\Delta L_1$	$-\Delta L_1$						$+\Delta L_2$	$-\Delta L_2$			0
19. Δ Equity	$-pe_1.\Delta E_1$		$+pe_1.\Delta E_1$					$-pe_2.\Delta E_2$		$+pe_2.\Delta E_2$				0
20. Δ Bills Country One	$-\Delta Bh_{1,1}$			$-\Delta Bb_{1,1}$	$+\Delta B_1$	$-\Delta Bcb_{1,1}$	$.e_r$	$-\Delta Bh_{2,1}$					$-\Delta Bcb_{2,1}$	0
21. Δ Bills Country Two	$-\Delta Bh_{1,2}$						$.e_r$	$-\Delta Bh_{2,2}$			$-\Delta Bb_{2,2}$	$+\Delta B_2$	$-\Delta Bcb_{2,2}$	0
22. Δ Advances				$+\Delta A_1$		$-\Delta A_1$					$+\Delta A_2$		$-\Delta A_2$	0
23. $\sum$	0	0	0	0	0	0		0	0	0	0	0	0	0

$$gd_i = \sigma_i y_{i_{-1}} \tag{4.2}$$

$$G_i = gd_i p_{s_i} \tag{4.3}$$

$$T_i = \tau_i Y_{h_i} \tag{4.4}$$

Households

Household income is composed by wages and financial income (4.5) – dividends and interests on held assets. Aggregate nominal wages are defined by equation (4.7). We assume that the nominal wage rate (W_{N_i}) is constant and exogenously given. Aggregate real wage is given by nominal wage divided by the domestic sales price level (4.8). Household disposable income is the household after-tax income (4.9). Households consume a fraction (α_{1i}) of their after-tax wages and a fraction (α_{2i}) of their stock of wealth at the beginning of the period (4.11). The savings are defined by equation 4.13.

Households are allowed to hold foreign assets (4.23), namely, the bills issued by the other country's government, on which they receive interest. Besides the capital gains on equities, households may have capital gains accruing from the value of these foreign assets in the domestic currency, which may change due to fluctuations in the exchange rate, in the case of a floating exchange rate regime (4.15).

Household's wealth changes due to their savings and due to capital gains (equation 4.16). Households allocate their wealth based on a Tobinesque portfolio choice framework – meaning that the increase in one asset's profitability, and hence demand, will come along with a decrease in other assets' demand. The deposits are the buffer of the household sector, which means that after households decided how much to invest in equities, domestic and foreign bills, and how much to keep as cash for precautionary reasons, they will allocate the rest of their wealth in the form of deposits at banks (equations 4.18–4.28). The return on equity (equation 4.29) is defined as the sum of dividends and of a fraction (ρ) of its capital gains (CG_i^{eq}) [6] divided by the market value of outstanding equity stock, similarly to van Treeck (2009).

In the case of a fixed exchange rate regime, the supply of foreign assets to households will be matched by their demand times (divided by) the exchange rate of the foreign currency (of the home currency) (equation 4.24). The exchange rate is defined as the price of the foreign currency. So an increase in the exchange rate of country one means the currency of country one is depreciating in relation to the currency of country two.

$$Y_{h_i} = W_i + FD_i + i_i(Bh_{i,i_{-1}} + D_{i_{-1}}) + i_j Bh_{i,j_{-1}} e_{n_i} \tag{4.5}$$

[6] As in Caverzasi and Godin (2015a), capital gains are accounted for in the rate of return but at a discount factor.

$$y_{h_i} = \frac{Y_{h_i}}{p_{s_i}} \tag{4.6}$$

$$W_i = W_{N_i}.Y_i \tag{4.7}$$

$$\omega_{R_i} = \frac{W_i}{p_{s_i}} \tag{4.8}$$

$$Y_{d_i} = (1 - \tau_i)Y_{h_i} \tag{4.9}$$

$$y_{d_i} = \frac{Y_{d_i}}{p_{s_i}} \tag{4.10}$$

$$C_i = \alpha_{1i}(1 - \tau_i)W_i + \alpha_{2i}V_{hi_{-1}} \tag{4.11}$$

$$c_i = \alpha_{1i}(1 - \tau_i)\omega_{R_i} + \alpha_{2i}vh_{i_{-1}} \tag{4.12}$$

$$Sh_i = Y_{d_i} - C_i \tag{4.13}$$

$$s_{h_i} = y_{d_i} - c_i \tag{4.14}$$

$$CG_i = \Delta pe_i E_{i_{-1}} + \Delta e_{n_i} Bh_{i,j_{-1}} \tag{4.15}$$

$$V_{hi} = V_{hi_{-1}} + Sh_i + CG_i \tag{4.16}$$

$$vh_i = \frac{V_{hi}}{p_{s_i}} \tag{4.17}$$

$$D_i^D = V_{hi} - H_i - pe_i E_i - Bh_{i,i} - Bh_{i,j} \tag{4.18}$$

$$Bh_{i,i}^S = Bh_{i,i}^D \tag{4.19}$$

$$H_i^D = \phi_{1i} V_{hi} \tag{4.20}$$

$$pe_i = \phi_{2i} \frac{V_{hi}}{E_i} \tag{4.21}$$

$$Bh_{i,i}^{D} = \phi_{3i} V_{hi} \tag{4.22}$$

$$Bh_{i,j}^{D} = \phi_{4i} V_{hi} \tag{4.23}$$

$$Bh_{i,j}^{S} = Bh_{i,j}^{D} e_{n_j} \tag{4.24}$$

$$\phi_{1i} = \lambda_{10} + \lambda_{11} i_{d_i} + \lambda_{12} r_{e_i} + \lambda_{13} i_i + \lambda_{14} i_j \tag{4.25}$$

$$\phi_{2i} = \lambda_{20} + \lambda_{21} i_{d_i} + \lambda_{22} r_{e_i} + \lambda_{23} i_i + \lambda_{24} i_j \tag{4.26}$$

$$\phi_{3i} = \lambda_{30} + \lambda_{31} i_{d_i} + \lambda_{32} r_{e_i} + \lambda_{33} i_i + \lambda_{34} i_j \tag{4.27}$$

$$\phi_{4i} = \lambda_{40} + \lambda_{41} i_{d_i} + \lambda_{42} r_{e_i} + \lambda_{43} i_i + \lambda_{44} i_j \tag{4.28}$$

$$r_{e_i} = \frac{FD_i + \rho CG_i^{eq}}{pe_{i_{-1}} E_{i_{-1}}} \tag{4.29}$$

Firms

We suppose that firms from both countries have an endogenous propensity to invest out of income (4.31) that reacts according to the discrepancies between the utilization rate and the normal utilization rate (4.32), following a Harrodian investment behaviour as in Lavoie (2016), Nah and Lavoie (2017a), and Freitas and Serrano (2015). γ_i represents the speed of adjustment of the propensity to invest to the discrepancies between the actual and the desired utilization rate. We further assume that if the utilization rate is inside a certain range, represented by χ_i, firms will want to keep their investment strategy unchanged, not triggering changes in the propensity to invest, as in Pedrosa and Macedo e Silva (2014) (for a justification of such a band see Hein et al. (2012) and Dutt (2011)).

The change in the capital stock is given by equation 4.33, the actual utilization rate is given by the ratio of output to full-capacity output (equation 4.36) and full-capacity output (equation 4.35) is determined by the ratio of the initial capital stock to the given capital-output ratio (v_i). From these equations, we can draw the short run actual growth rate of the capital stock (4.37), where δ_i denotes the rate of capital stock depreciation.

$$id_i = h_i y_i \tag{4.30}$$

$$I_i = id_i p_{s_i} \tag{4.31}$$

$$\Delta h_i = \begin{cases} h_{i_{-1}} \gamma_i (u_i - u_{ni}), & \text{if } |u_i - u_{ni}| > \chi_i \\ 0, & \text{otherwise} \end{cases} \tag{4.32}$$

$$k_i = k_{i_{-1}} - \delta_i k_{i_{-1}} + id_i \tag{4.33}$$

$$K_i = k_i p_{s_i} \tag{4.34}$$

$$Yfc_i = \frac{k_{i_{-1}}}{v_i} \tag{4.35}$$

$$u_i = \frac{Y_i}{Yfc_i} \tag{4.36}$$

$$g_{k_i} = \frac{h_i u_i}{v_i} - \delta_i \tag{4.37}$$

We assume that international trade takes place within the business sector, so firms import all inputs from firms in the other country and export part of its output to firms from the other country as well. Since we are dealing with a system of two countries necessarily the imports by one country are the exports by the other country (equation 4.38). As in Godley and Lavoie (2005), Carvalho (2012) and Bortz (2014), imports in each country are determined by the relevant prices and income elasticities (equation 4.39). It is import to highlight that this equation gives us the import volume in the foreign currency, so the real volume in domestic currency will be obtained multiplying it by the respective real exchange rate.

$$x_i = im_j \tag{4.38}$$

$$\ln(im_i) = \epsilon_{0i} - \epsilon_{1i} \ln\left(\frac{p_{m_{i_{-1}}}}{p_{y_{i_{-1}}}}\right) + \epsilon_{2i} \ln(y_i) \tag{4.39}$$

Firms in both countries put a mark-up on unit costs, composed by wages and imported inputs, as in Godley and Lavoie (2007), Hein and Vogel (2008), Bortz (2014), Rezai (2015). Pricing decisions will define the supply price in each country (equations 4.40, 4.44 and 4.45). Following Godley and Lavoie (2007, ch.12) and Bortz (2014), export prices will be determined in the exporting country and, as a consequence, import prices will be determined in the foreign currency (equations 4.41, 4.43 and 4.42). Output price level will be obtained dividing nominal output by real output and may differ from sales prices due to import prices (equation 4.46).

Since prices are not assumed to be constant, we are able to analyse both how a change in the nominal exchange rate and in relative domestic sales prices $\left(\frac{p_{s_j}}{p_{s_i}}\right)$ will affect the real exchange rate (equation 4.47) and, thus, international competitiveness between countries. On the one hand, changes in firms' mark-up or in the ratio of material to direct labour unit costs may change domestic prices and then the real exchange rate (see Lavoie (2014); Hein and Vogel (2008)). On the other hand, changes in the exchange rate may feedback into income distribution, changing relative costs.

$$p_{s_i} = \frac{(1+\mu_i)(W_i + IM_i)}{s_i} \tag{4.40}$$

$$p_{m_i} = p_{s_j} e_{n_i} \tag{4.41}$$

$$IM_i = p_{m_i} im_i \tag{4.42}$$

$$X_i = p_{s_i} im_j \tag{4.43}$$

$$s_i = c_i + i_i + g_i + x_i \tag{4.44}$$

$$S_i = s_i p_{s_i} \tag{4.45}$$

$$p_{y_i} = \frac{Y_i}{y_i} \tag{4.46}$$

$$e_{r_i} = e_{n_i} \frac{p_{s_j}}{p_{s_i}} \tag{4.47}$$

Firms must also decide how they will finance their investment. We suppose firms in both countries finance their investment through retained earnings, equity issuance and banks loans, which are assumed to clear firms' demand for funds (equation 4.48). Equities are a fixed proportion (ζ_i) of the capital stock at the beginning of the period (equation 4.49). Total nominal profits are obtained deducting total nominal wages from domestic output (equation 4.50). Total net profits are given by gross profit (equation 4.50) less interest payment on the opening stock of loans (equation 4.51). Firms retain a fraction of their net profits (s_{f_i}) (equation 4.52) and distribute the rest of net profits to households in the form of dividends to households (equation 4.53). Normalizing equation 4.50 and equation 4.51 by the nominal stock of capital at the

beginning of the period, we get respectively the gross profit rate (4.54) and the net profit rate (4.55), where π_i represents the profit share of domestic output.

$$L_i = L_{i_{-1}} + I_i - FU_i - pe_i \Delta E_i \tag{4.48}$$

$$E_i = \zeta_i K_{i_{-1}} \tag{4.49}$$

$$F_{G_i} = Y_i - W_i \tag{4.50}$$

$$F_{N_i} = F_{G_i} - i_i L_{i_{-1}} \tag{4.51}$$

$$FU_i = s_{f_i} F_{N_i} \tag{4.52}$$

$$FD_i = (1 - s_{f_i}) F_{N_i} \tag{4.53}$$

$$r_{g_i} = \frac{\pi_i u_i}{v_i} \tag{4.54}$$

$$r_{n_i} = \frac{\pi_i u_i}{v_i} - \frac{i_i l_{i_{-1}}}{1 + g_{k_{i_{-1}}}} \tag{4.55}$$

Banks

Banks in both countries lend to firms and accept all household deposits (4.56). Firms are not credit constrained (4.57). We suppose that banks do not profit, deposits earn the same interest rate of loans granted to firms. If the amount of loans exceeds the deposits, banks take on advances from the Central Bank, on which they pay interests. Otherwise, if deposits exceed loans, commercial banks will acquire government bills (4.58), as in Bortz (2014). Governments provide all bills demanded by commercial banks (4.59).

$$D_i^S = D_i^D \tag{4.56}$$

$$L_i^S = L_i^D \tag{4.57}$$

$$\begin{cases} A_i^D = L_i^S - D_i^S, & \text{if } L_i - D_i > 0 \\ Bb_i^D = D_i^S - L_i^S, & \text{otherwise} \end{cases} \tag{4.58}$$

$$Bb_i^S = Bb_i^D \tag{4.59}$$

Central Banks

The Central Bank of each country provides all the cash households demand (4.60). It also provides advances to commercial banks, if loans exceed the deposits (4.61). The changes in the stock of domestic government bills held by Central Banks are equal to the net changes in their liabilities (4.62, 4.63). It is assumed that the government one provides all the bills demanded by the central bank to manage the liquidity in the economy and to keep the policy interest rate constant (4.64). Country one is assumed to be the issuer of the internationally accepted currency, so it does not accumulate foreign reserves (it does not buy bills issued by government of country two). The Central Bank of country two holds foreign reserves, buying bills issued by the government of country one. The changes in the stock of domestic bills held by the Central Bank two must take the acquisition of international reserves into account (4.63).

The government of country two will supply to its central bank all the bills that are not supplied to domestic and foreign households (and commercial banks, when this is the case) (4.65). As in country one, the demand and supply of domestic government bills to the Central Bank two must equal each other, but there is no need for such an equation, for it will result from the other equations of the model (redundant equation). In the fixed exchange rate regime, the government of country one will supply to the central bank of country two all the bills which are not acquired by households of both countries and by the central bank of country one (4.66). The foreign reserves demand by country two will be equal to the supply by country one divided the exchange rate (4.67). As it is a regular feature of the relation between governments and central banks, central banks transfer their profits to governments (4.68, 4.69). Following one of the alternatives presented in Godley and Lavoie (2005)[7], if the bills held by each central bank do not suffice for purposes of monetary policy (keeping the policy interest rates and/or acquiring international reserves), the government will make deposits at the central bank, corresponding to the shortage of bills (4.70, 4.71).

We assume that policy interest rates are the same in both countries and that the rates of return of other assets are equivalent to the policy rates (4.72), with the exception of the rates of return of equity which are endogenous.

$$H_i^S = H_i^D \tag{4.60}$$

$$A_i^S = A_i^D \tag{4.61}$$

[7]Godley and Lavoie (2005) also suggest that Central Banks could issue their own bills and exchange them for Treasury bills held by the private sector.

$$Bcb^D_{1,1} = Bcb^D_{1,1_{-1}} + \Delta H^S_1 - \Delta A_1 + \Delta D_{G_1} \tag{4.62}$$

$$Bcb^D_{2,2} = Bcb^D_{2,2_{-1}} + \Delta H^S_2 - \Delta Bcb^S_{2,1}.e_{n_2} - \Delta A_2 + \Delta D_{G_2} \tag{4.63}$$

$$Bcb^S_{1,1} = Bcb^D_{1,1} \tag{4.64}$$

$$Bcb^S_{2,2} = B^S_2 - Bh^S_{2,2} - Bh^S_{1,2} - Bb^S_{2,2} \tag{4.65}$$

$$Bcb^S_{2,1} = B^S_1 - Bh^S_{1,1} - Bh^S_{2,1} - Bcb^S_{1,1} - Bb^S_{1,1} \tag{4.66}$$

$$Bcb^D_{2,1} = \frac{Bcb^S_{2,1}}{e_{n_1}} \tag{4.67}$$

$$Fcb_1 = i_1 Bcb_{1,1_{-1}} + i_a A_{1_{-1}} - i_1 D_{G_{1_{-1}}} \tag{4.68}$$

$$Fcb_2 = i_2 Bcb_{2,2_{-1}} + i_1 Bcb_{2,1_{-1}} e_{n_2} + i_a A_{2_{-1}} - i_2 D_{G_{2_{-1}}} \tag{4.69}$$

$$D_{G_1} = \begin{cases} A_1 - H_1, & \text{if } H_1 - A_1 < 0 \\ 0, & \text{otherwise} \end{cases} \tag{4.70}$$

$$D_{G_2} = \begin{cases} A_2 + Bcb_{2,1} - H_2, & \text{if } H_2 - (A_2 + Bcb_{2,1}) < 0 \\ 0, & \text{otherwise} \end{cases} \tag{4.71}$$

$$i_1 = i_2 = i_l = i_m = i_a \tag{4.72}$$

Current and Capital Accounts

To complete the framework of this system of two economies, we must present the current and capital accounts. The current account is the sum of net exports and net income, which in this model is composed only by interest paid on government bills (and include the interest paid on reserves in the case of a fixed exchange rate regime). As for the capital account, it represents the net changes in government bills and international reserves included in the case of a fixed exchange rate regime.

$$CA_1 = X_1 - IM_1 + i_2 Bh^S_{1,2_{-1}} e_{n_1} - i_1 Bh^S_{2,1_{-1}} - i_1 Bcb^S_{2,1_{-1}} \tag{4.73}$$

$$CA_2 = X_2 - IM_2 + i_1 Bh^S_{2,1_{-1}} e_{n_2} - i_2 Bh^S_{1,2_{-1}} + i_1 Bcb^S_{2,1_{-1}} e_{n_2} \tag{4.74}$$

$$KA_1 = \Delta Bh^S_{2,1} - \Delta Bh^S_{1,2} e_{n_1} + \Delta Bcb^S_{2,1} \tag{4.75}$$

$$KA_2 = \Delta Bh^S_{1,2} - \Delta Bh^S_{2,1} e_{n_2} - \Delta Bcb^S_{2,1} e_{n_2} \tag{4.76}$$

Floating exchange rate regime

If we move to a floating exchange rate regime, we can consider the level of international reserves held by the central bank of country two as given. This is what is shown in equation 4.63FL: the changes in the domestic bills held by central bank of country two no longer reflect changes in international reserves in order to keep the exchange rate constant, since the exchange rate now is endogenous and adjusts the supply and demand of foreign assets (equation 4.77).

While in the fixed exchange rate regime, the demand of the central bank of country two for government bills resulted from other equations, here we have a different closure for the economy and need to bring this equation back in (4.65FL). Now the supply of bills to households of country two will be what is left after the government provided all the bills the central bank and foreign households demanded (and commercial banks, when this is the case) (equation 4.19B). Considering that the household demand for bills is determined by the portfolio equations, if the model is consistent, it should follow that the supply of bills to households and household demand for bills of country two should equal each other without the need for such an equation. So equation 4.19 for country two is the redundant equation when we are dealing with a floating exchange regime. The rule for government deposits will be the same for both economies in the flexible exchange rate regime (4.78).

$$Bcb^D_{2,2} = Bcb^D_{2,2_{-1}} + \Delta H^S_2 - \Delta A_2 + \Delta D_{G_2} \tag{4.63FL}$$

$$e_{n_1} = \frac{Bh^S_{2,1}}{Bh^D_{2,1}} \tag{4.77}$$

$$Bcb^S_{2,2} = Bcb^D_{2,2} \tag{4.65FL}$$

$$Bh^S_{2,2} = B^S_2 - Bh^S_{1,2} - Bcb^S_{2,2} - Bb^S_{2,2} \tag{4.19B}$$

$$Bh^S_{1,1} = Bh^D_{1,1} \tag{4.19A}$$

$$Bh_{1,2}^{S} = Bh_{1,2}^{D} e_{n_2} \tag{4.24A}$$

$$Bh_{2,1}^{S} = B_{1}^{S} - Bh_{1,1}^{S} - Bcb_{2,1}^{S} - Bcb_{1,1}^{S} - Bb_{1,1}^{S} \tag{4.24B}$$

$$D_{G_i} = \begin{cases} A_i - H_i, & \text{if } H_i - A_i < 0 \\ 0, & \text{otherwise} \end{cases} \tag{4.78}$$

4.3 Short-run and long-run equilibrium conditions

For each country, real domestic output is the sum of household consumption, firms investment, government expenditures and net exports (equation 4.79). The term $e_{r_i} im_i$ represents imports in real terms and reflects the fact that import prices are defined abroad. If we substitute equations 4.12, 4.30, 4.3, 4.38 and 4.39 into equation 4.79 and normalize it by the opening stock of capital, we get the short run capacity utilization rate for each one of the economies (equation 4.80). We notice that, through exports, the level of activity in one country affects the utilization rate in the other country. Besides that, the ratio of capital between the two economies – defined in equation 4.81 – also affects the utilization rate of each economy: that is, the larger economy two in relation to economy one, the larger the effect of external demand through exports on the domestic level of activity of country one and vice-versa. The supermultiplier appears in the large parenthesis and so far is similar to the one presented in a closed economy model (chapter 2), since it only considers the effects of the domestic induced expenditures, with the addition of the effect of induced imports. It is worth noticing that the capital accumulation rate appears in the multiplier due to the effect of consumption out wealth on the short-run utilization rate. Besides that, the effect of induced government expenditures appears divided by the output growth rate, since we assume governments to decide how much to spend based on the output in the beginning of the period.

$$y_i = c_i + id_i + gd_i + x_i - e_{r_i} im_i \tag{4.79}$$

$$u_i = \left(\frac{1}{\left(1 + g_{k_{i_{-1}}}\right) \left[1 - \alpha_{1i}(1 - \tau_i)(1 - \pi_i) - h_i + er_i m_i - \dfrac{\sigma_i}{1 + g_{y_{i_{-1}}}} \right]} \right) \left[\alpha_{2i} v_{h_{i_{-1}}} + m_j \frac{u_j}{v_j} \kappa_i (1 + g_{k_{i_{-1}}}) \right] \tag{4.80}$$

$$\kappa_i = \frac{k_{j_{-1}}}{k_{i_{-1}}} \tag{4.81}$$

We can go a little bit further if we substitute the utilization rate of the other economy into equation 4.80. After some algebraical manipulation, we get equation 4.80A. To simplify the reading of equation 4.80A, we grouped the inverse of each country's domestic multiplier in the variable β_i (equation 4.82). This equation shows that, since we are now in an open economy, part of the domestic autonomous expenditure (consumption out of wealth) will leak to abroad, which is represented by the term β_j (which we assume to be lower than one and positive if savings react more than investment to changes in output and capacity in each economy) multiplying domestic consumption out of wealth. On the other hand, the consumption out of wealth of foreigners will also have a positive impact in the domestic utilization rate through exports, cet. par.. This impact will be larger, the larger the relative size of the other economy, the other economy's propensity to import and the domestic capital accumulation rate. The supermultiplier now is a combination of both economies domestic multipliers and, as a consequence, both endogenous investment accelerators (h_i, h_j) have a role to play in each country's level of activity.

$$u_i^* = \frac{v_i \left[\beta_j \alpha_{2i} v_{h_{i_{-1}}} + m_j \kappa_i (1 + g_{k_{i_{-1}}})(\alpha_{2j} v_{h_{j_{-1}}})\right]}{\beta_i \left[\beta_j - m_j m_i (1 + g_{k_{i_{-1}}})(1 + g_{k_{j_{-1}}})\right]} \tag{4.80A}$$

$$\beta_i = \left(1 + g_{k_{i_{-1}}}\right) \left[1 - \alpha_{1i}(1 - \tau_i)(1 - \pi_i) - h_i + e_{r_i} m_i - \frac{\sigma_i}{1 + g_{y_{i_{-1}}}}\right] \tag{4.82}$$

For the system of two-countries to be in equilibrium in the long run, two conditions must be satisfied: (a) both utilization rates should converge to the normal utilization rate (or inertia zone); (b) all stocks and flows in both economies must grow at the same rate. Bearing these conditions in mind, we move directly to simulation experiments to analyse how growth in both countries is affected by the expansion in demand in one of the countries in the long run – provided that the dynamics of the model is too complex to explore the system of dynamic equations of the stocks or to find an equation for the long-run equilibrium growth rate.

4.4 Experiments

We run simulation experiments from a system's steady growth state, in which both economies are growing at the same initial rate, to evaluate the long run aspects of the model. The same experiments are run for both exchange rate regimes. The results for the shocks to a fixed exchange rate regime are presented in what they differ from the results of the same shock to a flexible exchange rate regime. The three experiments are: (a) a reduction in firms' mark-up in one of the countries; (b) an increase in the propensity to consume out of after-tax wages in one of the countries; (c) a reduction in the propensity to import in one of the countries.

4.4.1 The paradox of costs

In a flexible exchange rate regime, a decrease in the mark-up on unit costs of the firms in country one[8] will reduce sales prices and, since the nominal wage rate is fixed, there will be an increase in the wage share of workers in this country. This redistributive shock in the central country will boost domestic activity, through a higher consumption out of after-tax wages, increasing the utilization rate above the normal rate of utilization. This process will trigger firms' investment reaction (there will be a higher propensity to invest), culminating in an accelerating rate of capital accumulation. So far, there is no difference from what would happen in a closed economy. However, the initial boost in activity also stimulates imports made by firms of country one, which will have an impact on exports of the peripheral country. The increase in exports of country two will warm up economy two leading, on the one hand, to an increase in capacity utilization which will change firms' expected rate of growth, fastening the pace of capital accumulation as was the case for country one (figures 4.1a, 4.1b and 4.1c); and, on the other hand, to an increase in imports of the subordinated country, which will expand exports of the key currency country as well, diminishing the initial gap on the trade balance (figure 4.1d).

This process is accompanied by a real depreciation of the currency of shocked economy due to the increase in the ratio of relative domestic sales prices (prices will be lower in country one when compared to country two) and also due to the nominal depreciation of its currency (figure 4.1e). What happens in this case is that as firms' financial needs for investment exceed their retained earnings, they increase the demand for new loans. Since firms' demand for loans will exceed households deposits, central banks will pass on larger advances to banks, which keep on accommodating firms' demand for loans. As the central bank one sells government bills to cover the demand for advances in excess of money demand, eventually it will fall short of the necessary bills [9] for managing interest rates, forcing the government to increase its deposits at the central bank. The higher supply of bills issued by government of country one will surpass foreigner households' demand for these assets leading to the nominal depreciation of the currency. It is worth stressing that there is also a relative reduction in domestic demand for these assets due to the increase in the rate of return of the equities held by households in the long run (see the paragraph on household wealth).

The depreciation of currency one, making the sales of firms in economy one cheaper abroad, will also increase the country's 'competitiveness' reversing part of the decrease in the profit share brought about by the reduction in the mark-up. Besides that, the depreciation will contribute to diminish the trade deficit of country one, since it negatively affects its imports. The opposite happens to economy two: the appreciation of its currency makes imports cheaper for firms, reducing its sales' prices, which will lead to an increase in the wage share (since the nom-

[8] In the flexible exchange rate regime, we phrase the results considering a shock to the economy one to render the text easier to read, but it is indifferent which economy is shocked in that case.

[9] This does not need to be the case, it depends on the amount of bills held at the central bank.

inal wage rate is fixed and there are no further changes in the mark-up), reflecting negatively on its trade surplus and positively on its domestic demand (higher wages and consumption).

In both economies government debt to capital ratio will be lower in the long run in comparison to the baseline scenario. The stimulus to activity coming from the larger wage share in both countries will, on the one hand, increase government expenditures (induced by income in this simplified framework), but on the other hand, it will increase household income. Since household income increases in relation to total income (and so does taxed income), in the short run there will be a reduction in primary and total government deficit (to income). Even if the reduction in government deficit is be larger in central country in the short run, it will stabilize at a higher level in relation to country two in the long run due to the higher levels of deposits it keeps at the central bank, which explain why the government debt to capital ratio will be higher in country one than in country two after the shock (figure 4.1f).

Firms' loans to capital ratio will be higher than in the baseline for both economies. This happens due to the fact that investment increases more than retained earnings, so firms need to recur more intensively to external funding – even if in the short run there is an increase in the equities as a source of finance for firms. Firms' loans to capital ratio will also be higher in country one in comparison to country two due to the larger drop in the profit share in country one and, thus, in its firms' retained earnings (figure 4.1a).

Regarding the profit rates, we notice that firms in the partner economy observe higher net and gross profit rates in the short run, since the initial positive effect on the utilization rate is larger than the decrease in the profit share due to the appreciation of the country's currency, which prevails in the long run. In the case of country one, the increase in the utilization rate and the depreciation of the currency counterbalance the negative effect of the reduction in the mark-up in the short run (figures 4.2b and 4.2c).

Household wealth to capital ratio in both countries will initially fall owing to the temporary reduction in the rate of return of equities which will lead to a lower household demand for these assets and, consequently, to a fall in their prices and a short term capital loss. The temporary reduction in the rate of return of equities is related to the reduction in the profit share which contributes to reduce distributed profits. The increase in consumption out of wages, which is higher than the increase in disposable income in the short run, will also reduce household savings to income and thus household wealth to capital. However, as soon as the effect of consumption on activity stimulates investment, the rate of return of equities will increase triggering capital gains, accelerating household wealth accumulation (see figures 4.3a and 4.3b) so that household wealth to capital ratio will now be temporarily higher than in the baseline scenario. These short run effects are higher in country one than in country two (figure 4.2d). In the long run, the rate of return of equities stabilize at a higher level in comparison to the baseline due to the increase in the ratio of distributed profits to the market value of equities. As the rate of return of equities will be slightly higher in country two this translates in to a slightly higher wealth to capital ratio in the second economy in relation to the first one.

Country one (two) also experiences short term capital gains (losses) from its currency depreciation (appreciation), which contribute to reduce the current account deficit (surplus) in country one (two), since it will increase (reduce) relatively the amount received as interest on foreign assets by households of country one (two) (figure 4.2e). In the long run, as capital gains fade away, the persistent effect on wealth is the one arising from the higher multiplier (and accelerator) of income. Since the average growth of household wealth will be lower than the capital accumulation rate, household wealth to capital ratios will be lower than in the baseline for both countries (figure 4.2d).

As in the case of a closed economy (see chapter 2), income distribution still has a permanent effect on growth in the long run, since the growth rate in both countries is permanently higher after a decrease in the mark-up of economy one. Through trade relations and through the financial movements represented by the exchange rate, activity and growth in one country are able to affect activity and growth in the other country. Smaller profit shares are still associated with larger capital accumulation rates in the long run, though not with higher profit rates.

It is worth to highlight that still, as in the original supermultiplier framework (Serrano, 1995a; Freitas and Serrano, 2015; Allain, 2015b; Lavoie, 2016), as investment increases in relation to output, the autonomous expenditure component, both for each country (consumption out of wealth and exports) and for the system as a whole (consumption out of wealth), decreases in relation to output.

We should further stress that if firms in both countries reduce their mark-ups (in the same proportion of the shock to an individual economy), growth in both economies will be higher than if only firms in one country reduce the mark-up. This reinforces the case for coordination among countries for expanding domestic demand (La Marca, 2010; Von Arnim et al., 2014), which might lead to faster growth and to higher long run growth rates (figure 4.2f).

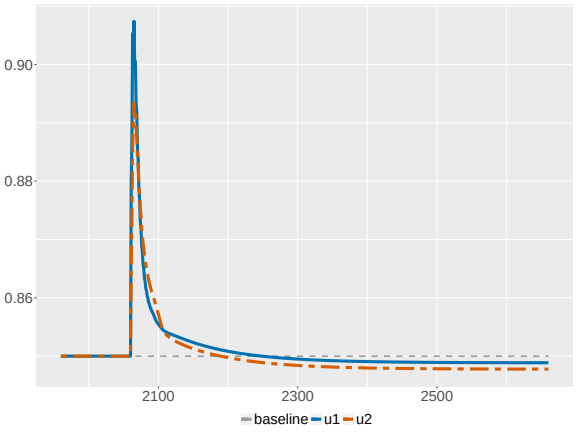
Fixed exchange rate

The results of the same shock for a fixed exchange rate regime will differ regarding: (a) the government debt dynamics, since one of the economies acquires reserves from the other one to keep the nominal exchange rate constant; (b) the results on the trade balance and on the current account; (c) the income distribution. Since the government and the central bank of these economies now have different behaviours, the results of the shocks also depend on which economy is expanding the demand: the one which accumulates reserves or the one issuing the internationally accepted currency.

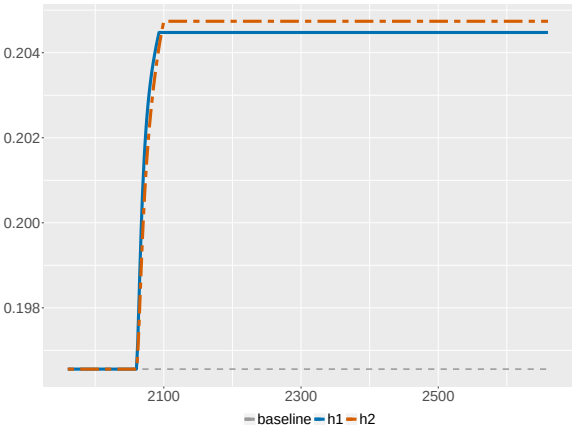
If firms of the country which issues the internationally accepted currency (one) reduce their mark-up, this will be accompanied by a reduction in the government debt to capital ratio in comparison to the baseline. However, the decrease in country one's government debt to capital ratio will be partially compensated by the process of reserves accumulation in country two in order to keep the nominal exchange rate constant. The country expanding demand is also the country experiencing a trade and current account deficit – larger in the fixed exchange rate regime, since

Figure 4.1: Effects of an increase in real wages in country one (reduction in μ_1) in a flexible exchange rate regime

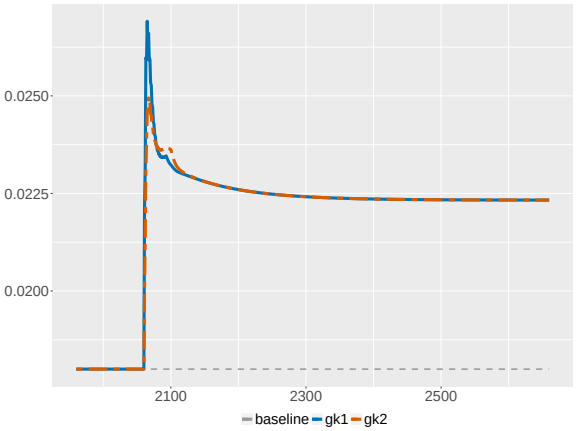
(a) Capacity utilization rates



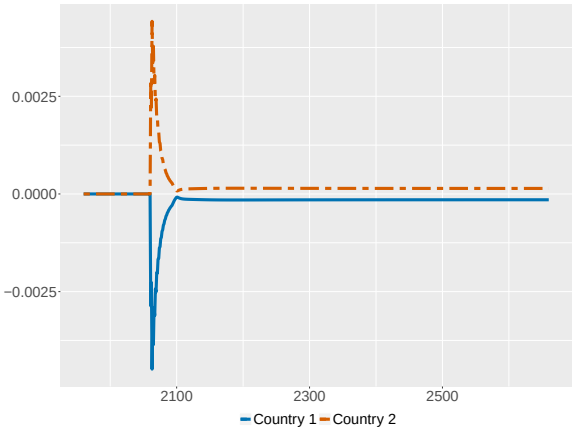
(b) Firms propensities to invest



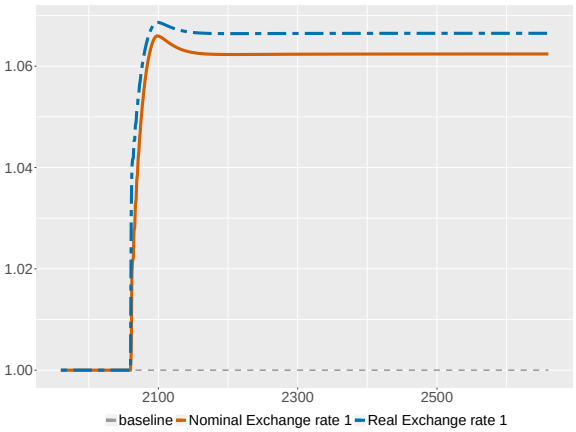
(c) Capital accumulation rates



(d) Trade balance as share of output



(e) Exchange rates



(f) Government debt to capital ratios

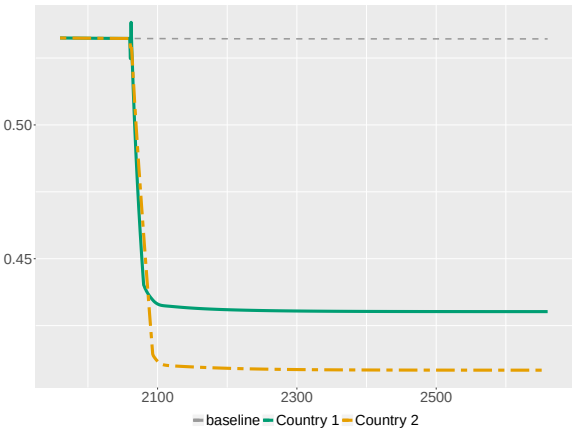
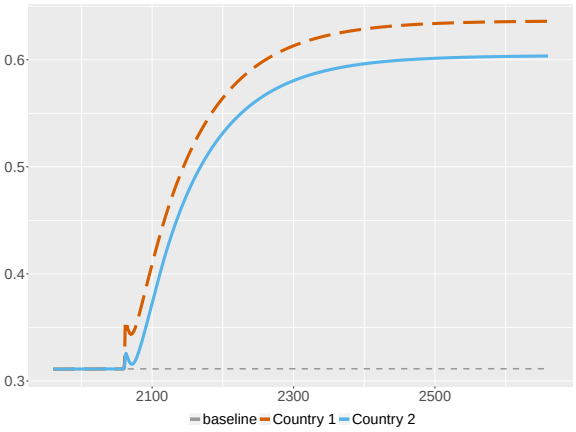
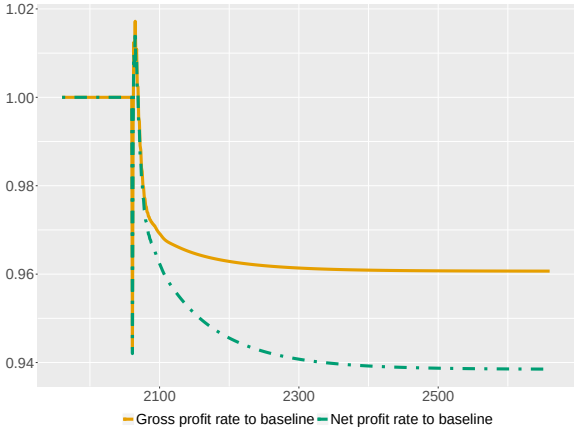


Figure 4.2: Effects of an increase in real wages in country one (reduction in μ_1) in a flexible exchange rate regime

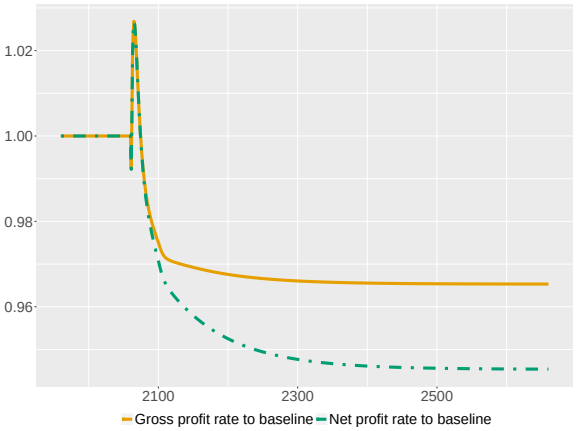
(a) Firms loans to capital ratios



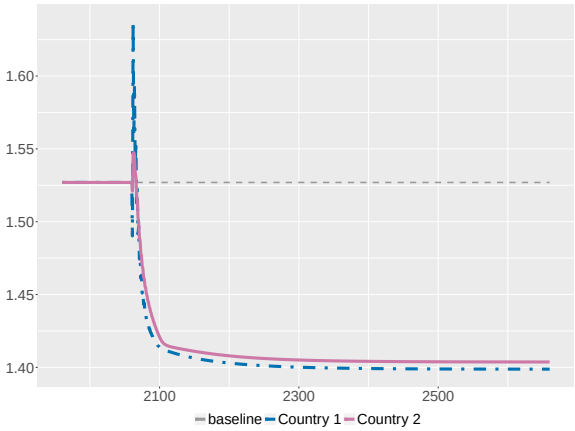
(b) Profit rates country one



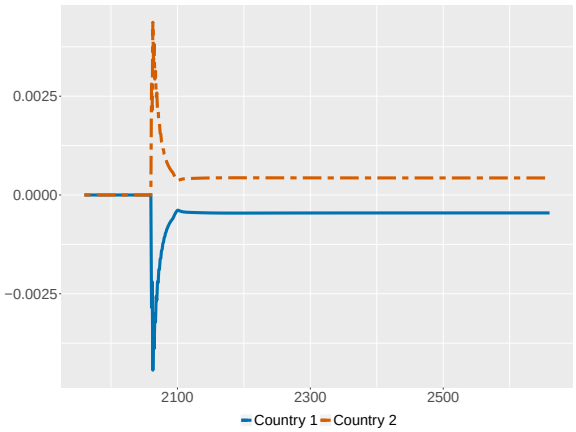
(c) Profit rates country two



(d) Household wealth to capital ratios



(e) Current accounts as share of output



(f) Compared growht rates

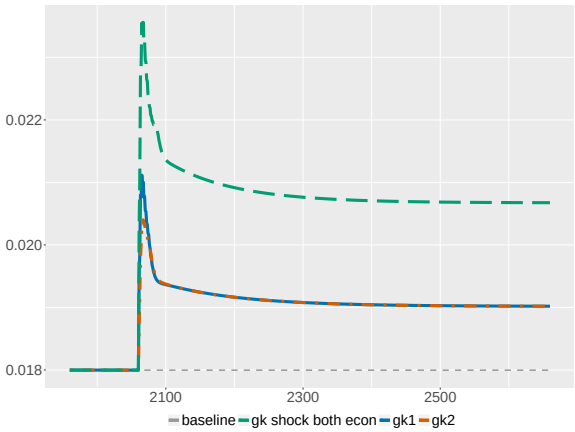
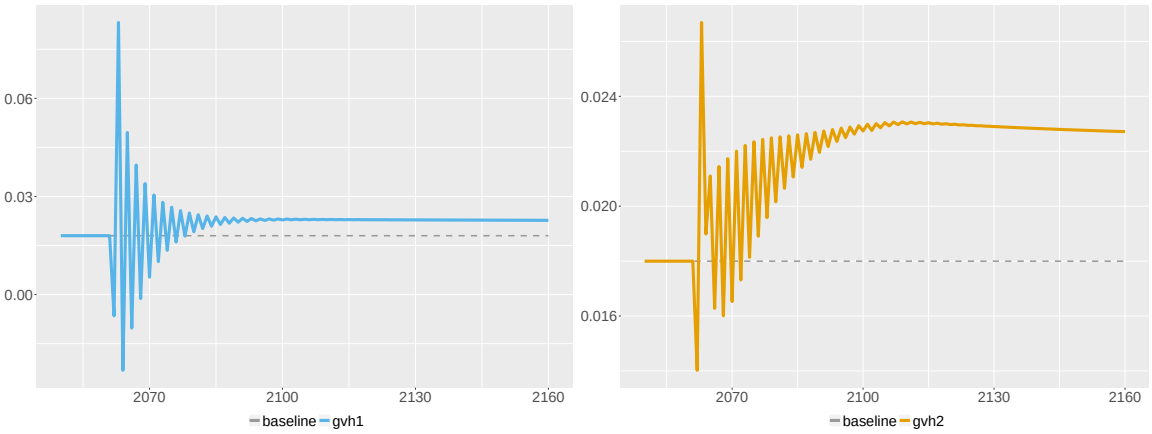


Figure 4.3: Household wealth growth rates after a reduction in firms' mark-up in country one

Flexible exchange rates

(a) Country one

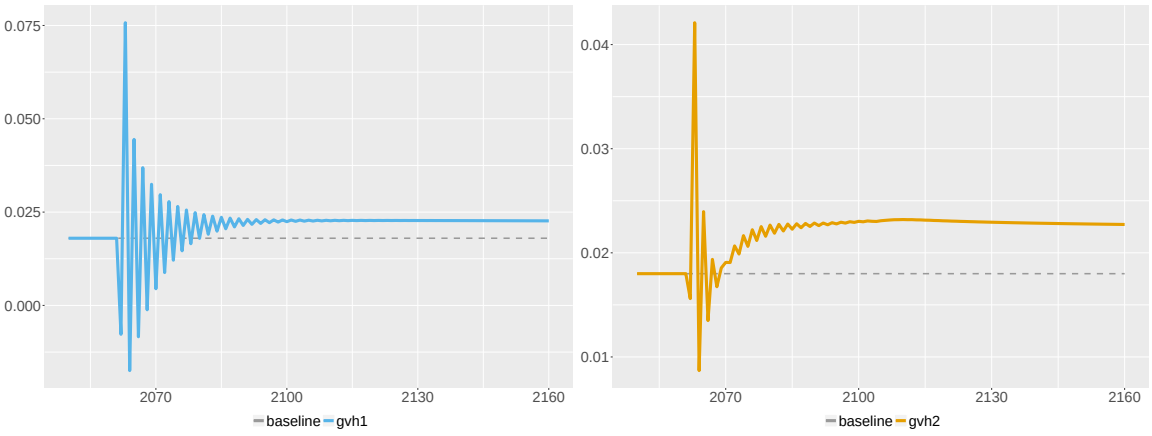
(b) Country two



Fixed exchange rates

(c) Country one

(d) Country two



they are not partially compensated by the nominal exchange rate movements (figures 4.4d and 4.4e)–, meaning it will need to increase the offer of domestic assets to foreigners to cover the income it remits to the other country. The increase in demand by households of country two is not enough to absorb all the supply of these assets (there is a decrease in the normalized demand), so that the central bank of country two absorbs its excess in the form of international reserves (figures 4.4a, 4.4b and 4.4c).

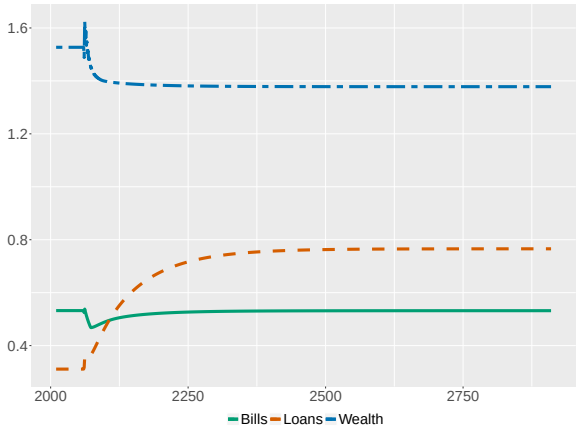
As for the case that firms of the second country reduce their mark-up, this will be accompanied by a trade account deficit. As firms in this economy demand a larger amount of loans to finance investment, which on the other hand will increase advances banks take from the central bank (since loans exceed deposits), the central bank is forced to sell its international reserves. Since central bank two sees its international reserves getting depleted, eventually some policy measure will have to be taken: to devalue the currency, to let the nominal exchange rate fluctuate or to raise the policy interest rate. It is worthwhile stressing that whether any of these measures will have to be taken sooner or later will depend on the initial stock of international reserves and on the magnitude of the trade deficit following the demand shock. These results are in line with those presented by Godley and Lavoie (2005) and it should be so, as we present a similar closure for the model.

As the nominal exchange rate is fixed, the real exchange rate will be affected only by changes in relative sales prices. Since there will be a decrease in prices in the country reducing the mark-up, this will make its imports more expensive and imports by the benefiting country cheaper. Consequently, sales prices will be reduced in the benefiting country as well. Since prices will be lower in the country expanding demand than in the benefiting country, the country expanding demand (partner country) sees a relative improvement (worsening) in the ratio of relative domestic sales prices, which translates into a real depreciation (appreciation) of its currency. The reduction in prices in the benefiting country will also mean a redistribution towards wage earners. So changes in income distribution in the economy which is expanding domestic demand will still have an impact on income distribution of the other country in the fixed exchange rate regime, if changes in relative domestic sales prices are observed.

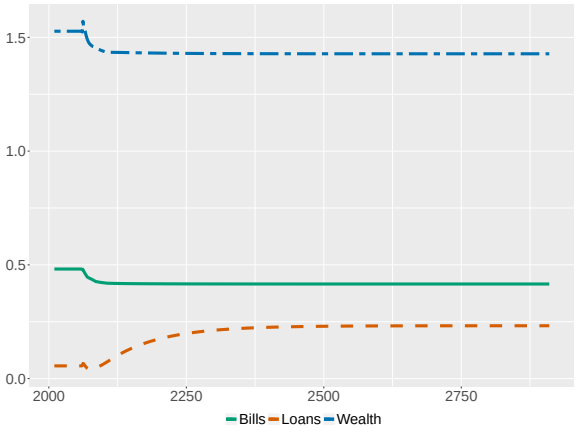
We already mentioned that short run oscillations in household wealth growth rates happen due to the changes in the capital gains accruing from changes in the price of equity and in the nominal exchange rate. This indicates that the exchange rate regime plays a role not only as a determinant of income distribution in the model but as a determinant of the relative distribution of *wealth* between countries. In the case of a reduction in the mark-up of firms in country one, while household wealth growth in country one will be, on average, higher in the flexible exchange rate regime (due to capital gains from foreign assets), household wealth growth in country two will be higher in the fixed exchange rate regime (no capital losses regarding the foreign assets) (figures 4.3c and 4.3d).

Figure 4.4: Effects of an increase in real wages in country one (reduction in μ_1) in a fixed exchange rate regime

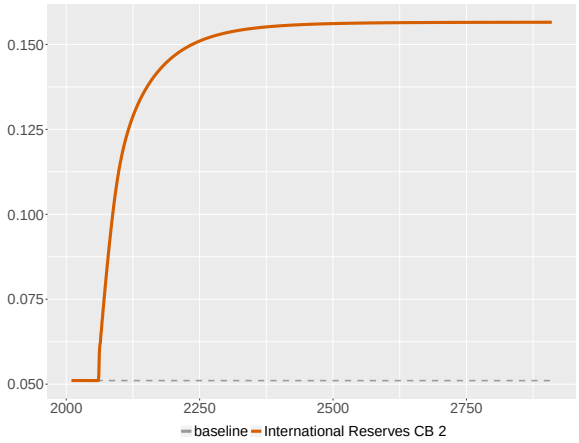
(a) Financial assets to capital ratios country one



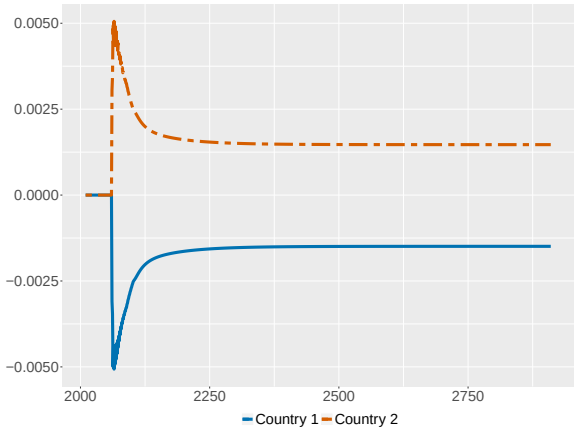
(b) Financial assets to capital ratios country two



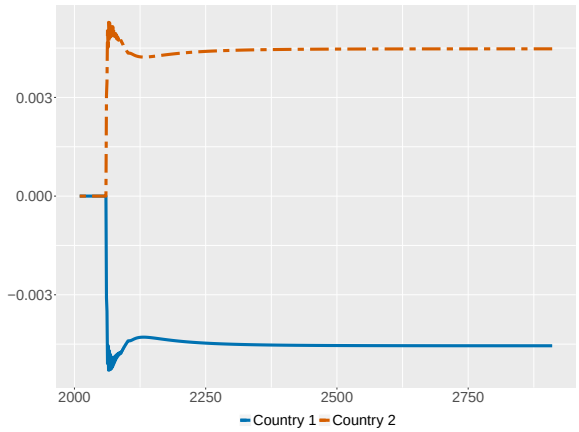
(c) International Reserves



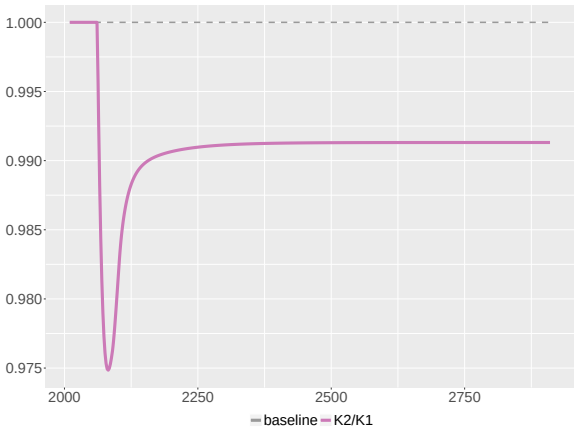
(d) Trade balance as share of output



(e) Current accounts as share of output



(f) Ratio of capital between the two economies



Capital stock ratio between the two economies: who wins relatively more after an expansion of demand?

Since we are dealing with two similar economies (identical in the flexible exchange rate regime), it seems worth to analyse a measure of the relative gain of these economies after an expansive shock to demand in one of them. Both countries will gain after an expansion of demand, however, what defines which one – the one expanding or the one initially just benefiting from the expansion in foreign demand – is gaining relatively more? The answer is closely tied to the trade gap, since a larger trade deficit means a larger part of domestic demand is leaking abroad. But that does not do trick alone, it all depends on the net effect of domestic and foreign demand on domestic investment demand and accumulation. We can name at least two factors which unambiguously affect the relative gain in the system's capital stock of an economy which is expanding demand, cet. par.: (1) the Marshall-Lerner condition, the price elasticities of demand for exports and imports; and (b) investment's speed of adjustment (γ_i) to deviations of the utilization rate (from the normal range).

Assume, for the flexible exchange rate regime, that firms of country one reduce their mark-up. As these firms increase investment to reply to the higher level of activity, they also increase the amount of imported inputs, leaking part of its demand to abroad. However, since we assume the Marshall-Lerner condition to hold ($\epsilon_{11} + \epsilon_{12} > 1$), the depreciation of the currency that follows the shock will minimize this effect through the positive effect on net exports (reducing the trade deficit). If we do the same experiment assuming the Marshall-Lerner condition does not hold ($\epsilon_{11}+\epsilon_{12} < 1$), the country which expands its domestic demand will see its capital stock decreasing in relation to the capital stock of the other economy, since there would be a lower positive effect of the depreciation[10] of its currency on net exports, meaning the feedbacks to the output of the partner economy, so to speak, would also be higher.[11] This gives rise to what Von Arnim et al. (2014) call a fallacy of composition: both economies grow faster if one of the economies expand its demand, however, the partner economy may benefit relatively more (figure 4.5a); if this same economy decides to contract demand in order to avoid the other's relatively larger gain, both economies will lose.

Moving to the second factor, it appears that the country in which firms reduce their mark-up will see its share of the system's capital stock increasing relatively more in the short run if its firms react faster than the firms in the other country to persistent changes in demand ($\gamma_1 > \gamma_2$). This happens despite the larger trade deficit in the country expanding demand when its firms

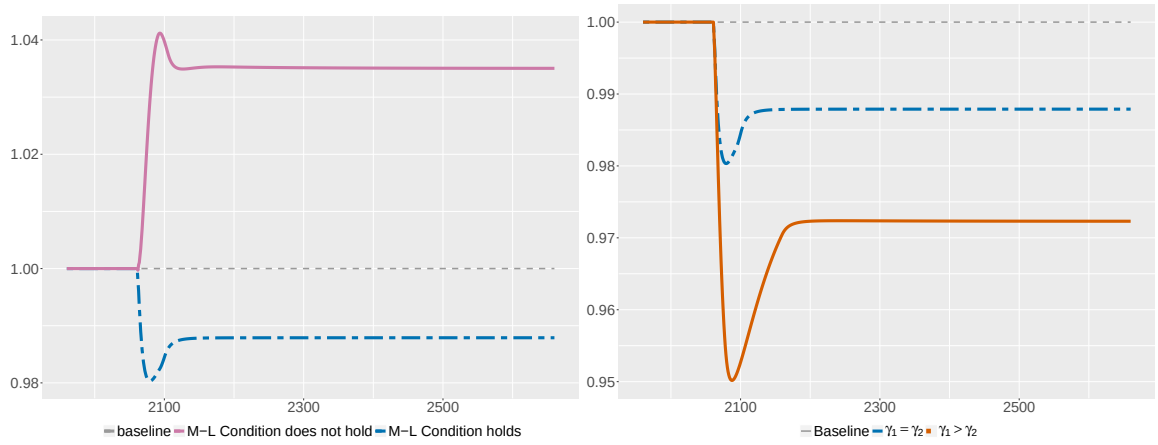
[10] In Von Arnim et al. (2014), the appreciating country always sees a decrease in its share of global demand (for a system of two identical countries). However, this is the case because the authors assume the Marshall-Lerner condition holds at all times. Whether the appreciating country increases its share of global demand or not depends more broadly on the changes of the import rate – which depends on the price (and income) elasticity of the demand for imports.

[11] It is not always the case that the country which expands domestic demand will see it's share in the system's capital stock decreasing considering that the Marshall-Lerner (M-L) condition does not hold. However, it will gain relatively less in relation to the partner economy if compared to the case in which the M-L condition holds. Whether the partner economy will increase its share in the system's capital stock or not is a matter of degree.

Figure 4.5: Capital stock ratio between the two economies ($\kappa_1 = \frac{k_2}{k_1}$) after a reduction in firms' mark-up in country one

(a) Marshall-Lerner condition

(b) Speed of adjustment of invesment



react faster to the increase in demand in comparison to the case in which firms in both countries react at the same speed ($\gamma_1 = \gamma_2$). Since imports happen within the business sector, they are related to higher investment rates. The accelerator effect through the inducement of a faster accumulation rate compensates the negative effect on output of a higher average propensity to import. From another angle, when firms in one of the countries are adjusting faster to the expansion of the demand they are reducing the interval in which the other economy can benefit from the out-of-equilibrium higher growth rate of external demand (figure 4.5b).

At last, the exchange rate regime might also play a role in which economy is gaining relatively more in the system's capital stock. However, the effect is ambiguous and will depend on the combination of the effects on the trade balance and of the effects of income redistribution on domestic demand in each country. For instance, in the case of a reduction of the mark-up in one of the economies, the economy expanding demand will gain relatively more in the flexible exchange rate regime than in the fixed one but for a tight margin (figures 4.4f and 4.5).

This happens because the redistribution towards wages in the subordinated economy will be larger in the flexible exchange rate regime (in comparison to the fixed one) following the shock to the mark-up, meaning a higher domestic demand and smaller gap in the countries' capital accumulation rates. So even if the country expanding demand ends up with a higher trade deficit it might increase relatively more its share in the system's capital stock in the fixed exchange rate regime, provided the other economy experiences a strong enough domestic income redistribution in the flexible exchange rate regime.

4.4.2 The paradox of thrift

We start, as usual, assuming a flexible exchange rate regime. An increase in the propensity to consume out of after-tax wages in the key currency country will immediately increase household consumption and reduce household savings. As in the previous experiment, the higher level of activity revealed in the increase of capacity utilization will lead to a reaction of firms which will raise investment, accelerating the capital accumulation rate. The stimulus to domestic demand also contributes to increase imports by country one, which will boost exports by country two. This process will lead to a higher utilization rate in country two as well, raising its firms investment and imports as a result (figures 4.6a, 4.6b, 4.6c and 4.6d).

Differently from the previous experiment, changes in income distribution between wage and profit earners come primarily from changes in the nominal exchange rate (there is no exogenous distributional shock). The nominal devaluation of currency one will increase the competitiveness of its firms, through the effect on the real exchange rate. However, this effect will be partially compensated by the increase in firms' sales prices due to higher costs of imports. The opposite happens in country two, firms' sales prices will be lower due to the cheaper imports, yet this is not enough to compensate the effect of the nominal appreciation on its real exchange rate. Since prices are higher (lower) in country one (two), there will be a redistribution of income towards profit (wage) earners (figure 4.6e).

Both countries will end up with a lower government debt to capital ratio in comparison to the baseline scenario and country one will once again have a higher government debt ratio in relation to country two (figure 4.6f). In this case, total government deficit to income in country one will be lower in comparison to the baseline but will be higher than in the other country in the long run – despite the sharp reduction in total government deficit in country one in the short run. This happens due to the increase in firms' profit share in country one. This reduces household income in relation to total income, reducing as well taxed income in relation to total income. By contrast, in country two the reduction in the profit share increases temporarily household income in relation to total income, increasing taxed income in relation to total income in the short run. The fact that government one needs to issue a larger amount of bills to finance its expenditures (in comparison to country two) combined with the sharper short run reduction in household wealth growth in country one and the increase in the rate of return of other assets in domestic households' portfolio (equities), which leads to a reduction in households' demand for domestic government bills, helps to explain the relatively higher supply of government bills to foreigners. This supply will be higher than foreign household demand for these assets, culminating in the nominal depreciation of currency one.

Firms' loans to capital ratio in country one will be lower in comparison to the baseline. The larger decrease in this ratio in the short run is due to the increase in retained profits and in equities as a source of finance – there will be a temporary increase in the value of newly issued equity in relation to capital since prices rise – at a faster pace than investment. In the

long run, as capital accumulation accelerates bringing the utilization rate back to its normal range, firms' loans to capital ratio increases but stabilizes at a lower level in comparison to the baseline, as there is a permanent increase in the profit share. In country two, as the faster increase in retained earnings (in relation to capital) comes from the higher level of activity and this is followed by a reduction in the profit share (and the increase in the value of newly issued equity is also temporary), the decrease in firms' loans to capital ratio will happen only in the short run. As investment accelerates more than retained profits and the value of newly issued equity, firms will recur more intensively to external funds, raising their loans in relation to the capital stock (figure 4.7a).

In what concerns the profit rates, firms in country one observe higher gross and net profit rates in comparison to the baseline due to the higher utilization rate (in the short run) and to the permanent increase in the profit share. Firms of country two experience higher gross and net profit rates in the short run owing to the increase in capacity utilization, but in the long run these rates stabilize at a lower level in comparison to the baseline as a result of the reduction in the profit share (figures 4.7b and 4.7c).

After the short run spike in equity prices – due to the higher rate of return of these assets caused by the increase in distributed profits in relation to the market value of equities – household wealth to capital ratios decline in both countries. Household wealth to capital ratio will be significantly lower in country one than in country two as a consequence of the initial shock to the propensity to consume out of after-tax wages which sharply reduces household savings. This effect is partially compensated by the capital gains accruing from the devaluation of currency one, which also contributes to reduce the country's current account deficit, increasing the relative amount it receives as interest on foreign assets held by domestic households. In country two, the increase in household savings, as a result of the higher wage income (and thus household income), positively contributes to household wealth growth. However, this effect is mitigated by the capital losses coming from the appreciation of currency two. Besides that, the oscillations in household wealth growth rates originated in the changes of equity prices are higher in country one, since there is an increase in the profit share of its firms which contributes to a higher rate of return on this asset (figures 4.7d and 4.7e).

An increase in the propensity to consume out of after-tax wages in one economy is associated with higher growth rates in both economies. Whether higher growth rates will be associated with higher or lower profit rates will depend on the movements in the nominal exchange rate, which change distribution across countries. In this case, the country expanding domestic demand sees its currency depreciating, which translates into a domestic redistribution of income towards profit earners. In other words, when the stimulus to demand does not originate in a domestic income redistribution, growth can be associated either with higher or lower profit rates.

As in the previous experiment, if the Marshall-Lerner condition holds, country one gains relatively more in the system's capital stock after an increase in the propensity to consume out

of after-tax wages. Likewise, both economies will grow at a faster pace if they both experience a higher propensity to consume than if just one of them does.

Fixed exchange rates

If households of country one increase their propensity to consume out of after-tax wages in a fixed exchange rate regime, this will still boost activity in country one, stimulating its imports and, consequently, exports by country two. Besides the permanent trade and current account deficit (figures 4.9d and 4.9e) in the country which is initially expanding demand, there will be no change in functional income distribution, since neither the nominal exchange rate changes nor do relative prices between the economies. These events help to shed some light on the differences in the movements of the financial assets ratios (in comparison to the case with flexible exchange rates) (figures 4.9a and 4.9b).

Since country one is expanding demand and faces a trade and current account deficit it will need to raise the supply of domestic government bills to foreigners to match its commitments in foreign currency. Provided that the households of country two see their demand for foreign assets increasing relatively less than their demand for domestic assets (due to the higher rates of return of equities), the central bank of country two will absorb the excess government bills issued by country one in the form of accumulated international reserves (figure 4.9c). So after the initial drop in total government deficit to income in country one owing to the higher level of activity and taxed income, there will be an increase in the deficit related to the larger amount of deposits kept at the central bank and, consequently, to the larger interest payments on bills (as a fraction of income or capital). As a result of the current account deficit and the accumulation of reserves by the peripheral country, country one presents a higher government debt to capital ratio in relation to the baseline in the long run while the second country presents a lower government debt to capital ratio. The opposite would happen if households of country two were to increase their propensity to consume out of after-tax wages, generating a trade and current account deficit which would lead to a reduction in the country's stock of international reserves.

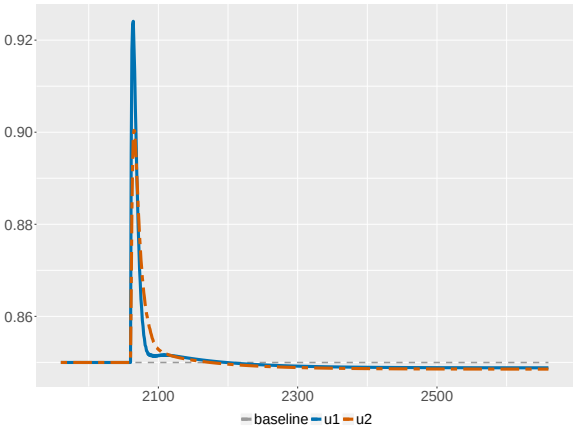
Differently from the flexible exchange rate regime, now in both economies firms' loans to capital ratio increases in the long run as investment accelerates more than retained earnings (profit shares remain unchanged). The increase in the value of newly issued equities as a fraction of capital is again short lived, meaning that sooner than later firms have to rely more intensively on debt to match their investment demand. For gross profit rates, this means any increase will be only temporary since the utilization rate goes back to a normal range in both countries. Net profit rates decline due to the higher fraction of profits committed with debt service.

As it was the case in the previous experiment as well, household wealth growth rates will be, on average, higher in country two and lower in country one if compared to the scenario with flexible exchange rates (figure 4.8).

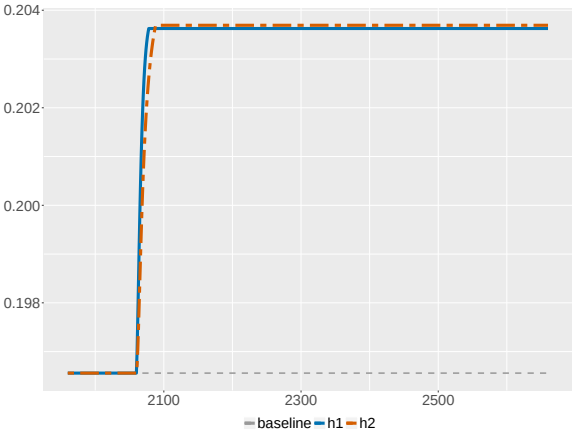
As we can see from figure 4.9f, a stimulus to domestic demand arising from a reduction in the propensity to save will have a permanent growth effect in both economies which is not

Figure 4.6: Effects of an increase in the propensity to consume out of after-tax wages (increase in α_{11}) in a flexible exchange rate regime

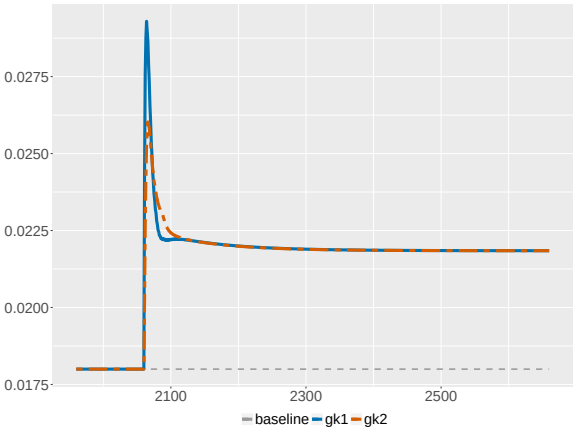
(a) Capacity utilization rates



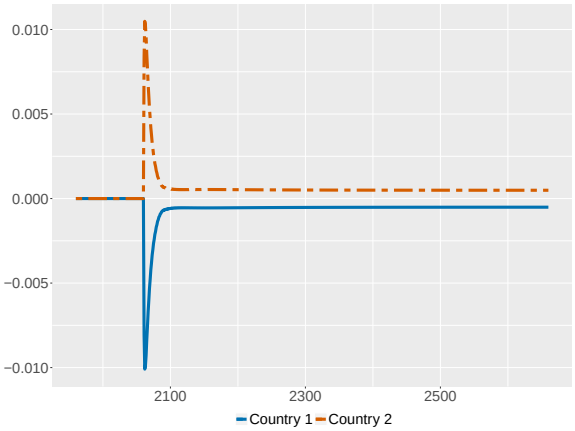
(b) Firms propensities to invest



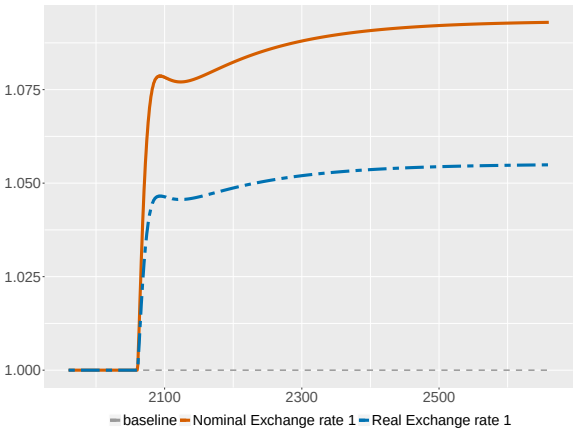
(c) Capital accumulation rates



(d) Trade balance as share of output



(e) Exchange rate



(f) Government debt to capital ratios

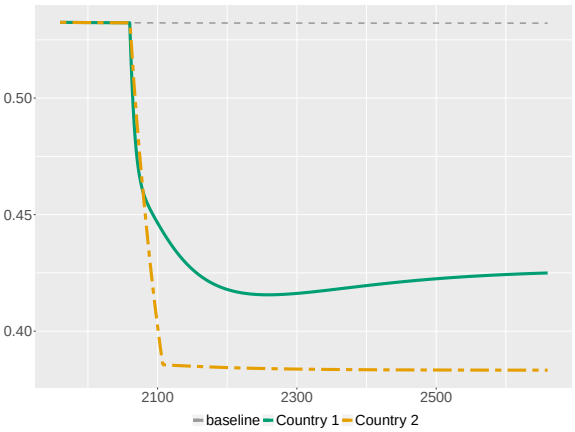
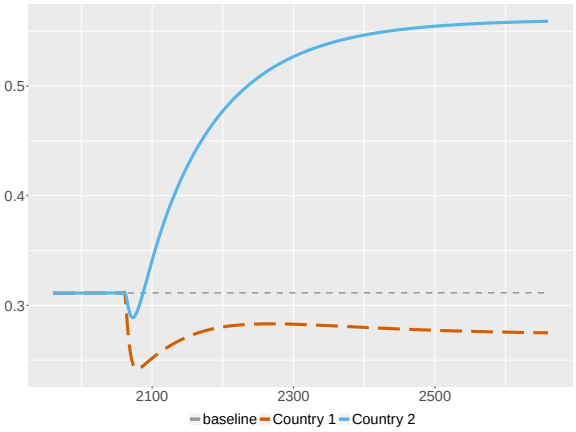
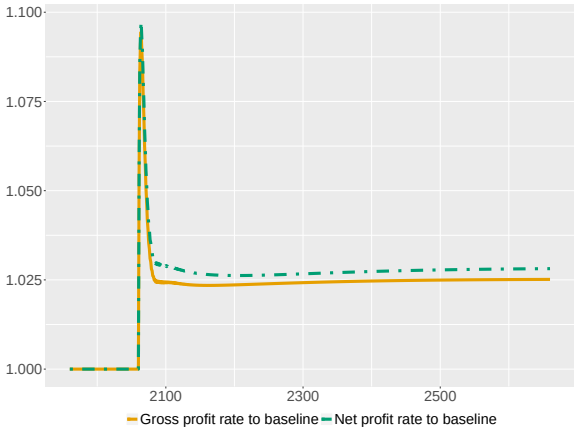


Figure 4.7: Effects of an increase in the propensity to consume out of after-tax wages (increase in α_{11}) in a flexible exchange rate regime

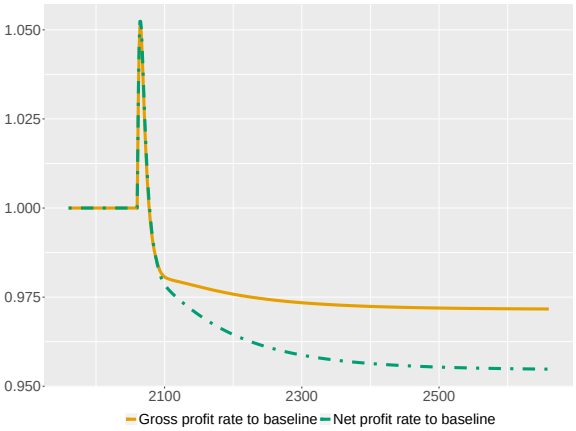
(a) Firms loans to capital ratios



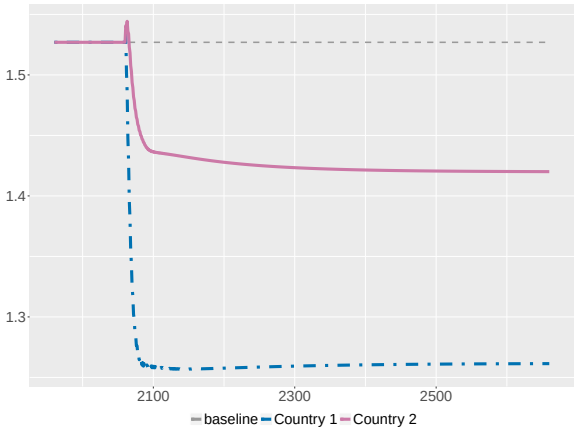
(b) Profit rates country one



(c) Profit rates country two



(d) Household wealth to capital ratios



(e) Current accounts as share of output

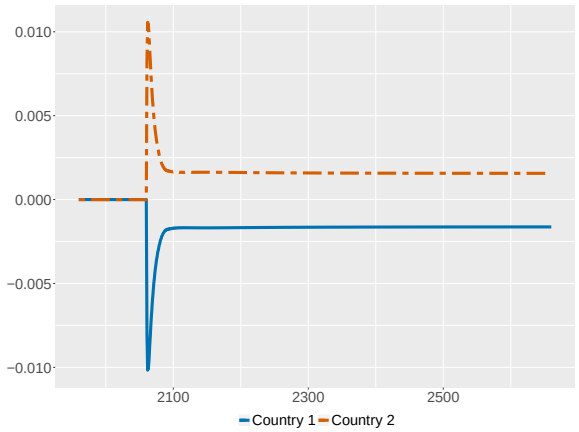
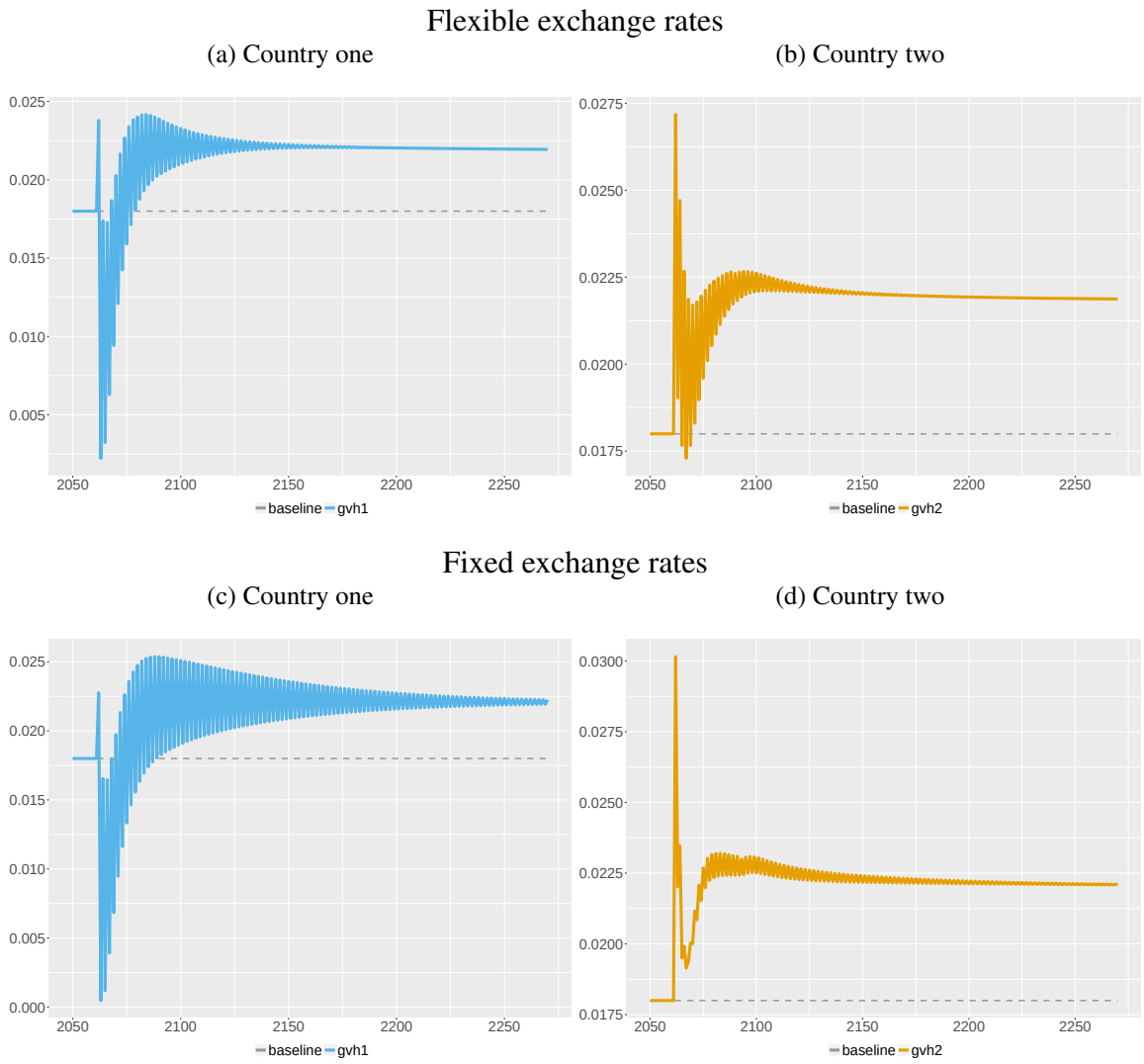


Figure 4.8: Household wealth growth rates after an increase the propensity to consume out of after-tax wages in country one



accompanied by any income redistribution domestically or abroad. The country which expands demand will present, cet. par., a permanent trade deficit but will still increase its share on the system's capital stock (owing to its higher capital accumulation rate). Yet when the second economy expands demand, its central bank may eventually run out of foreign reserves requiring some policy measure along the way.

4.4.3 A reduction in the propensity to import in one of the economies

At last, we briefly present the results of a reduction in the propensity to import in one of the economies for the flexible exchange rate regime, since the short run results differ from the previous experiments. If firms in country one reduce their propensity to import from country two, this will have initially a positive effect in economy one due to the trade surplus and a negative effect in economy two due to the trade deficit (figure 4.10a). After this initial shock, the lower level of activity in the partner economy will reduce its firms imports and, thus, exports by firms of country one, reducing the trade gap between the two economies (figure 4.10b).

Yet this is not the only effect of a reduction in the propensity to import. In this simplified framework, a reduction in the propensity to import also means there will be a decrease in the material input-output ratio, which reduces sales prices of firms in country one and as a result the profit share of economy one. Thus real wages and consumption increase reinforcing the initial positive effect on demand of net exports in country one and partially counterbalancing the negative effect of the initial slowdown in economy two.

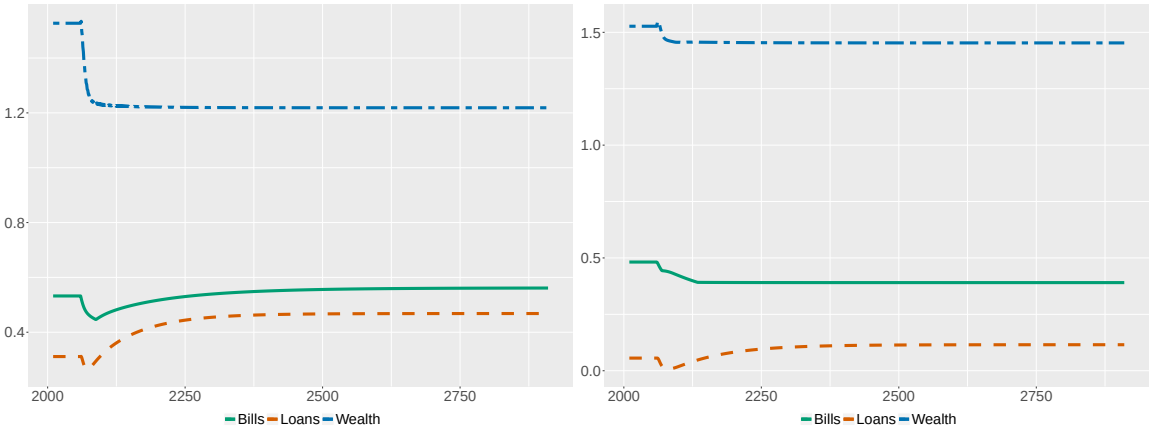
Both government debt to capital ratios decrease in relation to the baseline in the long run. However, two differences in relation to the other experiments are noticed: first, in the short run, there is an increase in government debt to capital ratio in country two; second, government debt to capital ratio in country one will stabilize at a lower level in comparison to country two (figure 4.10c). The former is explained by the lower level of activity, which reduces taxed income in relation to government expenditures, thus increasing the total deficit to income and requiring a faster expansion of government debt. As the peripheral country experiences a current account deficit (figure 4.10d), it has to increase the supply of government bills to foreigners which exceeds the demand for these assets by households of country one, leading to a temporary depreciation of currency two (figure 4.10e). What happens is that households of country one see their wealth increasing at a faster pace, but demand more equities in relation to the other assets, owing to the rise in the asset rate of return and following capital gains.

As a result of the temporary exchange rate capital gains and the slowdown in capital accumulation in economy two, household wealth to capital ratio will be temporarily higher in country two than in country one. As economy two recovers, the capital accumulation accelerates, reducing household wealth to capital ratio. In country one, the faster capital accumulation contributes to reduce equity prices, thus increasing relatively household demand for other assets. This helps to explain why currency one depreciates despite the lower government debt

Figure 4.9: Effects of an increase in the propensity to consume out of after-tax wages (increase in α_{11}) in a fixed exchange rate regime

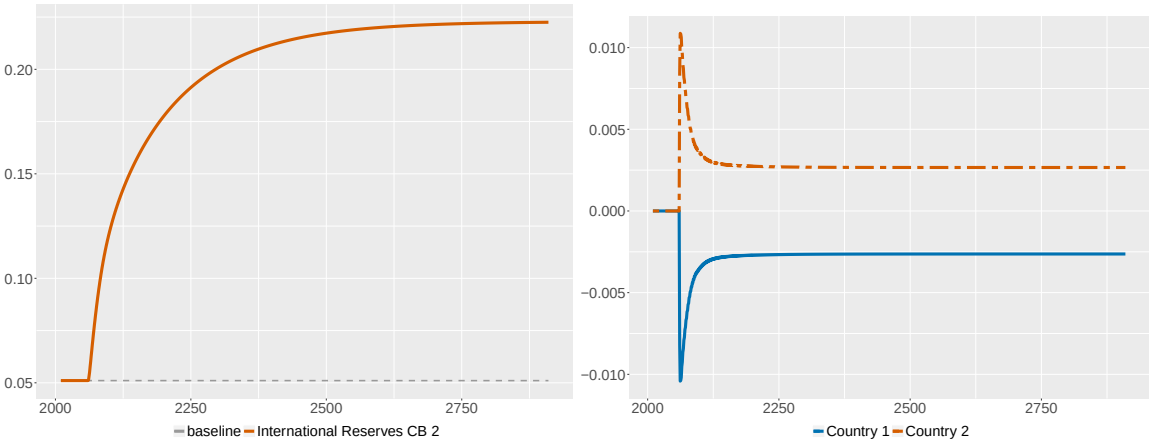
(a) Financial assets to capital ratios country one

(b) Financial assets to capital ratios country two



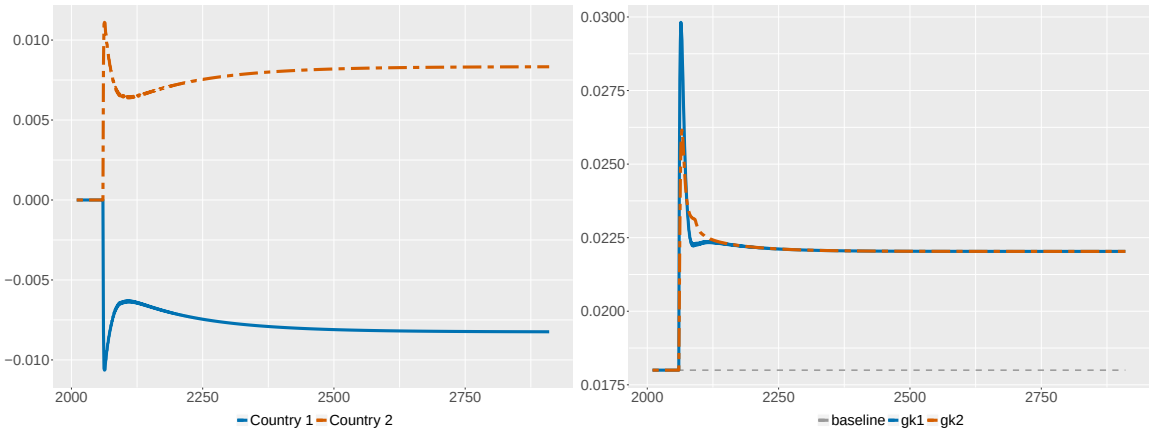
(c) International Reserves

(d) Trade balance as share of output



(e) Current accounts as share of output

(f) Capital accumulation rates



to capital ratio in relation to country two. Now households in country one (two) temporarily experience exchange rate capital gains (losses). As a consequence of these movements, household wealth to capital ratio in country one stabilizes at a higher level than in country two (figure 4.10f).

In the very short run there is an appreciation of the currency of country one, since government one supply of bills to foreigners falls short of households demand in the second economy. Households in country two will increase their demand relative demand for foreign assets due to the fall in equities rate of return in the short run. In what follows, the depreciation of currency one compensates part of the decrease in the profit share of firms in country one, since it increases the costs of imports and thus sales prices, and reduces the profit share of firms in country two (through the reduction of imports costs and sales prices). The overall effect will be similar to the case of a reduction in firms' mark-up in a flexible exchange rate regime: there will be a general redistribution in the system towards wage earners.

We notice that due to the fact that economy one becomes more closed, it gains while the other economy relatively loses. This also explains the larger increase in the share of economy one in the system's capital stock. Yet economy two benefits from the positive spillovers that the faster growth in economy one will have on its demand.

For the fixed exchange rate regime, the results of a reduction in the propensity to import of economies one and two are pretty similar to the ones presented for the reduction of the mark-up for economies one and two respectively, with the exception of the short run impact on the current account and the trade balance. Differently from the flexible exchange rate regime, in this case the economy which reduces the propensity to import will end up with a current account deficit in the long run, since the income it remits to the other economy – interests on government bills held by foreigners – will be larger than the income it receives and there are no compensations by the movements in the nominal exchange rate. Still the changes in relative prices following the reduction in the propensity to import in one of the economies will allow for an overall redistribution towards wages (the economy which reduces the propensity to import will experience a real depreciation of its currency due to the increase in the ratio of relative domestic sales prices, but sales prices will be lower in both economies).

This experiment also shows that it might be difficult for a country to conciliate an attempt to keep the nominal exchange rate constant through the accumulation of foreign reserves with a policy of restriction of imports in order to increase its trade balance. This is so due to the feedbacks between the two economies following the increase in domestic demand which will partially leak to abroad generating a trade deficit and a current account deficit. The respective country is transferring net income to abroad, which negatively impacts its stock of international reserves.

It is important to highlight that the permanent positive effect on both countries growth rates after a reduction in the propensity to import seems to be related to the redistribution of income in the system. If a reduction in the propensity to import were not associated with a redistribution

of income, there would be only a temporary positive effect on demand of the country increasing its net exports and a negative effect on the economy with a trade deficit. In the long run, these effects would net out.

4.5 Final Remarks

The model presented in this chapter represents a first step in investigating the features of a supermultiplier model in a two-country system. Table 4.3 displays its main attributes in comparison with a similar model for a closed economy (chapter 2) and in comparison with typical supermultiplier models in which there is a non-capacity creating autonomous expenditure growing at an exogenously given rate in the long run (Allain, 2015b; Freitas and Serrano, 2015; Lavoie, 2016; Nah and Lavoie, 2017a). Extending the model to a two-country setting renders the analysis increasingly difficult, the more so if we are concerned with the long-run features and would like to make inferences about the dynamic ratios of the system. Due to this stumbling block, we recurred to simulation experiments to address how a change in demand would impact growth in the long run for both exchange rate regimes. The main results, which are acknowledged not to be general at this stage, are summarized as follows:

(i) As in closed economy supermultiplier models, a higher growth rate of autonomous expenditures (in this case, of the combined growth rates of exports and consumption out of wealth for an individual country) is still associated with a higher investment to income ratio. As investment accelerates, in both countries consumption out of wealth represents a lower share of global income;

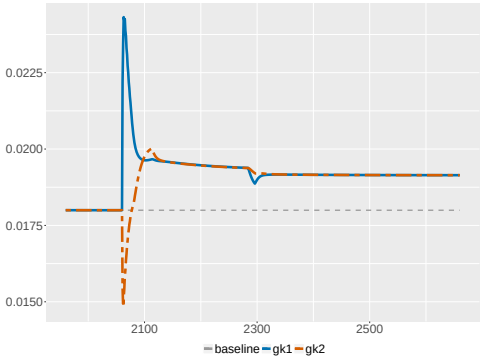
(ii) A reduction in the profit share arising from a reduction in firms' mark-up in one of the economies is associated with higher growth rates and with lower profit rates in both economies in the long run due to the reduction in the system's profit share for both exchange rate regimes;

(iii) An increase in the propensity to consume out of after-tax wages in one of the countries leads to a higher growth rate in both countries in the long run. This is associated with higher profit rates in the country which expands demand due to the effect of currency depreciation on the profit share and with lower profit rates in the other country due to the effect of that country's currency appreciation on its firms profit share. This experiment shows that in an open economy, even if the economy is wage-led, growth does not need to be associated with a lower domestic profit share due to the feedbacks between the economies;

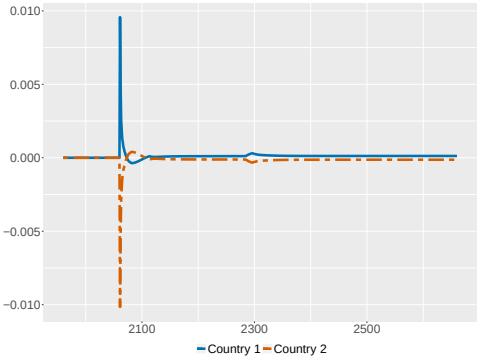
(iv) A reduction in the propensity to import in one of the economies is associated with higher growth rates in both countries since it is associated with a redistribution towards wages in the system for both exchange rate regimes;

Figure 4.10: Effects of a decrease in the propensity to import of country one in a flexible exchange rate regime

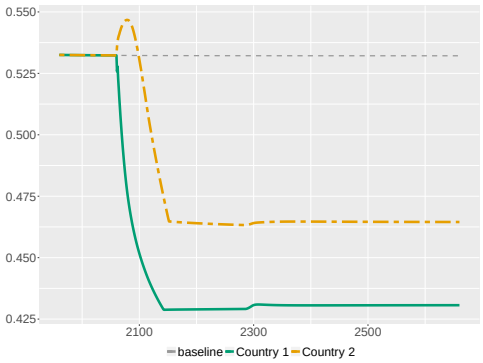
(a) Capital Accumulation rate both countries



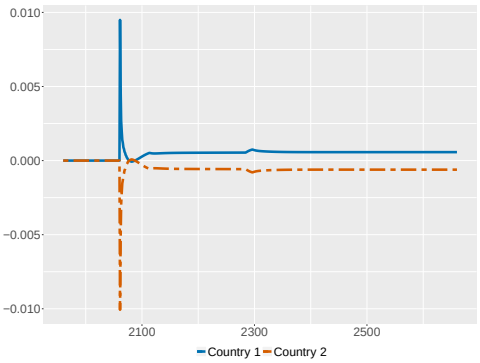
(b) Trade balance as share of output



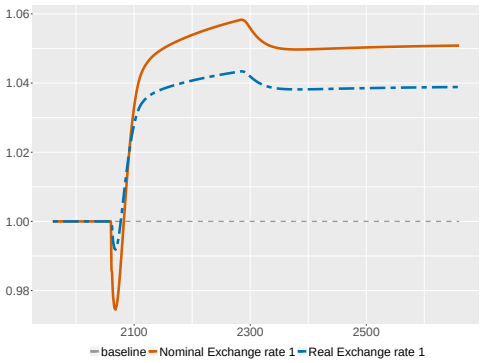
(c) Government debt to capital ratios



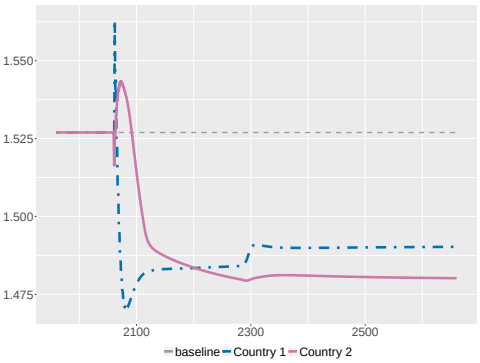
(d) Current account as share of output



(e) Exchange rates



(f) Hosehold wealth to capital ratios



(v) Growth in both economies will be higher in the long run if both economies expand domestic demand than if only one of the economies expands domestic demand. This is a shared result with neo-Kaleckian two-country models (Von Arnim et al., 2014; Capaldo and Izurieta, 2013) and reinforces the case for policy coordination among countries;

(vi) The movements in the exchange rate have a permanent effect on growth through the indirect impact they have on income distribution. If a devaluation of the currency has no impact on income distribution, the effect on growth will be only transitory. Assuming the Marshall-Lerner condition holds, the country which depreciates its currency will see a temporary increase in its growth rate, through the higher net exports, while the country which sees its currency appreciating will experience a temporary decrease in its growth rate;

(vi) The economy which expands domestic demand will gain relatively more in relation to the economy initially benefiting from the increase in the external demand, provided that, cet.par.: (a) the Marshall-Lerner condition holds; (b) its firms react faster than firms in the other country to any persistent change in demand.

It goes without saying that the results obtained here should be reassessed once labour productivity is taken into account, since it is understood as a major source of uneven levels of competitiveness across countries. Besides, the addition of an endogenous rule for the mark-up would also contribute to evaluate another channel through which distribution can affect international competitiveness and thus possibly long run results regarding the relation between distribution and growth. At last, the discussion presented here could also be enhanced by an analysis of the interactions between two economies with different features and behaviour. These issues are subject for future research.

Table 4.3: Compared features of Supermultiplier models

Features	**Sraffian and neo-Kaleckian Supermultiplier models**	**Closed economy Supermultiplier SFC model**	**Two-country Supermultiplier SFC model**
Non-capacity creating autonomous expenditures	Consumption (credit or wealth), exports or government expenditures	Consumption out of wealth	Consumption out of wealth (exports for each country)
Growth	Exogenous	Endogenous	Endogenous
Income distribution effect on growth	Transient	Permanent	Permanent
Effect of propensities to consume on growth	Transient	Permanent	Permanent
Exchange rate effect on growth	Transient†	–	Permanent: may change income distribution domestically and across countries
Paradox of thrift	Level	Growth	Growth
Paradox of costs	Level	Growth	Growth
Utilization rate	Converges to u_n	Converges to u_n	Converges to u_{n_1} and u_{n_2}
Financial stocks	Absent⋆	Included	Included
Output	$Y = C + I + G/XL$	$Y = C + I + G$	$Y = C + I + G + X - IM$
Supermultiplier	Domestic multiplier	Domestic multiplier	Combined –domestic and foreign – multiplier

† For Nah and Lavoie (2017a). For the other models – closed economy –, it does not apply.
⋆ Some models include financial assets. See Dutt (2016) and Hein (2016).

Chapter 5

Conclusions

The literature on Supermultiplier models is flourishing. As a tree which is relatively new and growing it has many branches and leaves to develop. These developments are faster in the places where more light is shed on and slower in the darker corners. The rapid expansion of the last few years can be seen in figure 5.1.

In this thesis we tried to illuminate one of these corners. We discussed some of the features and results of the Supermultiplier model with endogenous autonomous expenditures – in this case, consumption out of household wealth – embedded in a more complex financial environment.

We have seen that Supermultiplier models are equally capable of generating a common feature of neo-Kaleckian models, namely the paradoxes of thrift and costs, when the autonomous component of demand is allowed to grow endogenously. The effects of changes in income distribution (when considered as exogenous) and in the propensities to spend are not restricted to the short run. They permanently affect the growth trend – not just on average.

Under this framework, we are able to stablish a connection between household wealth, autonomous consumption and firms' propensity to invest. We are able to observe that even if the capacity utilization converges back to the normal range and household wealth to capital ratio decreases, the long run growth rate of the economy will be higher due to the permanent increase in the supermultiplier.

We have seen that an increase in the growth rate of the economy in the long run may have different effects on the financial assets to capital ratios depending on the source of the demand shock and on the interactions between the spur to demand and income distribution (whether it depends on the conflicting-claims between income groups and labour productivity or on the exchange rate).

Besides that, when we explicitly include the labour market in the analysis we are able to assess which shocks have a larger or lower impact on the employment rate. The faster the adjustment of both workers and firms income targets to changes, respectively, in the growth of employment and in the deviations of utilization rate from the normal rate, the smaller the

increments in the employment rate for the same expansion to demand. This is related to the endogenous interactions between real wage growth, output growth and labour productivity growth.

The oscillations in labour productivity and in real wages also explain the cycles generated in this economy. In the latter, household wealth growth seems to lead the upswings pulling capital accumulation up. As household to total income increases in the troughs be due to higher dividend payments, to higher interest payments or to temporary capital gains, it provides a floor to demand and reverses the downward trend.

Accounting for a conflicting-claims approach to inflation and for an endogenous growth of labour productivity also helps to show that a higher capital accumulation rate in the long run may be associated with either lower or higher profit rates, depending on the feedbacks from a higher real wage growth rate to the labour productivity growth rate. Yet, we highlight that a direct increase in the bargaining power of firms raises the profit rates in the long run, but decreases the capital accumulation rate owing to the negative impact on employment.

When we extend the basic framework of a closed economy (chapter 2) to a system of two economies, one of the first implications is that exports cannot work as a truly autonomous expenditure component for this region or "world". At least not when exports depend on firms' production decisions and not for countries which can influence external demand, whether through trade or financial channels.

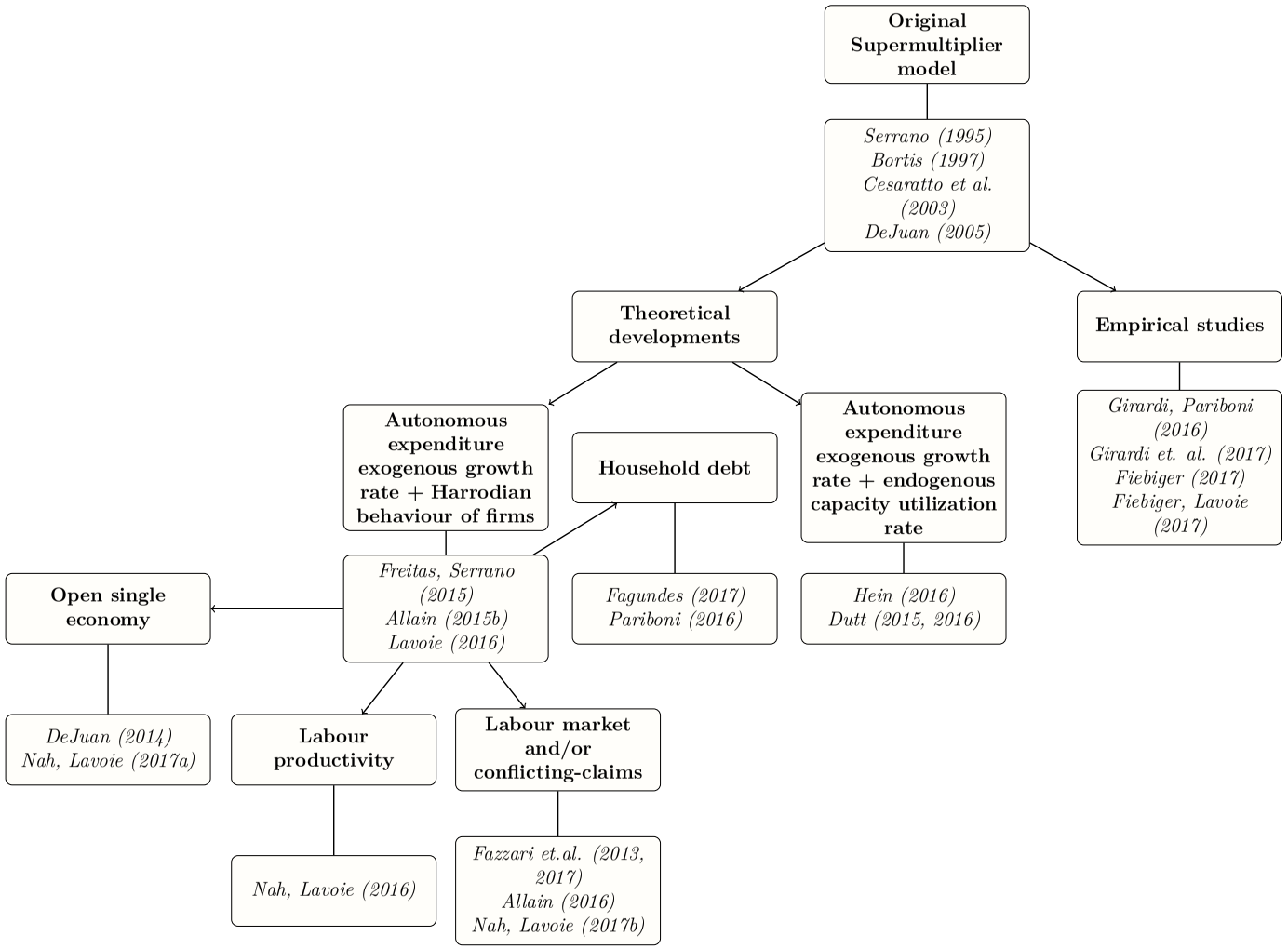
We have also seen that the exchange rate might have a permanent effect on the long run growth rate, through its indirect impact on countries' competitiveness and on income distribution. The movements in the exchange rate also change wealth distribution across countries.

All these interesting insights obtained by keeping what we believe to be the essentials of the Supermultiplier approach – a growing autonomous expenditure component associated with firms' induced investment and Harrodian behaviour – should be interpreted as showing how powerful Supermultiplier models can be. They are able to reproduce some of the neo-Kaleckian models' results, but while the latter fails to match important stylized facts, the former succeeds. They are versatile enough to account for different growth experiences, according to which variable leads economic growth. They are also suited for analysing a set of two or more economies, since the supermultiplier is lower in such a setting providing the model with more stability. They bring to the heterodox growth literature a useful toolbox we should not be afraid to explore.

Certainly the empirical front deserves more attention, since the small number of studies – and of countries studied – is not enough to validate the model. A deep investigation of hysteresis and path-dependence could also prove to be a fruitful path to take. The model could also be enhanced to be able to deal with financial crises. That would require the inclusion of a more elaborate profit-making banking sector and financial instruments. In the open economy framework, the interactions between two structurally different economies could provide fresh insights.

We end, therefore, with a handful of subjects for future research and the task of pursuing some of these paths we have drawn.

Figure 5.1: Tree of recent heterodox literature on autonomous expenditures and Supermultiplier growth models



Author's elaboration.

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Appendix A

Parameters and long run values of variables – model of chapter 2

Table A.1: Parameters and long run values of variables model of chapter 2

Parameters/variables	Baseline	Scenario 1	Scenario 2	Scenario 3
τ	0.37	0.37	0.37	0.37
σ	0.34	0.34	0.34	0.34
α_1	0.8	0.8	0.84	0.8
α_2	0.033735	0.033735	0.033735	0.0374
ζ	0.1	0.1	0.1	0.1
χ	0.001	0.001	0.001	0.001
λ_0	0.08	0.08	0.08	0.08
pe	0.9880292	0.8493563	0.8571246	0.846402
δ	0.044	0.044	0.044	0.044
i_r	0.02	0.02	0.02	0.02
v	2.5	2.5	2.5	2.5
μ	0.7	0.63	0.7	0.7
π	0.411765	0.3865031	0.411765	0.411765
s_f	0.4	0.4	0.4	0.4
γ	0.014	0.014	0.014	0.014
h	0.2	0.2131375	0.2091036	0.2101661
$u \simeq u_n$	0.8	0.8	0.8	0.8
$m^* = l^*$	0.7953325	1.054224	0.840638	0.8442299
b^*	0.7525772	0.276434	0.5021906	0.4817999
v_h^*	1.646715	1.415594	1.428541	1.41067
g^*	0.02	0.02421	0.02291702	0.023161

Note 1: For the initial period, given the initial rate of growth: $K_0 = 100$ and $Y_0 = \frac{u_n K}{v(1+g^*)}$, following equations 2.17 and 2.18.

Appendix B

Parameters and long run values of variables – model of chapter 3

Table B.1: Parameters and long run values of variables model of chapter 3

Parameters/variables	Baseline	Scenario 1a	Scenario 1b	Scenario 1c	Scenario 2	Scenario 3
τ	0.35	0.35	0.35	0.35	0.35	0.35
σ	0.34	0.34	0.34	0.34	0.34	0.34
α_1	0.8	0.85	0.85	0.85	0.8	0.8
α_2	0.06183	0.06183	0.06183	0.06183	0.06183	0.06183
ζ	0.1	0.1	0.1	0.1	0.1	0.1
χ	0.001	0.001	0.001	0.001	0.001	0.001
λ_0	0.45	0.45	0.45	0.45	0.45	0.45
λ	0.440065	0.444103	0.44489	0.443615	0.440325	0.439724
pe	5.452799	4.842489	4.778312	4.889915	5.429598	5.496956
δ	0.0515	0.0515	0.0515	0.0515	0.0515	0.0515
i	0.02	0.02	0.02	0.02	0.02	0.02
i_R	0.009935	0.005896	0.005108	0.06383	0.009676	0.010276
v	2	2	2	2	2	2
π	0.399366	0.397296	0.392965	0.399921	0.397339	0.401971
s_f	0.3	0.3	0.3	0.3	0.3	0.3
γ	0.02	0.02	0.02	0.02	0.02	0.02
h	0.18	0.180531	0.180425	0.180262	0.179764	0.179757
$u \simeq u_n$	0.85	0.85	0.85	0.85	0.85	0.85
$m^* = l^*$	0.252651	0.238860	0.246364	0.232061	256069	0.242898
b^*	0.449073	0.35868	0.375789	0.389533	0.441117	0.4624
v_h^*	1.239089	1.090399	1.074043	1.102287	1.233090	1.250092
n	0.883985	0.919502	0.90712	0.903244	0.866793	0.870205
θ	0.3	0.3	0.3	0.3	0.3	0.3
η_0	0.00375	0.00375	0.00375	0.00375	0.00375	0.00375
η_1	0.45	0.45	0.45	0.45	0.45	0.45
η_2	0.4	0.4	0.4	0.4	0.4	0.4
Ω	0.7	0.7	0.7	0.7	0.8	0.7
ξ	0.2	0.2	0.5	0.2	0.2	0.2
ψ	0.602388	0.602388	0.602388	0.602388	0.602388	0.8
Ψ	0.05	0.05	0.05	0.1	0.05	0.05
g_k	0.025	0.025217	0.025167	0.02511	0.024904	0.024902
g_y	0.025	0.025217	0.025167	0.02511	0.024904	0.024902
g_{vh}	0.025	0.02519	0.025124	0.025096	0.024915	0.024913
g_{pr}	0.025	0.025171	0.025138	0.025088	0.024924	0.024923
g_{wp}	0.025	0.025183	0.025157	0.025094	0.024919	0.024917
g_p	0.01	0.014021	0.014817	0.01353	0.010225	0.009625

Appendix C

Parameters and long run values of variables – model of chapter 4: flexible exchange rates

Table C.1: Part 1: Parameters and long run values of variables model of chapter 4: flexible exchange rates

Parameters/variables	Baseline	Scenario 1	Scenario 2	Scenario 3
τ_i	0.342577	0.342577	0.342577	0.342577
σ_i	0.3	0.3	0.3	0.3
$\alpha_1 1$	0.85	0.85	0.93	0.85
$\alpha_1 2$	0.85	0.85	0.85	0.85
$\alpha_2 i$	0.065529	0.065529	0.065529	0.065529
ζ	0.1	0.1	0.1	0.1
χ_i	0.001	0.001	0.001	0.001
λ_{10}	0.100709	0.100709	0.100709	0.100709
λ_{11}	-0.3	-0.3	-0.3	-0.3
λ_{12}	-0.2	-0.2	-0.2	-0.2
λ_{13}	-0.25	-0.25	-0.25	-0.25
λ_{14}	-0.25	-0.25	-0.25	-0.25
λ_{20}	0.268454	0.268454	0.268454	0.268454
λ_{21}	-0.2	-0.2	-0.2	-0.2
λ_{22}	1	1	1	1
λ_{23}	-0.3	-0.3	-0.3	-0.3
λ_{24}	-0.3	-0.3	-0.3	-0.3
λ_{30}	0.199814	0.199814	0.199814	0.199814
λ_{31}	-0.25	-0.25	-0.25	-0.25
λ_{32}	-0.3	-0.3	-0.3	-0.3
λ_{33}	1	1	1	1
λ_{34}	-0.2	-0.2	-0.2	-0.2
λ_{40}	0.199814	0.199814	0.199814	0.199814
λ_{41}	-0.25	-0.25	-0.25	-0.25
λ_{42}	-0.3	-0.3	-0.3	-0.3
λ_{43}	-0.2	-0.2	-0.2	-0.2
λ_{44}	1	1	1	1

Table C.2: Part 2: Parameters and long run values of variables model of chapter 4: flexible exchange rates

Parameters/variables	Baseline	Scenario 1	Scenario 2	Scenario 3
ϕ_{11}	0.050491	0.49723	0.04413	0.050160
ϕ_{21}	0.447544	0.451383	0.479349	0.449197
ϕ_{31}	0.150737	0.149585	0.141195	0.150241
ϕ_{41}	0.149585	0.150737	0.141195	0.150241
ϕ_{12}	0.05491	0.04962	0.04968	0.05044
ϕ_{22}	0.447544	0.451899	0.451497	0.447777
ϕ_{32}	0.150737	0.14943	0.149521	0.150667
ϕ_{42}	0.150737	0.14943	0.149521	0.150667
r_{e_1}	0.191090	0.194929	0.222895	0.192743
r_{e_2}	0.191090	0.195445	0.195143	0.191323
pe_1	6.833776	6.313775	6.047321	6.694929
pe_2	6.833776	6.313775	6.047321	6.694929
δ_i	0.044	0.044	0.044	0.044
i_{r_i}	0.015	0.015	0.015	0.015
i_i	0.015	0.015	0.015	0.015
v_i	1.5	1.5	1.5	1.5
μ_1	0.47248	0.425	0.47248	0.47248
μ_2	0.47248	0.47248	0.47248	0.47248
π_1	0.4	0.384782	0.410652	0.399366
π_2	0.4	0.387135	0.389289	0.392349
s_{f_i}	0.422356	0.422356	0.422356	0.422356
γ_i	0.05	0.05	0.05	0.05
h_1	0.196559	0.204476	0.203625	0.199754
h_2	0.196559	0.204739	0.203692	0.198416
$u_i \simeq u_{n_i}$	0.85	0.85	0.85	0.85
l_1^*	0.31142	0.636391	0.273704	0.392551
l_2^*	0.31142	0.603927	0.560685	0.485317
b_1^*	0.532153	0.430227	0.426237	0.430686
b_2^*	0.532153	0.408345	0.383237	0.46446
$v_{h_1}^*$	1.52695	1.398763	1.261569	1.49042
$v_{h_2}^*$	1.52695	1.403679	1.419868	1.47994
e_{r_1}	1	1.066497	1.0551	1.039092
e_{n_1}	1	1.062417	1.093346	1.051232
κ_1	1	0.987896	0.98765	0.892398
ϵ_{01}	-1.4	-1.4	-1.4	-1.5
ϵ_{02}	-1.4	-1.4	-1.4	-1.4
ϵ_{1i}	0.6	0.6	0.6	0.6
ϵ_{2i}	1	1	1	1
W_{N_i}	0.6	0.6	0.6	0.6

Appendix D

Parameters and long run values of variables – model of chapter 4: fixed exchange rates

Table D.1: Part 1: Parameters and long run values of variables model of chapter 4: fixed exchange rates

Parameters/variables	Baseline	Scenario 1a	Scenario 2a	Scenario 3a	Scenario 1b	Scenario 2b	Scenario 3b
τ_1	0.343975	0.343975	0.343975	0.343975		0.343975	0.343975
τ_2	0.344181	0.344181	0.344181	0.344181	0.344181	0.344181	0.344181
σ_i	0.3	0.3	0.3	0.3	0.3	0.3	0.3
α_{11}	0.85	0.85	0.93	0.85	0.85	0.85	0.85
α_{12}	0.85	0.85	0.85	0.85	0.85	0.94	0.85
ζ	0.1	0.1	0.1	0.1	0.1	0.1	0.1
χ_i	0.007	0.007	0.007	0.007	0.007	0.007	0.007
λ_{10}	0.100121	0.100121	0.100121	0.100121	0.100121	0.100121	0.100121
λ_{11}	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3
λ_{12}	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
λ_{13}	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25
λ_{14}	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25
λ_{20}	0.271395	0.271395	0.271395	0.271395	0.271395	0.271395	0.271395
λ_{21}	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
λ_{22}	1	1	1	1	1	1	1
λ_{23}	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3
λ_{24}	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3
λ_{30}	0.198931	0.198931	0.198931	0.198931	0.198931	0.198931	0.198931
λ_{31}	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25
λ_{32}	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3
λ_{33}	1	1	1	1	1	1	1
λ_{34}	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
λ_{40}	0.198931	0.198931	0.198931	0.198931	0.198931	0.198931	0.198931
λ_{41}	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25
λ_{42}	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3
λ_{43}	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
λ_{44}	1	1	1	1	1	1	1
ϕ_{11}	0.050486	0.050069	0.044313	0.050401	0.049294	0.049077	0.050117
ϕ_{21}	0.447544	0.451383	0.479349	0.449197	0.453532	0.454614	0.449416
ϕ_{31}	0.150737	0.149585	0.141195	0.150241	0.14894	0.148615	0.150175
ϕ_{41}	0.149585	0.150737	0.141195	0.150241	0.14894	0.148615	0.150175
ϕ_{12}	0.05491	0.04962	0.04968	0.05044	0.050074	0.044678	0.050318
ϕ_{22}	0.647783	0.6527	0.653338	0.649135	0.649455	0.676435	0.648233
ϕ_{32}	0.150737	0.14943	0.149521	0.150667	0.150111	0.142017	0.150478
ϕ_{42}	0.117279	0.115803	0.115612	0.116873	0.1167777	0.108683	0.117144
r_{e_1}	0.188177	0.19026	0.219041	0.188602	0.194137	0.195219	0.190021
r_{e_2}	0.134805	0.139722	0.14036	0.136157	0.136477	0.163457	0.135255

Table D.2: Part 2: Parameters and long run values of variables model of chapter 4: fixed exchange rates

Parameters/variables	Baseline	Scenario 1a	Scenario 2a	Scenario 3a	Scenario 1b	Scenario 2b	Scenario 3b
pe_1	6.834185	6.197059	5.830488	6.588704	6.47672	6.594751	6.751493
pe_2	9.891413	9.319321	9.493666	9.751485	8.951558	8.09973	9.498239
δ_i	0.095333	0.095333	0.095333	0.095333	0.095333	0.095333	0.095333
i_{r_i}	0.015	0.015	0.015	0.015	0.015	0.015	0.015
i_i	0.015	0.015	0.015	0.015	0.015	0.015	0.015
v_i	1.5	1.5	1.5	1.5	1.5	1.5	1.5
μ_1	0.47248	0.425	0.47248	0.47248	0.47248	0.47248	0.47248
μ_2	0.47248	0.47248	0.47248	0.47248	0.425	0.47248	0.47248
π_1	0.4	0.377407	0.4	0.39385	0.394461	0.4	0.398474
π_2	0.4	0.394461	0.4	0.398474	0.377407	0.4	0.39385
s_{f_1}	0.431133	0.431133	0.431133	0.431133	0.431133	0.431133	0.431133
s_{f_2}	0.42	0.42	0.42	0.42	0.42	0.42	0.42
γ_i	0.05	0.05	0.05	0.05	0.05	0.05	0.05
h_1	0.2	0.207505	0.207239	0.203183	0.207925	0.207397	0.201788
h_2	0.2	0.208092	0.207282	0.201828	0.207593	0.206642	0.20375
$u_i \simeq u_{n_i}$	0.85	0.85	0.85	0.85	0.85	0.85	0.85
l_1^*	0.311384	0.765697	0.468191	0.515942	0.4717	0.357135	0.340895
l_2^*	0.056166	0.232411	0.115331	0.096888	0.530588	0.283195	0.284427
b_1^*	0.532122	0.531832	0.561332	0.542181	0.292775	0.192771	0.345981
b_2^*	0.481679	0.415906	0.39066	0.471361	0.423241	0.383832	0.423037
$v_{h_1}^*$	1.526946	1.37818	1.218657	1.470704	1.428061	1.450627	1.502283
$v_{h_2}^*$	1.526964	1.427811	1.453102	1.502228	1.378318	1.197414	1.465252
e_{r_1}	1	1.028164	1	1.007688	0.972608	1	0.99237
e_{n_1}	1	1	1	1	1	1	1
κ_1	1	0.991311	0.989528	0.894524	1.010843	1.00845	1.122394
ϵ_{01}	-1.4	-1.4	-1.4	-1.5	-1.4	-1.4	-1.4
ϵ_{02}	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4	-1.5
ϵ_{1i}	0.6	0.6	0.6	0.6	0.6	0.6	0.6
ϵ_{2i}	1	1	1	1	1	1	1
W_{N_i}	0.6	0.6	0.6	0.6	0.6	0.6	0.6