UNIVERSIDADE ESTADUAL DE CAMPINAS

INSTITUTO DE ECONOMIA

LILIAN NOGUEIRA ROLIM

DETERMINANTS OF BRAZILIAN AGGREGATE DEMAND AND INVESTMENT: THE ROLE OF WAGES

DETERMINANTES DA DEMANDA AGREGADA E DO INVESTIMENTO NO BRASIL: O PAPEL DOS SALÁRIOS

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Prof.ª Dr.ª Carolina Troncoso Baltar – orientadora

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Abstract

In the 2000s, Brazil experienced a period of economic growth with social inclusion, determined by income transfer policies and by higher formalization and employment rates. However, after the 2007-2008 global financial crisis, the country faced a deceleration of economic growth and investment rates, despite the maintenance of the income transfer policies and growing consumption. The aim of this dissertation is to analyze the role of wages in the dynamics of the Brazilian economic growth and investment from 2003 to 2014 and investigate why income redistribution was not enough to sustain economic growth and investment after the 2007-2008 crisis. The main theoretical background is the Kaleckian economic growth and income distribution models, as they admit the possibility of a shift in functional income distribution toward wages having a positive effect on aggregate demand and investment (characterizing a wage-led regime) or a negative effect on it (profit-led regime). Because the determination of the demand and accumulation regimes is an empirical question, econometric equations are estimated using a structural vector autoregressive model (SVAR), which includes the output growth rate (proxy to capacity utilization), the investment rate, and the profit share as endogenous variables, besides other exogenous variables. The possibility of a structural break in the effect of the profit share on demand and investment is tested through the inclusion of a structural break variable (estimated at the first quarter of 2010) and by the comparison of a model estimated only for the period before the break with the baseline model. Thus, the contribution of this dissertation is to explicitly consider the possibility of a switch in the demand and accumulation regimes when the underlying economic conditions change. The case of the Brazilian economy exemplifies this possibility as several aspects that allowed the coexistence of income redistribution towards wages and economic growth progressively changed after the 2007-2008 crisis. The results suggest that the profit share became more significant to the investment rate after the structural break, turning a neutral accumulation regime into a profit-led regime. The structural break is not significant for the demand regime, but the comparison between the model which only includes the period until the break and the one which includes the whole period suggests a demand regime switch from wage-led to profit-led. Therefore, our results suggest that the higher wage share had a positive impact on the Brazilian economy, but such effect weakened when the underlying economic conditions changed.

Key-words: Brazil; Economic Growth; Investment; Functional Income Distribution; Kalecki.

Resumo

Nos anos 2000, o Brasil passou por um período de crescimento econômico com inclusão social, expressa por uma política de distribuição de renda e maiores taxas de formalização e de emprego. Entretanto, após a crise financeira global de 2007-2008, o país enfrentou uma desaceleração das taxas de crescimento econômico e de investimento, a despeito da manutenção da política de distribuição de renda e do crescimento no consumo. O objetivo desta dissertação é analisar o papel dos salários na dinâmica de crescimento econômico e do investimento no Brasil de 2003 a 2014 e investigar por que a distribuição de renda não foi suficiente para sustentar o crescimento econômico e a taxa de investimento após a crise de 2007-2008. O principal referencial teórico é os modelos Kaleckianos de crescimento econômico e distribuição de renda, pois estes admitem a possibilidade de que mudanças na distribuição funcional da renda a favor dos salários tenham um efeito positivo na demanda agregada e na acumulação de capital (caracterizando um regime *wage-led*) ou um efeito negativo (caracterizando um regime *profit-led*). Como a determinação dos regimes de demanda e de acumulação é uma questão empírica, equações econométricas são estimadas a partir do modelo de vetor autoregressivo estrutural (SVAR), incluindo a taxa de crescimento do produto (*proxy* para utilização da capacidade), a taxa de investimento e a parcela dos lucros na renda como variáveis endógenas, além de outras variáveis exógenas. A possibilidade de uma quebra estrutural no efeito da parcela dos lucros na demanda e na taxa de investimento é testada pela inclusão de uma variável de quebra estrutural (estimada para o primeiro trimestre de 2010) e pela comparação de um modelo estimado apenas para o período anterior à quebra com o modelo original. Desse modo, a contribuição desta dissertação é de considerar explicitamente a possibilidade de uma mudança nos regimes de demanda e de acumulação quando as condições econômicas subjacentes se modificam. O caso da economia brasileira exemplifica essa possibilidade, pois diversos elementos que permitiam a coexistência entre redistribuição de renda em favor dos salários e crescimento econômico foram progressivamente se alterando após a crise de 2007-2008. Os resultados sugerem que a parcela dos lucros se tornou mais significativa à taxa de investimento após a quebra, passando de um regime neutro para *profit-led*. A quebra estrutural não é significativa para o regime de demanda, mas a comparação entre o modelo estimado até a quebra e o modelo estimado para o período todo sugere uma mudança do regime de demanda de *wage-led* para *profit-led*. Assim, os resultados sugerem que a parcela dos salários teve um impacto positivo na economia brasileira, mas este efeito se enfraqueceu quando as condições econômicas subjacentes se alteraram.

Palavras-chave: Brasil; Crescimento Econômico; Investimento; Distribuição Funcional da Renda; Kalecki.

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Notation

A	capitalists' autonomous consumption (real)
a	labor coefficient (hours of labor per unit of output)
a_1	direct labor coefficient (hours of direct labor per unit of output)
B	trade balance (real)
C	aggregate consumption (real)
C_k	capitalists' aggregate consumption (real)
C_w	workers' aggregate consumption (real)
c	consumption per worker (real)
c_k	capitalists' propensity to consume
e	exchange rate (price of foreign currency in domestic currency)
f	ratio between overhead and direct labor at full capacity utilization
g	realized accumulation rate
g^i	investment function (in growth terms)
g^s	saving function (in growth terms)
I	aggregate investment (real)
$\bar{I}$	aggregate investment (nominal)
K	capital stock (real)
M	imports (real)
m	mark-up rate on direct costs
$m^{'}$	target return pricing mark-up rate on direct costs
N	employment level (sum of hours of labor)
$\hat{N}$	employment growth rate
N_0	total hours of overhead labor
N_1	total hours of direct labor
P	aggregate profits (real)
p	price level
$\bar{p}$	average price in the industry
p_f	foreign currency price of competing products
q	real exchange rate
r	rate of profit
r^e	expected rate of profit

r_n	rate of profit at normal capacity utilization rate
S	aggregate saving (real)
S_p	aggregate saving out of profits (real)
S_w	aggregate savings out of wages (real)
s_K	capitalist-managers' propensity to save
s_L	workers' propensity to save
s_p	propensity to save out of profits
s_w	propensity to save out of wages
u	rate of capacity utilization (current output to full capacity output)
u_d	desired rate of capacity utilization
u_n	normal capacity utilization rate
ULC	unit labor costs
UPC	unit prime cost
v	output-capital ratio at full capacity
W	aggregate wages (real)
w	wage rate (real)
$\bar{w}$	wage rate (nominal)
$\hat{w}$	wage growth rate (real)
$w^{'}$	average wage (nominal)
X	exports (real)
Y	output (real)
$\hat{Y}$	output growth rate (real)
$\hat{Y}_a$	autonomous demand growth rate (real)
$Y^{'}$	full capacity output (real)
Y_f	GDP of the rest of the world (real)
z	ratio between domestic unit labor costs and the price of foreign goods

Greek letters

α	animal spirits
ϵ	income-elasticity of exports
η	price-elasticity of exports
θ	elasticity of the price-costing margin with respect to the real exchange rate
λ	labor productivity (output per worker)
$\hat{\lambda}$	labor productivity growth rate
μ	income-elasticity of imports
π	net share of profits in national income
ϖ	net share of wages in national income
σ	ratio of the wage of overhead labor relative to that of direct labor
σ_L	workers' share of the capital stock

Φ	firms' target mark-up factor
φ_L	workers' share of the wage bill
φ	mark-up factor (one plus the mark-up rate)
ψ	price-elasticity of imports

Contents

Introduction

The Brazilian economic performance in the 2000s was quite different compared to that from the 1980s to the mid-1990s, when the country faced high inflation, low economic growth, and high economic instability. In the 1980s, the debt crisis and the succession of stabilizing plans were detrimental to its economic growth. The option, in the 1990s, was to follow a liberalization strategy, opening the economy for trade and finance and denationalizing property, which led to a dynamic of low economic growth and low investment (Carneiro, 2002), in spite of an initial recovery of the economy and a decrease in the inflation rate after the adoption of the Real Plan in 1994. This scenario of low economic growth, high unemployment rate, and the country's currency devaluations in 1999, 2001, and 2002 (which increased inflation) led to a functional income redistribution[1] between 1998 to 2004 that was prejudicial to labor (Baltar, P., 2015).

From President Lula's first term to the beginning of the 2010s, Brazil experienced high economic growth with low inflation compared to its reality in the 1980s and 1990s. The economy was positively influenced by the boom of commodities and growing external demand since 2003. Additionally, the minimum wage policy, pension benefits to rural workers, growth in the employment rate, higher formalization of labor contracts, and growth in the purchasing power of wages (due to the extensive boom of commodities and to capital inflows) increased the wage share (Baltar, P., 2015). Combined with a credit boom, this led to higher consumption and, along with higher exports, induced production and investment (Arestis et al., 2016). Thus, in this period, it is possible to say that Brazil experienced higher economic growth with social inclusion.

However, after the 2007-2008 global financial crisis, Brazil faced a deceleration of consumption, investment, and exports, despite the anti-cyclical policies put in place by the government and the brief recovery in 2010. Regardless of the income transfer policies and growing consumption (though at lower rates), investment was not sustained and Brazil faced lower GDP growth rates since 2011. In this period, consumption growth led to higher imports, in a context of an appreciated national currency (Arestis et al., 2016).

Thereby, despite the persistence of social inclusion between 2004 and 2014, economic growth reacted differently to it before and after the 2007-2008 global financial crisis. In a Kaleckian perspective, one can observe that, in favorable conditions, consumption stimulated

[1] Functional income distribution refers to the income distribution between wages and profits.

the economy and investment reacted accordingly, following the "accelerator effect"[2]; however, after the crisis, consumption was not enough to induce investment decisions and, thus, it was not enough to sustain the country's economic growth. In the latter period, investment was negatively affected by the more pessimistic world scenario and presented lower growth rates.

Given this setting, the aim of this dissertation is to analyze the role of wages in the dynamics of the Brazilian economic growth and investment from 2003 to 2014. In particular, the hypothesis under analysis is that, given the different economic context, income redistribution was not enough to sustain the previous growth and investment rates after the crisis.

In order to pursue this analysis, the main theoretical background is the Kaleckian economic growth and income distribution models that focus on demand and accumulation regimes (Dutt, 1984, Taylor, 1985, Blecker, 2002, Bhaduri and Marglin, 1990, Lavoie, 2014). These models assess the basic question that is the guiding line of this research project: once there has been a shift in functional income distribution, what is the effect of this shift in the economic performance?

The basic logic behind the Kaleckian models is that a redistribution of income towards wages will boost consumption (due to an expected higher marginal propensity to consume out of wages than profits), diminish the competitiveness of national products (reducing net exports), and lessen profits, which are an incentive for private investment. The sum of these particular effects will determine whether aggregate demand will grow or diminish in reaction to a shift in income distribution towards wages; in other words, if demand is wage- or profit-led respectively (Blecker, 2016). Additionally, the accumulation regime can also be characterized as wage- or profit-led depending on how investment reacts to changes in capacity utilization and in profitability. Because the type of economic regime[3] is not known *a priori*, its determination is an empirical matter.

Inspired by this literature, the contribution of this dissertation is to shed light on the multitude of determinants of the economic regime in a country by taking the example of the Brazilian economy since the beginning of the 2000s. The analysis of the Brazilian economy through the Kaleckian models suggests some factors that made economic growth with income redistribution possible in the period before the crisis and some reasons why they were not enough to sustain the previous growth rates after it. Given this complex determination, one ought not to expect that there is a stable regime, so we characterize the Brazilian demand and accumulation regimes as profit- or wage-led in the periods before and after an estimated structural break. In order to estimate the regimes, we apply the structural vector auto-regression (SVAR) approach. To the best of our knowledge, no study on the Brazilian economic regime has tested for structural breaks using a SVAR model, which seems to be the most adequate approach to this type of

[2]The accelerator effect is the effect of output growth on investment demand.

[3]Throughout this dissertation, economic regime is used in broad terms to refer to both the demand and accumulation regimes.

estimation. Therefore, this dissertation also explores how such test can be done within this model.

In order to explore this research question, the dissertation is organized in three chapters, besides this introduction and the conclusion. Chapter 1 analyzes the relationship between economic growth and income distribution in the Brazilian economy since the 2000s. Therefore, it provides a summary of the process of income redistribution that took place in the country and analyzes how such process was linked to the economic growth experienced by the country in the 2000s and early 2010s. The chapter closes with some suggestions of mechanisms that might have operated to reduce the effectiveness of a wage-led strategy.

Chapter 2 presents the literature review on the Kaleckian economic growth and income distribution models. It analyzes the Cambridge model and presents the Kaleckian critique to such model. Then, it reviews the core features of Kalecki's and Steindl's theories that were incorporated into the Kaleckian models and presents a review of the main contributions to these models. Moreover, some recent criticisms to the Kaleckian models are discussed.

Chapter 3 brings the empirical results for the Brazilian economy from 2003 to 2014. The chapter begins with a summary of the previous studies that have tested the demand or accumulation regimes of this economy and contrasts them with the approach taken in this dissertation. It, then, presents the methodology and database used in our study and discusses the main stylized facts and results. Finally, some conclusions are discussed in the closing section.

Chapter 1

Income redistribution and economic activity in the Brazilian economy since the 2000s

In the 2000s, more specifically from 2003 onwards, Brazil benefited from higher external demand for its export products and from an increase in commodities prices, which led to higher domestic GDP growth rates. Additionally, there was an increase in capital flows to the country and the improved external accounts allowed it to accumulate international reserves, leading to a domestic currency appreciation, which decreased inflation and improved workers' purchasing power (Baltar, C. T., 2015). This favorable economic scenario increased employment and formalization rates and allowed the government to implement income transfer policies targeting the lower class (Arestis and Baltar, 2017*a*). The resulting income redistribution, combined with a credit boom, increased domestic demand and further reinforced economic activity growth. Consequently, Brazil experienced higher growth and lower inflation rates during the 2000s than in the previous decades.

The income redistribution that took place in the period led to a reduction in the Gini index[1] and an increase in the wage share of national income (table 1.1). Within the Kaleckian growth and distribution models, a functional income redistribution towards wages can stimulate the economy through higher consumption, despite the negative stimulus on investment and on net exports, characterizing a wage-led economy. The opposite result, i.e. a negative stimulus, is also possible if the effect on consumption is sufficiently low, so the economy is profit-led. The outcome will depend on the responsiveness of each aggregate demand component to the wage share.

There is no consensus on which demand regime prevailed in the Brazilian economy during the 2000s, as empirical studies have not reached a consensus on what is the demand

[1]The Gini index measures how far the income distribution is from a perfect income distribution. Therefore, it is used as a measure of personal income distribution.

regime of the country nor have they focused exclusively on the period of the 2000s[2]. Still, despite the persistence of the income transfer policies between 2003 and 2014, the Brazilian economy has presented lower growth rates since 2011, suggesting that functional income redistribution was not enough to sustain aggregate demand and investment in the more complicated scenario since the global financial crisis of 2007-2008.

In order to investigate the role of functional income distribution in the dynamics of economic activity and investment in Brazil, this study estimates the demand and accumulation regimes of the country for the period between 2004 and 2014. It also investigates the possibility of a change on how accumulation and demand respond to the wage share, explaining why income redistribution was not enough to sustain high economic growth after 2011. The purpose of this chapter is to explore the characteristics of the income redistribution process that took place in the Brazilian economy in the 2000s and 2010s; to present some interpretations of the relation between this process and the country's economic growth; and to suggest some mechanisms that can lead to a shift in the economic regime. A brief conclusion closes the chapter.

1.1 Income redistribution in Brazil since the 2000s

To Biancarelli (2014), the distinctive feature of the Mr. Lula's administration (2003 to 2010), and of his successor, Ms. Dilma Rousseff (2011 to 2016), was to conciliate the objectives of economic growth and social justice. Therefore, the 2000s would have inaugurated a period in which, despite the maintenance of an orthodox macroeconomic regime, the social aspect of development was among the main concerns of the government.

The income redistribution observed in the period was a result of public policies implemented during the period with such objective (e.g. the *Bolsa Família* program), but also of the positive economic performance. In summary, five main features of such process can be listed (Baltar, P., 2015, Biancarelli, 2014)[3]:

- Direct cash transfers (*Bolsa Família*);
- Pension system;
- Increases in the real minimum wage;
- Improvements in the labor market;
- Lower inflation rate.

The *Bolsa Família* program became a federal law in 2004 by unifying previous social assistance programs. It establishes a monthly payment to households who have an income below

[2] See section 3.1.

[3] Lower interest rates could be added to these five main features as, from a Sraffian perspective, the interest rate affects the mark-ups (Serrano and Summa, 2012).

a certain threshold, encompassing poor and extremely poor households. As a counterpart, the children of the household must have a satisfactory level of school attendance and must follow the vaccine schedule until they are seven years old. Additionally, there are requirements for the monitoring of women's health. Therefore, the program links the cash transfers to some requirements that increase the quality of life of these households, encompassing more than just the economic aspect of social development. Since its beginning, the program has been expanded in terms of its resources (Brasil, 2017) and of the number of families included, but it is still cheaper than other programs as the payments are always below the minimum wage (Biancarelli, 2014). The effectiveness of such program is suggested by Hoffmann (2013), who shows that, within all types of income received by households, the cash transfers from *Bolsa Família* are the most progressive type of income in the sense of contributing to income equality.

Another important transfer policy has been the pension system to rural workers who have never contributed to the social security system, as well as to other categories of workers (in Portuguese, *Benefício de Prestação Continuada*, BPC). As this program guarantees a monthly minimum wage payment, it is more expensive than the *Bolsa Família* program and its payments increased together with the minimum wage (Biancarelli, 2014).

These two income transfer policies were fundamental to the improvement of the living conditions of the Brazilian lower class. Indeed, Hoffmann (2013) shows that, despite the fact that they account for less than 1.0% of total household income, government cash transfers (*Bolsa Família* and BPC) have contributed with 16.1% of the Gini coefficient reduction between 2001 and 2011, testifying the importance of the income transfer policies to such process and its characteristic of focusing on the lower class[4].

The real minimum wage increases in line with GDP growth (which became a policy rule in 2011) ensured that productivity growth was distributed to a large percentage of the population, through its direct and indirect impacts on the bargaining of workers (Baltar, P., 2015, Biancarelli, 2014) and on the lower public sector wages (Serrano and Summa, 2012), as well as on pension benefits to the very poor households with elderly people (BPC), as already mentioned. The real increase in the minimum wage[5] was of 64% between 2003 and 2014 (reaching 70% if the period between 2003 and 2017 is considered). As argued by Baltar, P. (2015) and Serrano and Summa (2012), the increases in the minimum wage had the positive impact of reducing poverty and enhancing the distribution of wages within the labor class, which was also allowed for by the lower inflation rate. However, Rugitsky (2017) suggests that the reduction in wage inequality might also have been related to a larger share of low-paying jobs in the job structure, mainly related to the services sector.

This process also benefited from the better conditions of workers in the labor market, with higher employment and formalization rates, leading to both a higher wage share and a better

[4]Other studies, with different methods, suggest that government transfers were responsible for a larger share of the Gini coefficient reduction (Barros et al., 2010, Calixtre, 2014).
[5]Deflated by the consumers price index (IPCA).

distribution of the wage income between workers (Baltar, P., 2015). Indeed, higher formalization rates make the minimum wage increases more relevant (Medeiros, 2015). Consequently, 41.5% of the reduction in the Gini coefficient between 2001 and 2011 was due to the labor income of employees, which accounted, on average, for 41.3% of total income and became less concentrated during this period (Hoffmann, 2013). Therefore, this process of income redistribution cannot be fully understood if the macroeconomic conditions that allowed it are not taken into consideration, as the context of economic growth created a better dynamics in the labor market that benefited workers by increasing the employment and the formalization rates.

Finally, the lower inflation rate is also perceived as an important mechanism in the process of income redistribution that took place in the 2000s (Baltar, P., 2015), as it was related to the evolution of the real exchange rate. Serrano and Summa (2012) argue that the lower real exchange rate[6] strongly influenced the increase in real wages and in the wage share. Indeed, Arestis and Baltar (2017*a*) argue that the increase of the purchasing power of workers in a context of lower inflation was possible due to changes in relative prices (associated with changes in the real exchange rate), rather than to higher investment (which would lead to higher productivity).

Therefore, because the external scenario allowed for higher economic growth with lower inflation, it had a positive impact on income distribution (Baltar, P., 2015). This was also due to its positive effect on the financial situation of the public sector, which allowed the government to implement the above mentioned income transfer policies (Arestis and Baltar, 2017*a*) and increased workers' bargaining power (Carvalho and Rugitsky, 2015).

Indeed, both the share of employees' remuneration and the wage share[7] of value added and of GDP grew in the period (table 1.1). Interestingly, Baltar, P. (2015, p. 30) points out that the increase in employees' remuneration share of value added from 2004 to 2008 was higher than the increase in their share of GDP (in percentage points), the difference being due to the increase in the share of indirect taxes in the period, which are partly directed to interest payments and thus operate to concentrate income. However, this difference is no longer present if the values between 2004 and 2014 are compared because there was a decrease in the share of indirect taxes in GDP from 2008 to 2014. Additionally, such difference was never expressive in the wage share because there was a larger fall in the share of mixed income in GDP between 2004 to 2008 than in 2008 to 2014, compensating for the increase in indirect taxes.

Other measures of inequality, such as the Gini index, which measures personal income distribution, also reveal a more egalitarian income distribution, as reported in table 1.1. Additionally, poverty and extreme poverty rates also decreased in the period (Serrano and Summa, 2012).

[6] In Brazil, the exchange rate is defined as the price of foreign currency in domestic currency.

[7] Employees' share does not include the self-employed income (mixed income), which is part of the wage share. The latter share is calculate by assuming that mixed income is split between labor and capital incomes in the same proportion as the remaining value added.

Table 1.1: Brazilian wage share and Gini index - 2003 to 2014

	W/Y	W/VA	Wage share (Y)	Wage share (VA)	Gini index
2003	38.56	45.57	44.83	52.99	58.30
2004	38.37	45.81	44.03	52.56	57.25
2005	39.27	46.89	44.87	53.57	56.95
2006	40.02	47.66	45.40	54.07	56.30
2007	40.27	47.88	45.57	54.17	55.60
2008	40.60	48.78	45.76	54.99	54.62
2009	42.44	50.41	47.37	56.27	54.26
2010	41.67	49.65	46.37	55.26	N.A.
2011	42.22	50.21	46.85	55.72	53.14
2012	42.79	50.86	47.61	56.60	52.97
2013	43.27	51.21	48.20	57.05	52.75
2014	43.55	51.17	48.36	56.82	51.79

Notes: W: sum of total employees' remuneration; Y: GDP; VA: value added. Wage share calculate by assuming that mixed income, i.e., self-employed income, in value added and in GDP is split between labor and capital incomes in the same proportion as the remaining value added. The Gini index goes from 0 to 100 and the lower the index, the closer the income distribution is to perfect distribution. N.A.: not available. Sources: IBGE (2017*a*) and Ipeadata (2017). Own elaboration.

The limits of such process

Despite an important concern with the bottom of the income distribution, expressed in both the income transfer policies and the real increases in the minimum wage, some features of the Brazilian economy were not dealt with and the top incomes remained relatively high in comparison to the rest of the country (Medeiros et al., 2015*a*,*b*).

In macroeconomic terms, two essential aspects that operate to concentrate income remained throughout the period. The levels of the interest rate, despite a short period of decrease, remained high and there was no tax reform (Biancarelli, 2014, Carvalho and Rugitsky, 2015). Additionally, there was no improvement in terms of wealth equality, which might have become worse (Biancarelli, 2014).

Thus, when income inequality is assessed through an index that contrasts the income of the upper class with total income (such as the share of income that goes to the top 0.1%, 1%, or 5%) and considers the tax statements in order to better capture the top incomes (combining them to the household surveys), there is no evidence of a reduction in income inequality and the results suggest that, in the best scenario, it remained stable between 2006 and 2012 (Medeiros et al., 2015*a*,*b*). Indeed, the average share on total income of the top 0.1%, 1%, and 5% was respectively of 11%, 25%, and 44% in the period and their average income with respect to the

Brazilian average income actually increased[8]. Therefore, the upper class continued to receive a large part of the increase in income between 2006 and 2012, although there has been a small increase in the share of this increase received by the lower class after 2009 (Medeiros et al., 2015*a*, Table 2).

As argued by Medeiros et al. (2015*b*), the comparison between the indexes on top incomes and the broader ones, such as the Gini index from household surveys[9] (table 1.1), suggests that there might have been an improvement of the lower class, but an overall assessment of income distribution also depends on the top incomes. According the author, most of the income redistribution process took place within the lower and middle classes, while the rich were more capable of protecting their income from it.

While this information questions the overall perception that income equality had inarguably improved in the 2000s, it also reveals a well-known aspect of the Lula's government, in particular: its conciliatory aspect. Thus, one could argue that because the richer groups were protected from the income distribution process that took place, it was, to some extent, easier to increase the income of the lower class because the elites offered less resistance. On the one hand, the increase in the income of the Brazilian lower class improved its quality of life, reducing poverty rates; on the other hand, it took place without questioning the privileged position of the Brazilian elites.

Still, the information from the national accounts suggests that there has been an increase in the wage share (table 1.1), which measures functional income distribution. While this can have resulted from the income transfer policies put in place by the government, it can overstate the improvement in the working class. The data from Medeiros et al. (2015*a*,*b*) shows that top incomes shares have not decreased and this suggests that top wages did not decrease either. Indeed, top wages must have increased with the reduction of the number of family-owned companies and the increase of the number of companies whose CEO (chief executive officer) is an employee (Hoffmann, 2013), although further studies would be needed in order to assess the intensity of such process from the 2000s onwards.

Yet, while this increase in the wage share might have resulted from a lower share of retained profits by firms[10] or higher top wages, it might as well have resulted from the income transfer policies, higher minimum wage, employment and formalization rates, which benefited the lower class. Despite the fact that the upper class preserved its share of income, this better position of the lower class meant including it in the consumption market (Baltar, P., 2015) and, to some extent, in the credit market (Biancarelli, 2014), creating a strong and new stimulus for consumption and aggregate demand.

[8] From 97.1 to 116.4 for the top 0.1%, from 23.4 to 27.1 for the top 1%, and from 8.5 to 9.7 for the top 5% between 2006 and 2012 (Medeiros et al., 2015*b*, Table 1).

[9] Household surveys tend to underestimate the incomes (Hoffmann, 2013), especially the top incomes, leading to a perception that the degree of inequality is lower than what is actually the case (Medeiros et al., 2015*a*,*b*).

[10] Medeiros et al. (2015*a*,*b*) do not account for retained profits as they deal with household income.

1.2 Income redistribution and economic growth

The more favorable external scenario, which led to an increase in commodities prices and external demand, increased Brazilian exports after 2003. This led to a more robust balance of payments, which also benefited from the increase in capital inflows that followed the increase in exports, and to the recovery of economic growth in 2004 (table 1.2). Indeed, the determinants of the economic growth in 2004 are the expressive increase in exports and investment, together with an increase in consumption (Baltar, P., 2015). As exports were the most dynamic aggregate demand component at the time, they were the main responsible for the GDP growth until 2005.

As discussed by Baltar, P. (2015), this favorable external scenario allowed economic growth to take place together with lower inflation (at least to the country's previous levels) due to the appreciation of the Brazilian currency. While lower inflation meant the recovery of the purchasing power of labor income, economic growth led to an increase in employment. Consequently, the combination of these two effects led to an increase in consumption (which was further enhanced by increases in consumer credit).

Therefore, despite the negative effect of a lower exchange rate on net exports, economic growth did not decelerate because domestic demand became its main driver from 2006 onwards, when the trade surplus lowered (Baltar, P., 2015, Biancarelli, 2014). Part of this positive economic performance can also be attributed to capital inflows that allowed for the reduction of Brazil's foreign debt while also increasing its international reserves (Arestis et al., 2016). This process is characteristic of the Brazilian economic growth pattern since the liberalizing reforms, in which favorable international circumstances improve the balance of payments (through higher exports and capital inflows) and lead to higher economic growth, lower inflation, and an appreciated currency, which stimulates domestic absorption (Baltar, 2013). Indeed, Serrano and Summa (2012) suggest that an appreciated currency stimulates consumption more than it reduces net exports, so the net effect on aggregate demand is positive.

This suggests that the positive stimulus given by the external scenario, combined with a small shift towards a more expansionary macroeconomic policy, allowed for the recovery of consumption and this higher demand stimulated investment, which was also positively impacted by an increase in public investment (Arestis et al., 2016, Serrano and Summa, 2012). Because this higher consumption was related to the process of income redistribution that took place since 2004, some interpretations suggest that the better position of workers led to higher economic growth as well.

However, the global financial crisis of 2007-2008 had a negative effect on Brazilian exports and led to a deceleration of consumption and to a decrease of investment. Despite the recovery that took place in 2010, the external scenario was of more international competition as there was more idle capacity in other countries, imposing a more challenging scenario to the Brazilian economy (Hiratuka and Sarti, 2015). Because the process of functional income redistribution continued (table 1.2), consumption continued to grow (at lower rates), but this was

Table 1.2: Brazilian aggregate demand components (yearly growth rates - %) and functional income distribution (% of value added) - 1996 to 2016

	VA	T	GDP	C	G	I	X	M	ws
1996	2.0	3.7	2.2	3.2	-1.8	1.2	-0.4	5.6	
1997	2.9	6.8	3.4	3.0	1.2	8.4	11.0	14.6	
1998	0.6	-1.7	0.3	-0.7	3.2	-0.2	4.9	-0.1	
1999	1.0	-3.1	0.5	0.4	1.7	-8.9	5.7	-15.1	
2000	3.9	7.4	4.4	4.0	-0.2	4.8	12.9	10.8	
2001	1.5	0.6	1.4	0.8	2.6	1.3	9.2	3.3	
2002	3.6	0.0	3.1	1.3	3.8	-1.4	6.5	-13.3	
2003	1.2	0.6	1.1	-0.5	1.6	-4.0	11.0	-0.5	53.0
2004	5.7	6.4	5.8	3.9	3.9	8.5	14.5	10.4	52.6
2005	3.0	4.3	3.2	4.4	2.0	2.0	9.6	7.5	53.6
2006	3.7	5.5	4.0	5.3	3.6	6.7	4.8	17.8	54.1
2007	5.8	7.6	6.1	6.4	4.1	12.0	6.2	19.6	54.2
2008	4.7	7.5	5.1	6.5	2.0	12.3	0.4	17.0	55.0
2009	-0.1	-0.3	-0.1	4.5	2.9	-2.1	-9.2	-7.6	56.3
2010	7.0	10.8	7.5	6.2	3.9	17.9	11.7	33.6	55.3
2011	3.7	5.3	4.0	4.8	2.2	6.8	4.8	9.4	55.7
2012	1.6	3.7	1.9	3.5	2.3	0.8	0.3	0.7	56.6
2013	2.9	3.7	3.0	3.5	1.5	5.8	2.4	7.2	57.0
2014	0.5	0.8	0.5	2.3	0.8	-4.2	-1.1	-1.9	56.8
2015	-3.2	-6.0	-3.5	-3.2	-1.4	-13.9	6.8	-14.2	
2016	-3.0	-6.3	-3.5	-4.3	-0.1	-10.3	1.9	-10.2	

Note: VA: value added; T: indirect taxes; GDP: gross domestic product; C: household consumption; G: government consumption; I: gross capital formation; X: exports; M: imports; ws: wage share of value added. Sources: IBGE (2017*c*, Table 5932) and IBGE (2017*a*). Own elaboration.

accompanied by raising imports at rates higher than exports growth. Indeed, according to Arestis et al. (2016), the unfavorable international scenario, from 2009 to 2013, enhanced the negative effects of the appreciated domestic currency on GDP growth because imports responded more intensively to it.

Thus, despite the counter-cyclical policy answer to the crisis by the government, the uncertainty related to the crisis had a negative effect on investment, consumption decelerated, and the domestic production of manufactured goods was negatively affected by the greater international competition in this market, which, combined with the overvalued domestic currency, had a negative effect on the trade balance (Arestis et al., 2016). Thus, the positive impact of the income transfer policies after the Great Recession was transfered to other countries through higher imports, having a lower induced effect on investment (Arestis and Baltar, 2017*b*). This scenario then led to the lower growth rates of GDP and investment from 2011 to 2016, as reported in table 1.2.

The role of wages

If, on the one hand, the process of income redistribution between 2006 and 2008, through its effect on consumption, had been linked to the higher GDP growth rates observed in this period, the relationship between the sustained process of income redistribution and the Brazilian economic dynamics after 2008 became less clear, specially given the behavior of investment. Despite the lower intensity of the reduction in income inequality after the crisis, it was still in place, so an income concentration did not take place and does not explain the weaker economic growth after the crisis in case the economy was wage-led. This leads to some questioning of how important the reduction in income inequality, especially in functional income inequality, is to economic growth in Brazil.

According to Arestis et al. (2016), higher wages and credit growth did stimulate the economy through higher consumption[11] and the change that took place with the Great Recession was a stronger effect of currency appreciations on imports growth, which was also positively affected by increases in GDP. Additionally, they point out the effect of the lower investment in the deceleration after the Great Recession. Also to Serrano and Summa (2012), the process of poverty reduction and improvements in income equality was a strong stimulus to consumption, aggregate demand, and employment, leading to further reductions in poverty and in inequality[12]. To them, the deceleration after the world financial crisis also resulted from the negative effect of the exchange rate appreciation on the current account and industry competitiveness, as well as from a shift in the country's macroeconomic policy, which did not operate so strongly to sustain aggregate demand and was directed to increase profitability (Carvalho and Rugitsky, 2015). Indeed, the main focus of the fiscal policy from 2012 to 2014 was on fiscal incentives rather than on public investment (Mello and Rossi, 2017). Thus, despite identifying a positive relation between income distribution and economic growth, neither of these authors directly links the deceleration of the economy to this relation or its sustainability possibilities.

In a different perspective, a process of increase in the wage share combined with economic growth was doomed to fail because it relied on foreign savings (Bresser-Pereira, 2012). The argument, in this case, is that, when economic growth relies on foreign savings, the domestic currency appreciates and domestic saving decreases due to higher consumption, obtained through an "artificial" increase in wages[13], and due to the reduction of profitable investment opportunities. To the authors who share this perspective, the overvaluation of the domestic currency prevents a sustainable growth pattern in the long-run, as it reduces the current account balance (Oreiro et al., 2012). Therefore, in this case, the explanation for the deceleration is that, since its beginning,

[11] Empirical support for this hypothesis is also provided by Schettini et al. (2012).

[12] Rugitsky's (2017) analysis supports this rationale by suggesting that there is a cumulative process by which the distribution of income changes the demand composition, which changes the relative prices and the production structure, impacting the relative shares of skilled and unskilled workers and, thus, further impacting wage inequality. In the Brazilian case, this took place through an increase in the services share, which led to an increase of low productivity jobs and lower wage inequality.

[13] An artificial increase in wages is when they increase due to a currency appreciation rather than due to an increase in productivity (Bresser-Pereira, 2012).

the process was not a sustainable one. Indeed, as noted by Carvalho and Rugitsky (2015), the point of view of these authors seems to suggest that the economy would actually be profit-led, as a devaluation, that would bring about a reduction in the wage share, would lead to higher aggregate demand.

Finally, to a third group of authors, it is possible that the reduction in income inequality stimulated economic growth mostly due to the reduction in personal income inequality (mainly a better distribution of labor income), rather than due to the redistribution from profits to wages[14] (Carvalho and Rugitsky, 2015). Rugitsky (2017) also suggests that the main stimulus to economic growth came from a reduction in wage inequality and the credit boom. Thus, the deceleration of the reduction in personal income inequality might have led to the deceleration of aggregate demand, which was also caused by other factors. Still, one could question whether this proves that the reduction in personal income inequality was the main driver of aggregate demand at the time as the reduction in functional income inequality also decelerated after 2010 (table 1.1).

A more interesting insight is the possibility of a non-linear response of investment and consumption to the profit share. Indeed, Carvalho and Rugitsky (2015) suggest that the reduction of the profit share, while beneficial to economic activity until 2010 (so the economy would be wage-led at the time), became so low after 2011 that prevented investment growth, so the economy became profit-led. The next section explores the possibility of a regime switch by discussing some alternative explanations.

1.3 The possibility of a regime switch

Despite the persistence of income redistribution between 2004 and 2014, economic growth reacted differently to it before and after the 2007-2008 global financial crisis. After a decrease in GDP in 2009 and some recovery in 2010, the economy started to decelerate from 2011 onwards and showed lower average growth and investment rates. Indeed, while the average GDP growth rate was of 4.84% per year between 2004 and 2008, it decelerated to 2.35% per year between 2011 and 2014 and the average investment growth rate decreased from 8.30% per year between 2004 and 2008 to 2.30% per year between 2011 and 2014 (IBGE, 2017*c*).

Certainly, a multitude of aspects contributed to such deceleration, so the purpose of the present section is not to discuss the validity of the analyses presented in the previous section[15], but to discuss specifically the role of income distribution in this process. More precisely, our argument is that even within a wage-led demand regime (or a profit-led), the continuation of the functional income redistribution process might have become a weaker stimulus to aggregate demand and investment, decreasing its wage-ledness (or increasing its profit-ledness).

[14] For a discussion on the relation between personal income inequality and the demand regime, see Carvalho and Rezai (2016).

[15] Additionally, see Ferrari-Filho et al. (2014), Paula et al. (2015), and Mello and Rossi (2017).

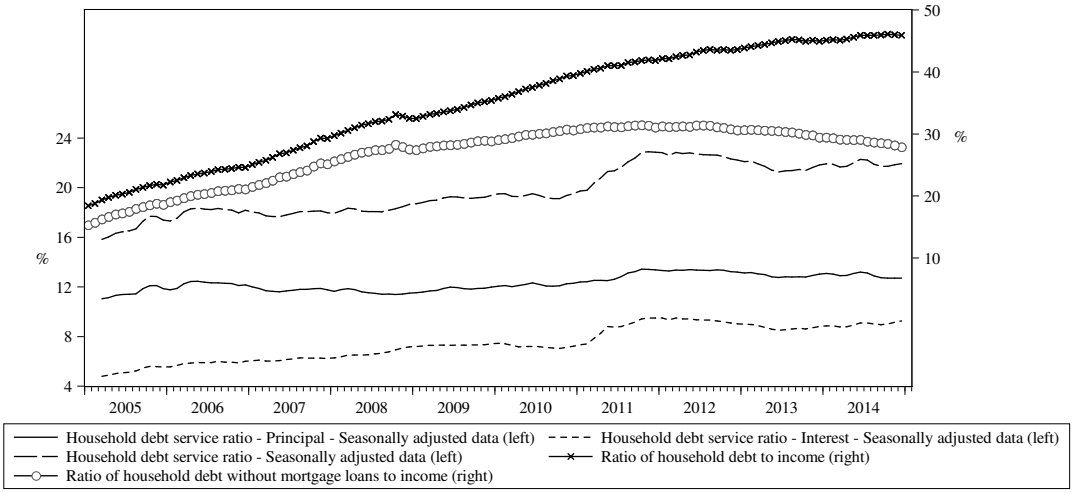
The possibility of non-linearities in the demand and accumulation regimes is explored by part of the Kaleckian literature. For instance, Nikiforos and Foley (2012) assume a non-linear distributive schedule. Additionally, Bhaduri and Marglin (1990, Appendix B) suggest that the response of investment to the profit share might be different depending on the level of capacity utilization. They argue that, if capacity utilization is at very low levels, increases in the profit share would have a weak effect on stimulating investment, so the likelihood of a wage-led regime would be higher. Finally, Nikiforos (2016) analyzes the possibility of an endogenous mechanism that leads to changes in the relation between income distribution and economic growth. He argues that changes in income distribution affect the propensities to invest (at high profitability, the importance of profits to finance investment decreases) and save (higher capitalist income means a lower marginal propensity to consume).

The argument here, which is inspired by the Brazilian case, shares some similarities with Carvalho and Rugitsky's (2015) and Nikiforos's (2016) arguments, but it highlights some mechanisms that are more prone to operate in an open developing economy such as Brazil. In particular, some mechanisms may be specific to an open developing economy because they relate to how the world scenario affects the domestic economy, leading to more stringent conditions for wage-led growth, as external conditions may change their regime.

In terms of the consumption dynamics, besides the increase in the wage share and the better wage income distribution, a central aspect of the 2000s, which is highlighted by a number of authors, was the increase in household borrowing since 2004. This was driven by financial innovations (such as *crédito consignado*, a modality in which interest payments are deduced directly from the debtor's payroll) and by the better situation in the labor market in terms of higher wages and higher formalization rates, allowing more people to access the financial market (Arestis et al., 2016, Baltar, P., 2015, Biancarelli, 2014, Rugitsky, 2017). Additionally, the response to the 2007-2008 crisis involved increasing the grant of credit to households (Paula et al., 2015).

This led to an increase in household indebtedness rates. Consequently, after 2011, households were reluctant to take new loans despite the looser monetary policy between 2011 and 2013 (Paula et al., 2015). Figure 1.1 shows that the increase in the ratio of household debt to income decelerates around the middle of 2012 and, if mortgage loans are not considered, this ratio actually started to decrease around the same time. Additionally, around the beginning of 2011 there was an increase in all indicators of household debt service ratio, with a further increase in 2013, when the Brazilian monetary authorities started to increase the interest rates.

Figure 1.1: Household debt indicators - 2005 to 2014



Source: Brazilian Central Bank (2017, Series 19879 to 19882 and 20400). Own elaboration.

Thus, with a larger share of households' income committed to debt services and a reversal of their debt ratios (excluding mortgage loans), they postponed consumption expenditures. Consequently, despite the maintenance of an income redistribution process leading to a higher wage share, the credit boom was over and it is likely that a smaller part of the increase in households' income was directed to consumption. Not only consumption decelerated due to the end of the credit boom (Rugitsky, 2017, Paula et al., 2015), but the financial relations undertaken by households might have led to a decrease in their propensity to consume by the end of the period, reducing the likelihood of a wage-led regime.

Regarding investment dynamics, because it responds to the accelerator effect, it is reasonable to assume that the weaker stimulus from the wage share to consumption also had an impact on the responsiveness of investment to the wage share. Additionally, a reduction in public investment since 2011 (Rugitsky, 2017) and the more complicated international markets for Brazilian exports had a negative effect on total investment. Yet, its relation to income distribution might also have changed due to financial aspects related to this expenditure that changed during the period and led to its deceleration.

The main question is, then, the role of profitability on investment decisions. While the deceleration of investment can be accounted to the decrease in the profit share, this took place since 2004 and did not hamper the investment boom in the following years. Still, it is possible that, as suggested by Carvalho and Rezai (2016), the relationship between investment and the profit share is non-linear and around 2011 the profit share became so low that it started to limit investment expenditure. Indeed, the participation of own resources in the financing of investment decreased from 2004 to 2014, from 10.1% in 2004 to 6.3% in 2014, which is assumed to be related to the decrease in retained earnings since 2010 (CEMEC, 2017).

Yet, it does not seem to be the case that the reduction in retained resources had a negative effect on investment because it restricted available cash to investment plans. Indeed, table 1.3 shows that there was some compensation between the three most important sources of investment finance (own funds, foreign investment, and BNDES loans): while there was a reduction of the importance of own funds (savings and retained profits), there was an increase in the share of foreign investment and BNDES loans. It is worthwhile mentioning an increase in issuances of shares after 2010, which helped to fill the gap left by the decrease in own resources (CEMEC, 2017).

Table 1.3: Average participation of the three most important sources of investment financing (% of total investment)

	2004 to 2009	2010 to 2014
Own resources	59.25	41.88
Foreign investment	15.06	20.54
BNDES	10.73	14.26

Source: CEMEC (2017, Graph 4). Own elaboration.

Thus, there is not a clear link from the lower profit share to the decrease in investment due to the lack of financial resources. Additionally, one should bare in mind that retained profits also decreased in the period because the share of dividend payments relative to gross operating surplus increased since 2009 (Rezende, 2016). While this might have occurred from pressures from the transnational companies in order to compensate for their lower profits abroad with the crisis, as remittances increased around 2011 (Rezende, 2016), suggesting another impact from the international scenario on the Brazilian economy, it does not seem that this restricted investment because there were lower funds available to it.

Yet, within Kalecki's theory, the role of profits is also to signal the ability of firms to meet their debt commitments. As firms' indebtedness ratios were increasing from 2010 to 2016 (CEMEC, 2016) and the liquidity preference of banks increased after the European crisis, which, together with a higher risk perception, led to the exhaustion of the credit boom in the country (Paula et al., 2015), profits might have become increasingly more important as a signal that firms were creditworthy. The harsher financial conditions, which partially resulted from the global crisis, would then have implied a larger dependence on profitability.

Additionally, it is also possible that there is an asymmetric non-linear response of investment to the profit share. Building on Bhaduri and Marglin (1990, Appendix B), one can assume, as they do, that an increase in the profit share will have a weaker effect on investment if capacity utilization is at a low level. However, it is also plausible that, in such a situation, a decrease in the profit share leads to an even larger decrease in investment as it strengthens the negative animal spirits, already weakened by the low capacity utilization. It is possible, then, that when the Brazilian economy was hit by the harsher international conditions, that had a negative impact on its exports and on capacity utilization, the further decreases in the profit share

were perceived as another signal that there was a deceleration in the economy, inducing more pessimistic expectations and making investors postpone their expenditure.

Therefore, there were two sources that might have decreased the stimulating effect of the increases in the wage share on investment and economic activity. Firstly, the higher indebtedness of households (Paula et al., 2015) might have led to a lower propensity to consume out of disposable income, decelerating consumption and economic activity[16]. Secondly, the increase in firms' indebtedness ratios (CEMEC, 2016), the higher risk perception regarding the Brazilian economy (Paula et al., 2015), and the more pessimistic expectations due to the global crisis increased the negative effect of the decreases in the profit share on investment. This indicates that the extent to which the situation in the world economy affects the domestic economy and animal spirits might affect the likelihood of an increase in the wage share having a positive effect on economic activity and investment. Thus, it is possible that, in the recent past of the Brazilian economy, a shift in the demand and accumulation regimes took place (or that they became less wage-led/more profit-led) when the world scenario became worse.

1.4 Conclusion

The Brazilian economy was positively impacted by the higher external demand and by the increase in commodities prices in the 2000s. This allowed the government to implement income transfer policies that, together with the higher formalization and employment rates, redistributed income towards the lower class (Arestis and Baltar, 2017*a*, Baltar, P., 2015, Biancarelli, 2014). Thus, there was an increase in the wage share and a decrease in the Gini coefficient, along with a reduction of poverty rates (Serrano and Summa, 2012).

This income redistribution meant incorporating more people into the consumption and credit markets, leading to an increase in consumption, which became the main driver of economic growth after 2006. Thus, the income redistribution that took place in the 2000s was perceived as having a positive effect on economic growth (Arestis et al., 2016, Arestis and Baltar, 2017*a*, Baltar, P., 2015, Biancarelli, 2014, Serrano and Summa, 2012).

However, the deceleration of investment and economic activity from 2011 onwards suggests that the ongoing income redistribution process was not enough to sustain the previous growth rates. Indeed, section 1.3 explored some mechanisms that might have led to a lower stimulus from the income redistribution process to economic activity. These mechanisms are related to the indebtedness levels of firms and households and to the international scenario.

This dissertation explores the relation between income redistribution and economic activity in Brazil. More specifically, it analyzes the importance of the wage share to demand and investment and, thus, the focus is on functional income distribution. The literature review

[16]The lower propensity to consume out of disposable income also results from the income redistribution towards the rentier class through interest payments. As this class is likely to have a low propensity to consume, such income redistribution contributes to the deceleration of the economy.

(chapter 2) focuses on the Kaleckian economic growth and income distribution models, which provide a theoretical framework that explores the effect of a functional income redistribution on demand and accumulation. Then, the Brazilian economic regime is estimated for the period from 2003 to 2014 and the possibility, raised in the present chapter, of an economic regime switch is tested in chapter 3.

Chapter 2

Theoretical models

This chapter reviews the Kaleckian economic growth and income distribution models. They draw a theoretical relation between functional income distribution and economic growth, exposing the mechanisms that may take place in the determination of an economy's regime. Thus, they provide a theoretical background to the analysis of the Brazilian economy in the 2000s, when functional income distribution towards wages took place simultaneously to economic growth.

Section 2.1 discusses the contribution of the neo-Keynesian economists from Cambridge and the neo-Kaleckian critique to them. Section 2.2 brings the contributions of Kalecki and Steindl that have been incorporated by the Kaleckian economic growth and income distribution models, while section 2.3 discusses these models. Section 2.4 briefly presents some critiques to these models. Finally, section 2.5 concludes this chapter by discussing the contributions of the theoretical models to the understanding of the Brazilian economy since the 2000s.

2.1 The Cambridge model

In the 1950s, neo-Keynesian economists from Cambridge, UK, such as Kaldor (1956), Robinson (1956), and Pasinetti (1962), developed models that contributed to the understanding of the relation between economic growth and functional income distribution. As Lavoie (2006) explains, the purpose of these economists was to provide an alternative to the traditional marginal productivity perspective from the neoclassical theory by studying the profit rate (and, through it, income distribution) for a given growth rate from a Keynesian perspective.

To Kaldor (1956), the Keynesian theory can be applied to the long-run in order to explain the relation between prices and wages if the level of employment and output is considered fixed[1]. This is a different perspective from the short-run perspective adopted by Keynes (1991)

[1] Kaldor (1956) considered that the theory of effective demand could not determine the level of economic activity and income distribution simultaneously, so he assumes that the economy is in full employment in order to study the income distribution (Lavoie, 2014, ch. 5). However, Lavoie (2014, ch. 5) shows that both output and income distribution can be determined within a model that includes overhead labor costs.

in *The General Theory*, as the focus in his book was to explain the level of employment and output taking the distribution of income (i.e. the relation between prices and wages) as given. However, to Kaldor (1956), the same structure based on the multiplier principle can be applied to the long-run, justifying the *Keynesian* label in his theory.

The model assumes that workers do not save, output is at the full employment level, and investment is exogenous (Kaldor, 1956). Equation 2.1 is the output from the income approach, equation 2.2 is the commodity market equilibrium condition, and equation 2.3 is the saving function:

$$Y = W + P \tag{2.1}$$

$$I = S \tag{2.2}$$

$$S = S_p = s_p P \tag{2.3}$$

where Y is real output, W is real aggregate wages, P is real aggregate profits, I is real aggregate investment, S is real aggregate saving, S_p is aggregate real saving out of profits, and s_p is the propensity to save out of profits.

From equations 2.2 and 2.3, it is possible to derive equation 2.4, according to which aggregate profits are directly proportional to the level of aggregate investment and inversely proportional to the propensity to save out of profits.

$$P = \frac{I}{s_p} \tag{2.4}$$

Dividing both sides of equation 2.4 by the real capital stock (K), the so-called *Cambridge equation* becomes clear:

$$r = \frac{g}{s_p} \tag{2.5}$$

where $r = P/K$ is the rate of profit and $g = I/K$ is the realized accumulation rate[2]. According to equation 2.5, the rate of profit is directly proportional to the growth rate and inversely proportional to the propensity to save out of profits.

As Lavoie (2006) puts it, the Cambridge equation can also be interpreted as a saving function. Dividing both sides of equation 2.3 by the capital stock, we have the same relation as the one in equation 2.5:

$$g^s = r s_p \tag{2.6}$$

where $g^s = S/K$ is the saving rate.

[2]The realized accumulation rate (g) will be determined jointly by the investment rate (g^i) and by the saving rate (g^s). Throughout this chapter, the term "growth rate" will refer to g, which represents the growth rate of the capital stock and will be equal to the output growth rate only if the rate of capacity utilization and the output-capital ratio at full capacity are kept constant.

In equilibrium, the saving rate from equation 2.6 must be equal to the investment rate, which is determined by a different equation. The investment equation adopted by Robinson (1956)[3] depends on the expected rate of profit, as follows:

$$g^i = \alpha + \beta r^e \tag{2.7}$$

where $g^i = I/K$ is the capital accumulation rate, r^e is the expected profit rate, and α and β are parameters greater than zero. The intercept α represents the Keynesian animal spirits, a "*spontaneous urge to action rather than inaction*" (Keynes, 1991, p. 161). To Robinson (1962), this function would be non-linear and generates a banana-shaped diagram. However, for simplicity, the function is assumed linear.

The model assumes that the economy produces only one good. The pricing equation of the Cambridge model is a simple Kaleckian price equation in which a gross costing margin (mark-up rate) multiplies the unit direct cost (given by labor costs). Therefore, the gross costing margin must cover overhead costs and also provide a return to capitalists in the form of profits. A key assumption is that the mark-up rate is completely flexible[4]; thereby, so are prices. Equation 2.8 describes the price equation:

$$p = (1+m)\frac{\bar{w}N}{Y} = (1+m)\bar{w}a \tag{2.8}$$

where p is the price level, $m > 0$ is the mark-up rate on direct costs, $\bar{w}$ is the money wage rate, N is the level of employment, and a is the labor coefficient (total hours of labor/unit of output).

The logic behind the Cambridge model is that, because the level of investment is exogenously given, there will be only one saving rate that will keep the system in equilibrium. If investment is growing, saving will have to grow and, thus, consumption will have to fall (as the economy is operating at the full capacity level). However, this is not incompatible with independently given individual propensities to save, as there is always an income distribution that produces the required level of saving to maintain the commodity market equilibrium condition expressed in equation 2.2 (Pasinetti, 1962). This equilibrium income distribution will be achieved through the price mechanism in order to adjust the price level to money wages.

This mechanism is known in the literature as the *forced saving mechanism*, as a reduction in consumption is equivalent to higher saving, which will be achieved through a redistribution of income from the class who consumes a higher portion of their income (workers)

[3] To Kaldor (1956), the growth rate of investment (in relation to total output), since the economy is in a state of continuous full employment, is given by the natural growth rate (as in Harrod's model), which is the sum of the rate of technical progress and the growth in working population. To Amadeo (1986*b*, p. 9), this assumption is *"hardly Keynesian in spirit"*. Taking a different perspective, Robinson (1962) explains that there are risks and limits to capital accumulation that are not explained by the animal spirits and argues that it is reasonable to consider that, to have a higher accumulation rate, a higher profit rate is required to sustain it, as it means more resources to the investment project and increases the chances of success.

[4] According to Steindl (1976), the flexibility of the mark-up rate and, consequently, the profit rate reflects the assumption of a competitive economy. In an oligopolistic economy, the competitive strategy of firms is not through prices and, thus, the profit rate is no longer flexible.

to the class who has a smaller propensity to consume (capitalists). According to Robinson (1956), if workers resist to a fall in real wages by asking for higher nominal wages, there will be a barrier to growth, as it will initiate a wage-price spiral - the author named this as *inflation barrier*.

The only restriction, according to Pasinetti (1962), so that the mathematical formulations have an economic meaning, is that it is not possible to have a negative share of profits ($s_w < I/Y$, where s_w is the propensity to save out of wages) or a negative share of wages ($s_p > I/Y$). Therefore, if workers' saving is to be considered, it is a necessary condition that $s_w < s_p$.

Pasinetti (1962) shows, however, that the model's results can hold even if there is no assumption with respect to the propensity to save out of wages. The author's insight is that if it is assumed that workers save, it should also be assumed that they receive a portion of profits, as the stock of capital is owned by those who, in the past, saved the corresponding amount. Hence, profits will be divided between capitalists and workers and the distribution of income between workers and capitalists will not be equivalent to the distribution of income between wages and profits (insofar as $s_w > 0$). In the author's model, capitalists' propensity to save will determine the ratio of profits to savings to all saving groups and, consequently, will determine the distribution between profits and wages, as well as the profit rate.

Therefore, by showing the irrelevance of the workers' propensity to save to the determination of the income distribution, Pasinetti (1962) bespeaks the absolute relevance of the capitalists' decisions to save. To the author,

> [t]hese conclusions (...) now suddenly shed new light on the old Classical idea, (...) of a relation between the savings of that group of individuals who are in position to carry on the process of production and the process of accumulation (Pasinetti, 1962, p. 274).

This relation is confirmed without any assumptions on workers' saving, giving the model a much greater generality than Robinson's and Kaldor's models.

According to Rowthorn (1981), to the neo-Keynesians, stagnation results from low prices caused by insufficient effective demand. As prices rise in relation to the nominal wage rate, firms will have an incentive to invest and economic growth will be enhanced. Lavoie (1995) remarks that the conclusion that a necessary negative long-run relation between the real wage rate and the profit and accumulation rates is shared also by the neo-Marxian model and is in conformity with the old classical theories[5].

2.1.1 The neo-Kaleckian critique to the Cambridge model

It is the assumption on the utilization rate that differentiates the Cambridge model and the family of models known as neo-Kaleckian. Whereas in the Cambridge model utilization

[5] See also Marglin (1984) and Amadeo (1986*a*) for a comparison between the neo-Keynesian and the neo-Marxian models.

is equal to the full capacity level or to the desired level, in the neo-Kaleckian models there is always idle capacity. These two branches of models share a similar theoretical framework and the different assumptions with respect to the level of capacity utilization reflect what each branch considered to be *normal* in a capitalist economy - many neo-Keynesians believed that the economy would normally be operating at the full capacity utilization level, while neo-Kaleckian authors believed that it would seldom be in this situation (Rowthorn, 1981).

The neo-Kaleckian assumption of existence of idle capacity is based on Kalecki's (1990, 1971) and Steindl's (1976) analyses with respect to a mature capitalist economy, in which it is part of the firm's competitive strategy to maintain a certain degree of idle capacity. Therefore, to this group of authors, the assumption that utilization is always at the full capacity level (or at the desired level) is a very restrictive one, as it is rarely verified in a mature capitalist economy.

Moreover, such assumption by the neo-Keynesians has as immediate consequence that investment can only grow if there is a reduction in consumption, which is brought about by a redistribution of income from workers to capitalists, as it has been previously mentioned. In this sense, investment can only grow if there is *forced saving*.

Amadeo (1986*a*) compares the neo-Keynesian model and the neo-Kaleckian model characterizing each by four simple equations (presented in an adapted form in this section). In order to simplify the model, it is assumed that workers consume all their wages ($s_w = 0$) and that capitalists save all their profits ($s_p = 1$). This assumption, however, does not change the results of the model, as the analysis holds as long as the propensity to save out of wages is less than the propensity to save out of profits ($s_w < s_p$).

Both models share two equations: the profit rate equation and the saving equation. From the Kaleckian price equation (2.8), the wage share in national income is given by equation 2.9 and the real wage rate (which is equal to consumption per worker) is given by equation 2.10:

$$\varpi = \frac{wN}{Y} = 1 - \frac{P}{Y} = 1 - \frac{rK}{Y} = 1 - \frac{r}{uv} \tag{2.9}$$

$$w = \frac{\varpi}{a} = c \tag{2.10}$$

where ϖ is the wage share in national income, $u = Y/Y'$ is the rate of capacity utilization, Y' is output at full capacity level, $v = Y'/K$ is the output-capital ratio at full capacity level (assumed to be fixed in the short-run), w is the real wage rate, and c is the real consumption per worker. Thus, the rate of profit is given by the following equation (known as Weisskopf's (1979) profit rate decomposition):

$$r = \frac{(1-\varpi)Y}{K} = (1-\varpi)uv = \pi uv \tag{2.11}$$

where $\pi = 1 - \varpi$ is the profit share.

The second equation common to both models is the saving function. As the propensity to save out of profits is assumed to be equal to one, equation 2.6 becomes:

$$g^s = r \tag{2.12}$$

The neo-Keynesian model has two specific equations that close the model. The first one expresses the assumption that capacity utilization is always at the desired level (equation 2.13) and the second one is the investment function from equation 2.7, in which the actual profit rate is considered to be a proxy to the expected profit rate ($r = r^e$).

$$u = u_d \tag{2.13}$$

where u_d is the desired level of capacity utilization.

From equations 2.7, 2.9, 2.10, 2.12, and 2.13 and the goods market equilibrium ($g^i = g^s$), the following equilibrium values[6] hold[7]:

$$g^* = r^* = \frac{\alpha}{1-\beta} \tag{2.14}$$

$$\varpi^* = 1 - \frac{\alpha}{(1-\beta)u_d v} \tag{2.15}$$

$$w^* = c^* = \frac{\varpi^*}{a} \tag{2.16}$$

As Amadeo (1986*a*) explains, the Keynesian shock would be a shift in the animal spirits (α). In case of $\Delta\alpha > 0$, equations 2.14, 2.15, and 2.16 show that there will be a rise in the growth rate of the economy and in the profit rate and a fall in the wage share, in the real wage, and in real consumption per worker. The dynamic behind this result is that, to a given utilization rate, a rise in investment must be compensated by a reduction in consumption per worker. The mechanism to achieve this is a rise in the price level, given the money wage rate.

On the other hand, the mechanism underlying the neo-Kaleckian models is quite different. Indeed, Blecker (1989) argues that the neo-Kaleckian models contrast with the neo-Keynesian conclusion of an inverse relation between wages and accumulation due to two key assumptions assumed by the former: a fixed utilization rate and no independent investment function. A brief explanation of the neo-Kaleckian model, which is extensively discussed in the following sections, aids the understanding of its differences to the neo-Keynesian model.

Following Amadeo (1986*a*), in addition to equations 2.11 and 2.12, the other two equations that close the neo-Kaleckian model are the Kaleckian price equation and the investment equation inspired by Steindl (1976). Kalecki (1971, ch. 14) considers an oligopolistic market

[6]The superscript "*" is used to specify equilibrium values throughout this chapter.
[7]The stability condition is that investment reacts less strongly to changes in the rate of profit than saving ($1 > \beta$).

structure in which firms set their prices by setting a fixed mark-up on their unit labor costs[8], as shown in equation 2.8:

$$p = (1 + m)\bar{w}a \tag{2.8}$$

where m is the mark-up rate (exogenously given and fixed in the short-run).

Because the mark-up is considered fixed in the neo-Kaleckian model, the wage share, the profit share, and the real wage will be determined by equations 2.17, 2.18, and 2.19, respectively. This means that income distribution is exogenous in this set of models.

$$\varpi = \frac{1}{1 + m} \tag{2.17}$$

$$\pi = \frac{m}{1 + m} \tag{2.18}$$

$$w = c = \frac{1}{(1 + m)a} \tag{2.19}$$

The final equation of the neo-Kaleckian model is the investment equation. As in the neo-Keynesian model, it is assumed that investment responds positively to the rate of profit. However, following Steindl (1976), investment also responds to output growth (the so-called accelerator effect). Once the utilization rate is included in the investment equation, the rate of profit as a determinant of investment loses its meaning[9], so Amadeo (1986*a*) considers the investment rate to be a function only of the difference between the actual utilization rate and the desired utilization rate, as follows:

$$g^i = \alpha + \beta(u - u_d)v \tag{2.20}$$

where coefficients α and β are greater than zero.

Equations 2.11, 2.12, 2.19, and 2.20 close the neo-Kaleckian model. In the commodity market equilibrium ($g^i = g^s$), the following relations hold:

$$u^* = \frac{\alpha - \beta u_d v}{(\pi - \beta)v} \tag{2.21}$$

$$g^* = \alpha + \beta \left(\frac{\alpha - \beta u_d v}{(\pi - \beta)v} - u_d \right) v \tag{2.22}$$

[8] Kalecki (1971, ch. 14) considers an equation in which m is an increasing function of the relation between the weighted average price of the industry and the firm's price. Moreover, the author argues that this function is negatively affected by the power of trade-unions, that might restrain the mark-ups. See section 2.2.1 for a more detailed discussion on Kalecki's price equation.

[9] Amadeo (1986*a*) explains that the inclusion of the rate of profit in the investment equation loses its meaning once the profit margin becomes a variable controlled by firms (in an oligopolistic structure). In this case, capacity utilization is the central variable to determine investment and the level of aggregate demand.

$$c^* = w^* = \frac{1}{(1+m)a} \tag{2.23}$$

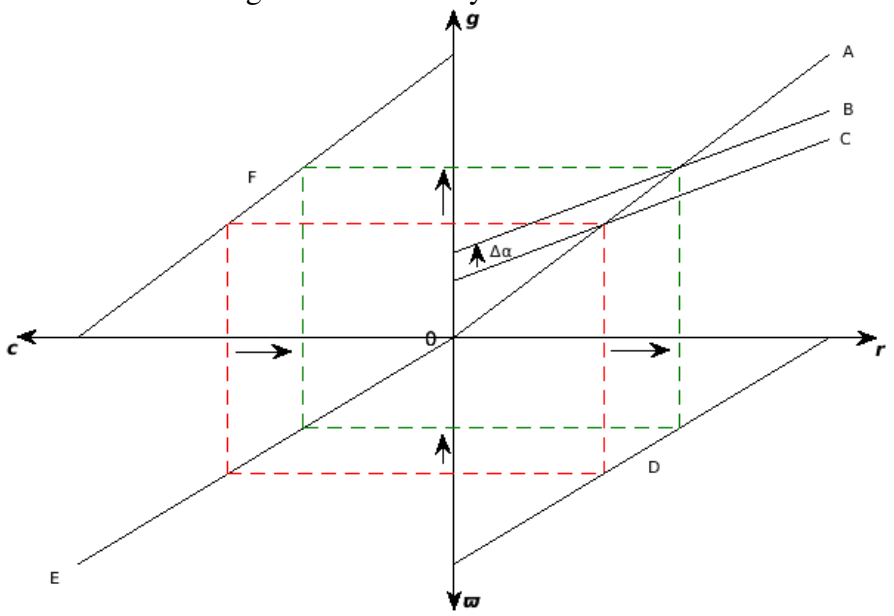
Given this set of equations, one is able to analyze the effect of the same shock applied to the neo-Keynesian model: a shock in the animal spirits that increases the value of the α parameter. According to equations 2.21 and 2.22, there will be an increase in the utilization rate and an increase in the growth rate. However, there will be no effect in the real wage (and in real consumption per worker), which, according to equation 2.23, is determined solely by the mark-up factor and the labor coefficient, and in the wage share, since the mark-up factor and the labor coefficient are not affected by a shift in the α parameter. Therefore, through this exercise, Amadeo (1986*a*) shows that a reduction in the real wage is not a necessary condition for a higher growth rate in the presence of idle capacity.

The following figures show the effect of an increase in α in both models to illustrate the different outcomes when capacity utilization is taken as exogenous (figure 2.1) and endogenous (figure 2.2). In figure 2.1, corresponding to the neo-Keynesian model, causality goes from the parameters of the investment and saving equations to the equilibrium growth rate and profit rate, given the utilization rate (u_d). From these variables, income distribution and real consumption per worker are determined.

Therefore, in figure 2.1, the upper-right hand quadrant determines the equilibrium values of the profit rate (abscissa) and growth rate (ordinate) through equations 2.7 (lines B and C, where B has a higher α than C) and 2.12 (line A). In the lower-right hand quadrant, the equilibrium profit rate determines the wage share (ordinate) through equation 2.11 (line D). In the lower-left hand quadrant, the wage share (ordinate) determines real consumption per worker (abscissa) through equation 2.10 (line E), while the upper-left hand quadrant shows, in line F, the negative relation between real consumption per worker (abscissa) and the growth rate (ordinate) through equation 2.10 (substituting ϖ by equation 2.9 and r by equation 2.12).

An increase in α will shift the investment function from line C to line B. As a result, the profit rate and the growth rate will increase, but the wage share and real consumption per worker will decrease. Thus, figure 2.1 illustrates the trade-off between growth and the wage share in the neo-Keynesian model.

Figure 2.1: Neo-Keynesian model

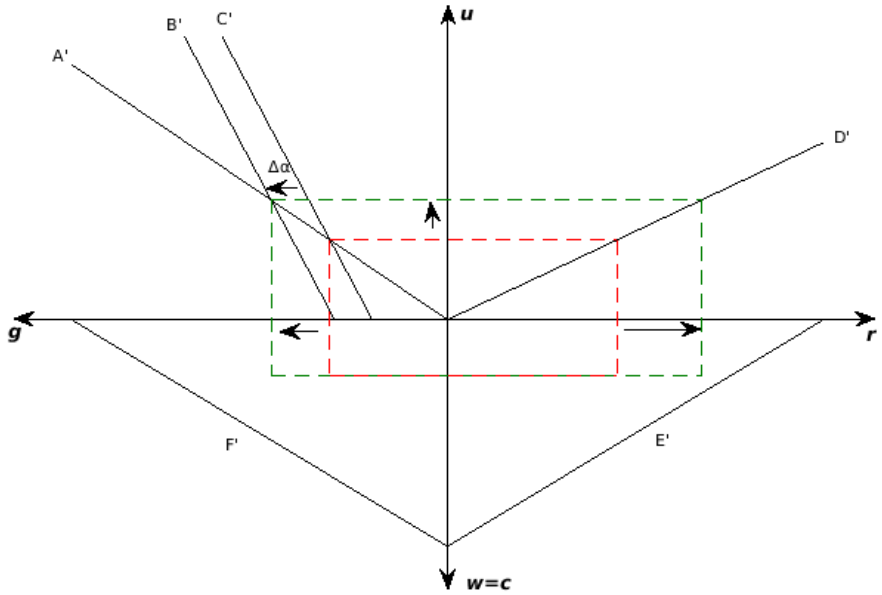


Source: Adapted from Amadeo (1986*a*).

In figure 2.2, corresponding to the neo-Kaleckian model, causality goes from income distribution (more precisely, the mark-up rate) and the parameters of the investment and saving equations to the growth rate and capacity utilization. Thus, the growth rate (abscissa) and capacity utilization rate (ordinate) are jointly determined by equations 2.12 (line A') and 2.20 (lines B' and C', where B' has a higher α than C') in the upper-left hand quadrant. From the equilibrium utilization rate, the profit rate is determined in the upper-right hand quadrant through equation 2.11 (line D'). Equations 2.9 and 2.10 and the equilibrium profit rate determine the real wage rate (and the real consumption per worker) in line E' at the lower-right hand quadrant when the utilization rate is equal to the desired level (equation 2.13). This is also shown in line F' at the lower-left hand quadrant, but in relation to the growth rate. However, the real wage rate, which is determined by equation 2.23, can be different from the value set by lines E' and F' when the actual and desired utilization rates do not coincide and will depend on the mark-up rate.

A shift in α, as shown in figure 2.2, leads to a shift of the investment function from line C' to line B'. The utilization rate, the profit rate and the growth rate will increase as a result, but the real wage rate (and, equivalently, real consumption per worker) will not be altered as long as the utilization rate is at a level lower than the desired one. Thus, in the neo-Kaleckian model, a simultaneous increase in both the growth rate and real consumption per worker is possible, as the real wage rate is exogenous.

Figure 2.2: Neo-Kaleckian model



Source: Adapted from Amadeo (1986*a*).

Amadeo (1986*a*) sheds light on the fact that if the actual utilization rate is systematically different from the desired rate, one may question why would not capitalists review their desired rate until it reaches the actual rate. However, the author argues that the desired utilization rate is a result of the competitive strategy of an oligopolistic firm in order to respond quickly to changes in demand. The effect of shifts in demand is already captured in the investment function by the inclusion of the actual utilization rate, so it makes no sense to systematically change the desired level of utilization even if it rarely coincides with the actual rate.

This analysis has shown that the key assumption of the neo-Keynesian model that, in the long-period, capacity utilization will return to the desired level has a major consequence to the conclusions achieved. This assumption means that any adjustment in the long-run will be done through prices and gross costing margins, preventing a positive relation between growth and real wages. To Lavoie (2006, p. 122), these models *"cannot be considered a generalization of Keynes's General Theory and of Kalecki's models since the transition of these growth models towards equilibrium does not involve quantity adjustments"*.

2.2 Basic features of the Kaleckian models

This section presents the main aspects of Kalecki's and Steindl's works that have been incorporated into the neo-Kaleckian models. Section 2.2.1 reviews Kalecki's price equation and the distribution of income that derives from it, section 2.2.2 examines Kalecki's investment function, and section 2.2.3 analyses Steindl's contribution to the understanding of a mature economy and its tendency to stagnation.

2.2.1 Kalecki's price equation and the distribution of income

Kalecki's (1971, ch. 5) analysis of price formation is a key element of his income distribution theory. The author separates two broad groups that differ themselves by how their short-term price changes are determined. The first is the one of final goods, whose prices are mainly determined by changes in the cost of production since their supply is elastic (due to the presence of excess capacity). In this group, when there is an increase in demand, the volume of production increases while prices tend to remain at the same level. The second group is the one of raw materials, which have an inelastic supply and, thus, whose prices are mainly determined by changes in demand.

Kalecki's study is mainly focused on the formation of "cost-determined" prices and their relation to income distribution. For the second group, Kalecki (1971) only states that the share of wages in the value added will be determined by the ratio of prices of the raw materials produced to their unite wage cost, as there is no direct relation between prices, which are demand-determined, and wages. Therefore, the determinants of the share of wages in gross income of the private sector are the degree of monopoly, the ratio of prices of raw materials to unit wage costs and industrial composition (composition of the value of the gross income of the private sector, influenced by a change in the volume of industrial components and in relative prices).

With respect to the determinants of "cost-determined" prices, Kalecki (1971) considers that an individual firm takes into account its average prime cost and the prices of other firms that produce similar products when fixing its own price, as described by equation 2.24. Overhead costs do not influence the price formation as it is assumed they remain stable as output varies.

$$p = aUPC + b\bar{p} \tag{2.24}$$

where UPC is unit prime cost and $\bar{p}$ is the average price of other firms. The coefficients $a > 0$ and $0 < b < 1$ reflect the firm's degree of monopoly (that will differ from firm to firm). As Kalecki contends, equation 2.24 is a semi-monopolistic price equation. If price competition prevailed, the difference between the price and unit prime costs would make the firm expand its output until it reached full capacity utilization. The author argues that the fact that final goods prices are fixed on costs rather than influenced by demand is an evidence that idle capacity is an usual aspect of industries.

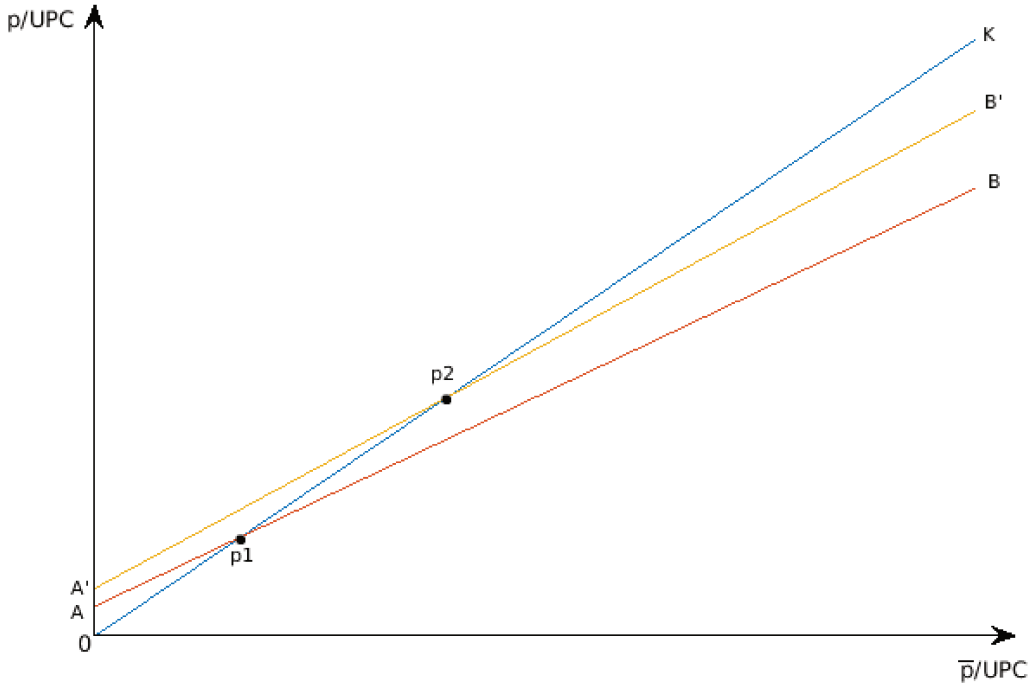
As coefficients a or b grow, the possibility of the firm setting a higher price than the industry average price grows as well (equation 2.25).

$$\frac{p}{UPC} = a + b\frac{\bar{p}}{UPC} \tag{2.25}$$

Figure 2.3 shows the firm's price in relation to its unit prime cost in the ordinate and the industry's average price (also in relation to the unit prime cost of the firm) in the abscissa. Line $0K$ draws a curve of 45 degrees from zero point, when $p = \bar{p}$, while AB and $A'B'$ are

curves for different values of a and b, in which the inclination will be less than 45 degrees because $b < 1$. When a and b increase, moving line AB to $A'B'$, the degree of monopoly increases and, thus, the firm sets a higher price (p) over the average price of the industry ($\bar{p}$). As the degree of monopoly increases, the abscissa of the point of intersection between curve OK and each curve AB and $A'B'$ (points $p1$ and $p2$ respectively), which is equal to $a/(1-b)$, also increases.

Figure 2.3: Price setting in an oligopolistic structure



Source: Adapted from Kalecki (1971).

In order to draw a general case, Kalecki (1971) selects a representative firm, which would have the mean values of p, UPC, a, and b. Therefore, the degree of monopoly of the industry will be that of the representative firm, which is given by $a/(1-b)$ at the mean values of a and b. A generalization can be made in the sense that the average price is proportionate to the average unit prime cost as long as the degree of monopoly is given. If there is an increase in the degree of monopoly, the price will rise in relation to the unit prime cost (as long as there is elastic supply).

From this analysis of the price formation process, Kalecki (1971) analyses the distribution of national income. As the mark-up is considered to be fixed, income distribution will be exogenously given. It will be determined by the mark-up that firms apply to their unit prime costs, which is a reflection of their monopoly power. According to Asimakopulos (1975, p. 319),

> [w]hatever the judgment reached on Kalecki's use of the term 'degree of monopoly', a Kaleckian theory of distribution can be developed on the as-

> sumption that it acts to protect the rate of profits of established firms in the industry.

Kalecki (1971, ch. 14) has also written on the relation between income distribution and economic growth. Arguing against the theories based on Say's law, which he considers to be fallacious, Kalecki analyses the effect of an increase in wages using a three department structure ("Marxian schemes of reproduction") and assuming that workers do not save. Department I (DI) produces investment goods, department II (DII) produces capitalists' consumption goods (C_k), and department III (DIII) produces workers' consumption goods (C_w). The total output of each department is equal to the wages paid to its workers and the profits received by its capitalists as follows:

$$Y_{DI} = P_{DI} + W_{DI} = I \tag{2.26}$$

$$Y_{DII} = P_{DII} + W_{DII} = C_k \tag{2.27}$$

$$Y_{DIII} = P_{DIII} + W_{DIII} = C_w \tag{2.28}$$

$$Y = P + W = I + C_k + C_w \tag{2.29}$$

where the subscripts refer to each department. From equation 2.29 and from the assumption that workers do not save ($C_w = W$), it is clear that $P = C_k + I$, the so-called *Kaleckian profit equation*. As capitalists can only choose how much to spend, but not how much to earn, profits are determined by capitalists' consumption and investment decisions in the past, which are directly subject to the decisions of capitalists (Kalecki, 1971, ch. 14).

A rise in all wages ($\Delta W/W = \Omega$) will increase the wage bill of all three departments. As Kalecki (1971, ch. 14) explains, the level of investment and capitalists' consumption are determined in a period prior to the short-run considered and, therefore, are not affected by the wage rise (the determinants of income distribution and the determinants of investment and capitalists' consumption are different). Departments DI and DII will suffer a profit decline of the same magnitude as wages increase, but, because workers spend all their income immediately, DIII will have an increase in its production equal to the increase in the aggregate wage bill. Despite the increase in wages paid in department DIII, profits in this department will increase by the amount of the W_{DI} and W_{DII} increase, as follows:

$$P_{DIII} = Y_{DIII} - W_{DIII} = Y_{DIII} - C_{w_{DIII}} = W_{DI} + W_{DII} \tag{2.30}$$

$$\Delta P_{DIII} = \Omega(W_{DI} + W_{DII}) \tag{2.31}$$

It is clear, therefore, that, in spite of the wage increase, no absolute shift from profits to wages occurs. There is a redistribution of profits within the capitalist class, but functional income distribution does not change. As profits do not change, there is no reason for a subsequent cut in investment or capitalists consumption. Hence, an increase in real wages increases national income without lowering profits or shifting income distribution. Kalecki's exposition draws a necessary positive relation between income distribution and economic growth, which is a fundamental insight to the neo-Kaleckian theories developed later on.

2.2.2 Kalecki's investment function

To Kalecki (1990), investment in fixed capital is determined directly by savings (a proxy to firm's internal profit accumulation) and the rate of change of profits and indirectly by the rate of change of the capital stock[10].

Firstly, the inclusion of the internal profit accumulation of firms reflects the fact that investment decisions are limited by the restrictions of the capital market and by the principle of increasing risk, which states that, as the amount of third party capital grows in relation to the total capital of the firm, the firm is at a riskier situation. Thus, higher internal accumulation loosens the financial restrictions to investment. To Possas (1987), this is a strategy to make investment dependent not only on the rate of change of output, but also on its level. The resulting investment function is, thus, more realistic and the unstable character of the accelerator is attenuated. Secondly, the rate of change of profits through time is set to capture the need of an increase in profits in order to make new investment projects attractive. Finally, the rate of change of the capital stock through time captures the adverse effect of a high investment level in one period on the next periods. If profits are constant, higher investment means a fall in the profit rate.

According to Possas (1987), the rate of change of profits and the rate of change of the capital stock are included as determinants of investment in fixed capital in order to capture the effect of changes in the expected profitability of the actual capital stock. This effect would be similar to the previously mentioned "accelerator effect", which consists on adjusting capacity to the expected growth in sales (estimated with basis on the recent performance of the economy). Because Kalecki assumes that structural conditions (such as the capital-output relation or the mark-up) are stable in the short-run, Possas (1987) explains that the rate of change of profits and the rate of change of the capital stock will mainly represent changes in the level of economic activity with respect to the capacity of production in the economy, i.e., changes in the use of that capacity.

[10] Kalecki also considers a constant subject to changes in the long-run, that would reflect, for example, the effect of innovation. This constant would determine the tendency element of the business cycle and, according to Possas (1987), it reflects all the determinants of investment which are autonomous with respect to effective demand. Because the equation for investment in fixed capital only reflects changes in effective demand, so Kalecki does not model this constant, it has been omitted here.

To Possas (1987), the rate of change of profits must not be seen as an indicator of the expected profitability of the new investment, for the risk of innovations and structural changes imposes increasing risk to new investment projects in such a way that they would require higher profitability than the present one. Therefore, the inclusion of this variable must be understood as an indicator of changes in the rate of capacity utilization that were not predicted.

In comparison to Keynes (1991), Kalecki's analysis of the investment decisions does not include any consideration with respect to the interest rate. The author explains, however, that, in the long-run, the interest rate does not have a clear cyclical behavior (i.e., Kalecki's investment equation is part of his study of the cyclical fluctuations of the economy). Possas (1987) also points out that Kalecki does not explicitly consider the role of expectations as Keynes does. On the other hand, the design of the accelerator principle is an important feature that Kalecki has introduced and that has been incorporated by neo-Kaleckian economists.

2.2.3 The stagnationist view

Steindl (1976) studies a mature capitalist economy. As the book was originally written in 1952, the author's object of study was the American economy of the post-war period. At the time, there was a major concern with the possibility of rich countries following a tendency towards stagnation in the future. In hindsight, this concern seems inappropriate, as these countries experienced a period of prosperity in the following decades, which has been named as the "Golden Age" of capitalism. Yet, Steindl's writings are a precise picture of the dynamics of a mature capitalist economy as this growth period was the result of external factors, such as the role played by governments, instead of a result of its own dynamics.

As Steindl (1976) explains, a mature capitalist economy differentiates itself from an economy at the competitive stage mainly due to its oligopolistic character, which has important consequences for the competitive strategy of the firm. In an industry where entry is difficult (an oligopolistic industry), the marginal producers (the ones with the highest cost) will have "abnormal profits". This characteristic changes the whole competitive strategy of the firms, as bigger firms will not be able to follow the same strategy they would have followed in a competitive industry.

Briefly, in a competitive industry, small firms (by assumption, the ones with the lowest gross profit margin and lowest profit rate) will only receive "normal profits" and will own a modest amount of capital. On the other hand, the advantageously placed firms, due to large scale economies or technical innovations, will have greater profit margins because their costs are lower and prices are given. This will allow these firms to accumulate internal funds at a higher rate; consequently, they will have a natural tendency to expand relatively to other firms.

In a situation in which the expansion of the favorably placed firms is higher than the expansion of their industry (exogenously given), these firms will have to secure a higher relative share in the market. This will be done through a sales effort: lower prices, quality competition,

or advertisement. As this strategy means higher costs to these firms, their own profit rate will fall and their internal accumulation will be limited. If the internal accumulation of these firms is higher than a certain critical level, however, the advantageously positioned firm will be able to eliminate part of the existing firms, especially the small and less productive ones. In the long run, therefore, capacity utilization and the profit rate will return to their "normal" level.

In an oligopolistic industry, however, the smallest firms will earn "abnormal profits", which will allow them to offset the effect of a price cut of the progressive firms (the advantageously positioned ones) by also cutting their price. Moreover, these firms will often have some sort of financial resilience. In these circumstances, the sales effort becomes a risky strategy for a progressive firm, as it would have to be done in such a magnitude that it could offset the differential advantage this firm previously had. According to Steindl (1979, p. 7), it would cause a *"ruinous price war"*.

Therefore, it becomes much harder to squeeze out part of the marginal firms in an oligopolistic structure. The competition strategy will be modified and the automatic limitation to the rate of accumulation (and to the profit rate at given levels of utilization) brought about by the rate of investment will be seriously disturbed, as oligopolists will tolerate low long-run utilization rates rather than engaging in cut-throat competition when facing low growth rates (Steindl, 1979). It is important to note that Steindl (1976) was worried with the effects of a low growth rate, as it tends to lead to excess capacity, setting up an increase in competitive pressure (Steindl, 1979).

As profit functions become inelastic, a reduction in the degree of utilization will be necessary to reduce the rate of profit to the required level. This will have an impact on the investment rate, as Steindl (1976) believes that investment is determined by the internal accumulation of firms, capacity utilization rate, gearing ratio, and profits (evidently, there is some similarity with the Kaleckian investment function[11]). Taking other factors as given, investment will react to the difference between the actual utilization rate and the desired rate ($u - u_d$). If the actual utilization rate is greater than the desired one, investment will grow. In the opposite case, the factor $u - u_d$ will be negative and, thus, it will negatively influence the investment rate. When the two rates coincide ($u = u_d$), investment will not change, *ceteris paribus*.

Steindl (1976) recognizes the similarity of his investment function with the so-called accelerator principle. The author emphasizes, however, that this principle draws a direct relation of investment with increases in demand, so the focus is on total utilization rate (not on utilization rate in relation to a certain level). Moreover, the influence of the utilization rate in Steindl's (1976) theory is only partial, as the author includes other determinants in his equation.

The complete dynamic drawn in Steindl's (1976, 1979) theory is that, in the transition to maturity, big firms increase their mark-up (shifting their profit functions upwards) and, as this increase cannot be achieved by the whole economy, since macroeconomic profits are determined by investment (as in Kalecki's theory), this leads to a decline in utilization. The latter will set

[11] Indeed, as Kalecki, Steindl does not explicitly model the role of technological change in his investment function.

up a decline in investment, through the influence of the utilization rate, more precisely $u - u_d$, in investment decisions. The utilization rate will only be set equal to the desired rate if there is a change in prices. However, as the profit rate is inelastic in an oligopolistic industry, this adjustment will not take place. Utilization will continue to fall as investment decisions are being revised downwards, leading to a process that cannot easily lead to an equilibrium.

As Steindl (1976) explains, this process of adjustment will lead to unemployment, as the reduction in utilization rate requires a decrease in national income and, thus, in employment. A second major drawback of this adjustment process is that a lower utilization rate will mean unplanned idle capacity, setting up a process that will establish a lower growth rate. This is the stagnationist mechanism that Steindl believe would operate in mature capitalist economies in the 1950s.

In the 1960s, a particular branch of Marxist economists, namely Baran and Sweezy (1966), developed a wide study on the nature of capitalism. Their study follows a similar path as Steindl's study, as the authors were also concerned with what seemed to be, at the time, a tendency to stagnation in rich countries in the future. Their argument is that the increasingly monopolistic character of the United States economy generated a tendency of rising surplus that was not accompanied by adequate mechanisms for surplus absorption. As surplus that is not absorbed is surplus that is not produced, there is a tendency towards unemployment and underutilized productive capacity.

In the 1970s, after the "Golden Age" of capitalism, Steindl (1979) reappraises his book *Maturity and Stagnation*. The author recognizes that innovation may play a role in the accumulation of capital because it is capable of generating a trend, as Kalecki thought of it. Still, Steindl believes that effective demand has a major role and that his theory contributes to the understanding of the dynamics of a mature capitalist economy.

The author explains that the post-war full employment era was influenced by important institutional changes, such as the unprecedented role played by governments, public policy, and politics, which led to an upward shift in the investment function. This shift explains the prosperous period experienced despite the existence of oligopolistic structures. The 1970s, however, saw a weakening of the factors that stimulated growth in the post-war period, especially with the relaxation of the tensions in the Cold War, but also due to other factors, such as the emergence of a stronger opposition to economic intervention. With these changes, a downward shift in the investment function took place and the possibility of low growth in future years became evident. To Steindl (1979), the system would only adapt itself to this new historical reality if there was a downward shift in the profit equation and, thus, a long-term change in distribution. Because the author recognized that this was unlikely to happen, he foresaw a period of stagnation as the weight of adjustment would be thrown on the rate of utilization, through the same mechanism explained in his earlier book.

2.3 Kaleckian growth and distribution models

The neo-Kaleckian model of economic growth and income distribution was firstly developed independently by Bob Rowthorn and Amitava Dutt, but its main results are similar to those found in a paper in Italian by Del Monte (1975, apud Lavoie (1995)). Different economists have contributed to this set of models since these first drawings and they were strongly inspired by Steindl's and Kalecki's works.

These models assume that the economy produces solely one industrial good in an oligopolistic industry. To Lavoie (1995) and Blecker (2002), these models share characteristics that ensure that they can be unambiguously called Kaleckian. Firstly, the investment function includes retained profits, as internal funds are believed to relieve financial constraints on investment (the "increasing risk" principle). Secondly, prices are mainly determined by the degree of monopoly (which determines the mark-up), suffering little influence from the level of demand. Thirdly, marginal costs are thought to be constant up to full capacity. Fourthly, it is assumed that workers have a higher marginal propensity to consume than capitalists (for simplicity, it is usually considered that workers consume all their wages). Lastly, it is assumed that there is idle capacity and labor is not a constraint, so that aggregate demand is key to determining the equilibrium levels of realized profits and national income even in the long-run.

Among other names, these models are also known as neo-Kaleckian and post-Kaleckian models. According to Hein (2014) and Lavoie (2014), neo-Kaleckian models (or the canonical Kaleckian models) have results well in line with Kalecki's thoughts; conversely, models that present a slightly different structure from the canonical model are called post-Kaleckian models, which is the case of Bhaduri and Marglin (1990). The term "Kaleckian" includes the original models as well as its extensions; hence, it will be used to refer to both these branches of models.

The next section (2.3.1) discusses the determination of income distribution and labor productivity within the Kaleckian models, while the following one (section 2.3.2) explores the first Kaleckian models, which find wage-led results. The following sections open the possibility of a profit-led result by incorporating saving from workers (section 2.3.3), the external sector (section 2.3.4), and an alternative investment function (section 2.3.5). Section 2.3.6 presents the models that deal with overhead labor and section 2.3.7 presents a class approach to the Kaleckian models. Finally, section 2.3.8 discusses the theoretical and political contribution of these models.

2.3.1 Income distribution and labor productivity

Asimakopulos (1975) draws a model for the determinants of income distribution that combines two of Kalecki's most relevant contributions: the importance of the degree of monopoly in setting the mark-ups and the key role of capitalists' decisions to spend in determining profits

and the level of employment. Because his model includes overhead labor[12], Asimakopulos (1975) also shows that the profit share and labor productivity behave pro-cyclically.

The model begins with the Kaleckian price equation (2.32) in which prices are determined by the mark-up, the money wage rate and the direct labor coefficient (a_1). In this case, the mark-up m is supposed to cover overhead labor costs and profits (thus, it is a gross mark-up).

$$p = (1 + m)\bar{w}a_1 \tag{2.32}$$

As labor is split between direct (N_1, proportional to current output) and overhead (N_0, proportional to production capacity) labor, the direct labor coefficient is given by $a_1 = N_1/Y$, so national income is given by equation 2.33, as follows:

$$Y = \frac{N_1}{a_1} \tag{2.33}$$

Income is split between profits and wages (equation 2.34), the latter being equal to the real wage rate times the total amount of labor ($N = N_0 + N_1$), as follows[13]:

$$Y = W + P = wN + P \tag{2.34}$$

Asimakopulos's (1975) consumption function considers that capitalists consume a certain real amount of goods independently of their income (autonomous consumption) and that workers' consumption is equal to aggregate wages because they do not save. The consumption function is thus expressed by the following equation:

$$C = W + c_k P + A \tag{2.35}$$

where C is aggregate real consumption, $c_k = 1 - s_k$ is capitalists' propensity to consume, and A is their autonomous real consumption. Real saving can be determined by subtracting equation 2.35 from equation 2.34, as follows:

$$S = (1 - c_k)P - A \tag{2.36}$$

Asimakopulos (1975) considers that real investment is exogenous, as it is determined by capitalists' decisions in a previous period. Thus, nominal investment will be equal to a certain value in real terms multiplied by the price level:

$$\bar{I} = pI \tag{2.37}$$

[12] Overhead labor is the labor which is not directly related to the firm's production and is proportional to the firm's production capacity.

[13] Here, it is assumed that overhead labor earns the same real wage as direct labor.

where $\bar{I}$ is the amount of investment in nominal terms.

From the output equation from the expenditure side ($Y = I + C$) and equations 2.32, 2.34, 2.33, 2.36, and 2.37, it is possible to determine real profits, direct employment, and the share of profits in national income, according to equations 2.38, 2.39, and, 2.40 respectively.

$$P = \frac{I + A}{1 - c_k} \tag{2.38}$$

$$N_1 = \frac{1}{m}\left[N_0 + \frac{p}{\bar{w}}\frac{(I + A)}{(1 - c_k)}\right] \tag{2.39}$$

$$\pi = \frac{P}{Y} = \frac{m(I + A)a_1}{(1 - c_k)N_0 + (1 + m)a_1(I + A)} \tag{2.40}$$

Equation 2.38 rearranges Kalecki's profit equation, according to which profits are determined by capitalists' expenditures. With respect to employment, equation 2.39 shows that direct employment (i.e. the one that is affected by the level of income) is a function of the mark-up rate, overhead labor and capitalists' expenditures expressed in wage units. Because the author assumes a fixed direct labor coefficient a_1, the level of direct employment reflects the degree of capacity utilization. Therefore, equation 2.39 reveals a negative relation between the utilization rate and the mark-up. Finally, equation 2.40 shows that the profit share is a positive function of the mark-up and that functional income distribution (measured by relative shares) is not affected by money wage rates, as argued by Kalecki (1971, ch. 14)[14].

Some modifications to this model show that both labor productivity and the profit share behave pro-cyclically. The relation between overhead and variable labor at full capacity is given by the f ratio in equation 2.41 (Lavoie, 2014, ch. 5):

$$f = \frac{N_0}{N_1'} \tag{2.41}$$

in which N_1' is the amount of direct labor at full capacity. Given that $N_1'/Y' = N_1/Y = a_1$, so $N_1' = N_1/u$, output per worker (λ) is given by equation 2.42:

$$\lambda = \frac{Y}{N} = \frac{Y}{N_1 + N_0} = \frac{1}{a_1(1 + f/u)} \tag{2.42}$$

which is a positive function of capacity utilization (at a decreasing rate). According to Lavoie (2014, ch. 5), this positive relation between output and productivity in the short-run illustrates Okun's law, which states that the elasticity of output with respect to the employment rate is larger than one and, thus, increases in output are accompanied by increases in the output-labor ratio.

Additionally, the profit share also behaves pro-cyclically. A positive shock in capitalists' autonomous expenditures ($\Delta(I + A) > 0$) will lead to an increase in direct labor and, thus,

[14] However, in the case of an open economy, international competition can make income distribution sensitive to money wages (Kalecki, 1971, ch. 14).

in capacity utilization (equation 2.39). The derivative of the profit share (equation 2.40) with respect to $(I + A)$, shown in equation 2.43, shows that such shock will also lead to an increase in the profit share.

$$\frac{d\pi}{d(I+A)} = \frac{ma_1(1-c_k)N_0}{[(1-c_k)N_0 + (1+m)a_1(I+A)]^2} > 0 \tag{2.43}$$

Thus, a higher capacity utilization due to an external shock is accompanied by a higher profit share.

The main rationale behind this result is that, if unit direct costs are roughly stable (up to full capacity) and prices are defined by adding a gross profit margin (supposed to cover overhead costs and profits), the profit share will vary pro-cyclically with capacity utilization because unit costs will decrease as overhead costs do not increase with production (Lavoie, 2014).

Indeed, Kalecki (1990) observed already in 1956 that the share of wages in income is fairly stable during the business cycle, while the share of salaries (overhead labor income) seems to vary counter-cyclically[15]. The analysis by Weisskopf (1979) for the USA economy also supports the conclusion that the profit share is pro-cyclical by showing that the cyclical behavior of the profit rate can be strongly accounted by changes in the rate of capacity utilization in the early expansion and contraction phases of the business cycle.

2.3.2 The possibility of wage-led growth

The possibility of wage-led growth was firstly opened by Rowthorn (1981) and Taylor (1983). According to Hein (2014), the first neo-Kaleckian models that strictly follow the "underconsumptionist" or "stagnationist" theories can be named as "Rowthorn-Dutt" models, as their structures are quite similar. These models originated from the so-called realization crisis theories, written by authors such as Marx (1986), Kalecki (1971), Baran and Sweezy (1966), and Steindl (1976). These theories emphasize the non-realization of profits as a consequence of the inadequacy of aggregate demand. It is, therefore, an analysis that emphasizes effective demand as a key element.

The model presented in this section is closer to the one in Dutt (1984), which was designed with the purpose of examining the deceleration of the Indian economy since the mid-1960s, especially with respect to the effects of the bad income distribution of the country on its economic performance. The main differences between this model and the one designed by Rowthorn (1981) is that the latter includes the government sector and overhead labor, while Dutt (1984) considers a Leontief production function that is not present in Rowthorn's model.

The Leontief production function in Dutt (1984) has constant returns of scale and fixed capital-output and labor-output ratios. The assumption of fixed coefficients can be seen as a consequence of technological rigidities in factor substitution or of the fact that techniques are

[15]Note that Steindl (1979) also considers profits as an increasing function of capacity utilization.

chosen in developing countries independently of factor prices. The economy produces only one good which is entirely produced by labor.

The model assumes an elastic supply of labor, fixed money wage above the level of subsistence (money wages react only with a lag to changes in the cost of living), and the level of employment given by the demand for labor, which is determined by the output level and the labor coefficient:

$$N = aY \tag{2.44}$$

Since the model considers the possibility of excess capacity, the stock of capital (resulting from past investment) will be subject to the following restriction:

$$K \geq \frac{Y}{v} \tag{2.45}$$

The equality defines the relation at full capacity.

The price equation will be given by the Kaleckian price equation (equation 2.8). Therefore, Dutt (1984) assumes that the economy operates under an oligopolistic structure in which there is excess capacity, as it justifies capitalists setting prices without considering capital costs. From the price equation, it is possible to define the profit share, the rate of profit, and the real wage rate, according to equations 2.46, 2.47, and 2.48 respectively.

$$\pi = \frac{m}{1+m} \tag{2.46}$$

$$r = \frac{P}{K} = \frac{m\bar{w}aY}{pK} = \frac{mY}{(1+m)K} = \frac{\pi Y}{K} \tag{2.47}$$

$$w = \frac{\bar{w}}{p} = \frac{1}{(1+m)a} \tag{2.48}$$

From the classical assumption that workers do not save and that capitalists save a constant fraction of profits (s_p), nominal consumption can be defined by equation 2.49. Subtracting this equation from equation 2.1 in nominal terms and dividing the result by the capital stock, it is possible to determine the saving rate, as follows in equation 2.50:

$$pC = \bar{w}N + (1 - s_p)rpK \tag{2.49}$$

$$g^s = \frac{S}{K} = \frac{pY - pC}{pK} = s_p r \tag{2.50}$$

The investment function includes a constant that reflects the "animal spirits" as in Keynes's (1991) theory. Additionally, in line with Robinson (1956), Dutt (1984) also includes the profit rate as a determinant of investment, as the author believes that, the higher the expected profit (which is based on actual profit), the higher the amount of investment firms will undertake.

Finally, based on Steindl's (1979) theory on the determinants of investment, according to which investment is determined by the utilization rate, Dutt (1984) includes the utilization rate as a determinant of the investment rate. Rowthorn (1981) argues that the strategy of maintaining idle capacity in an oligopolistic industry is important in such industrial structure because a temporary inability to meet demand may result in a permanent loss of the firm's market share. Hence, the investment equation is defined as:

$$g^i = \frac{I}{K} = \alpha + \beta r + \gamma u = \alpha + \left(\beta + \frac{\gamma}{\pi v}\right) r \tag{2.51}$$

where the coefficients α, β, and γ are assumed to be positive.

From this set of equations and a few substitutions, the equilibrium values (when $g^i = g^s$) for the profit rate, national income, and investment rate are given by equations 2.52, 2.53, and 2.54 respectively.

$$r^* = \frac{\alpha}{s_p - \beta - \gamma/(\pi v)} \tag{2.52}$$

$$Y^* = \frac{\alpha K}{[s_p - \beta - \gamma/(\pi v)]\pi} \tag{2.53}$$

$$g^* = \alpha + \left(\beta + \frac{\gamma}{\pi v}\right)\left(\frac{\alpha}{s_p - \beta - \gamma k \pi^{-1}}\right) \tag{2.54}$$

As Rowthorn (1981) explains, these equilibrium values are not convergence values. For instance, equation 2.52 expresses the rate of profit that can be exactly realized at any given level of utilization without excess supply or excess demand.

The commodity market equilibrium stability condition requires that saving respond more elastically than investment to shifts in the profit rate (the g^i and g^s curves will only intersect if the former is flatter than the latter). Therefore, the following condition must be satisfied[16]:

$$s_p > \beta + \frac{\gamma}{\pi v} \tag{2.55}$$

From the equilibrium values, it is possible to analyze the effect of a shift in the mark-up rate. Supposing an increase in the mark-up rate, other things constant, there will be an increase in the profit share (equation 2.56), a decrease in the profit rate (equation 2.57) and a decrease in the real wage rate (equation 2.58).

$$\frac{\delta \pi^*}{\delta m} = \frac{1}{(1+m)^2} > 0 \tag{2.56}$$

$$\frac{\delta r^*}{\delta m} = \frac{-\alpha\gamma}{v[m(s_p - \beta) - \gamma(1+m)/v]^2} < 0 \tag{2.57}$$

[16]This is known as the "Keynesian stability condition" (Lavoie, 2014, ch. 6).

$$\frac{\delta w^*}{\delta m} = \frac{-1}{(1+m)^2 a} < 0 \tag{2.58}$$

In Dutt's (1984) model, income distribution is determined solely by the mark-up rate (equation 2.17). As the author explains, an increase in the value of the wage share, due to a decrease in the mark-up rate, can be interpreted as an improvement of income distribution towards a more equal society. Therefore, when there is an increase in the mark-up, there is a worsening of income distribution because the wage share decreases.

$$\varpi = 1 - \pi = \frac{1}{1+m} \tag{2.17}$$

$$\frac{\delta \varpi}{\delta m} = \frac{-1}{(1+m)^2} < 0 \tag{2.59}$$

From equation 2.54, it is possible to determine the derivative of the growth rate with respect to the mark-up rate, as follows:

$$\frac{\delta g^*}{\delta m} = -\frac{s_p \gamma \alpha}{v[m(s_p - \beta) - \gamma(1+m)/v]^2} < 0 \tag{2.60}$$

From equations 2.58 and 2.60, Dutt (1984) concludes that an improvement in income distribution will be accompanied, *ceteris paribus*, by a higher rate of growth. The author's conclusion is a formal argument in support of the realization crisis theories. However, it is valid only as long as there is idle capacity. In case of full capacity utilization, the conclusions derived from the models of the Cambridge variety (discussed in section 2.1) apply, as Amadeo (1986*a*) has demonstrated.

As explored by Rowthorn (1981), this model structure gives rise to two paradoxes that Lavoie (2014, p. 17) categorizes as "macroeconomic paradoxes" that highlight the interesting fact that *"what seems reasonable for a single individual or nation leads to unintended consequences or even to irrational collective behaviour when all individuals act in a similar way"*. Firstly, the paradox of thrift brings light to the fact that a lower propensity to save leads to a higher rate of accumulation and level of output, and, thus, more saving. This paradox was firstly explored by Keynes (1991), in his *General Theory* and is a guiding line of his principle of effective demand.

Secondly, the paradox of costs shows that a rise in real wages (and lower costing margins) leads to a higher profit rate at the macroeconomic level. Although wages are seen as a cost and individual firms may ask for a reduction of labor costs in an effort to improve their profitability, they are also a source of demand, so a decrease in wages can reduce aggregate consumption, sales, capacity utilization, and investment expenditures, driving profit rates down. This idea is summarized by the claim by Marglin and Bhaduri (1990, p. 183) that "*high wages are bad for the capitalist as* producer *but good for the capitalist as* seller". However, this is a less general paradox, as it is only valid as long as there is excess capacity; otherwise, higher wages will induce higher prices rather than higher activity. Moreover, when the assumption of no

savings out of wages is relaxed (Lavoie, 2014) and in fully adjusted positions (Lavoie, 1996*a*), the paradox of costs is uncertain, though the paradox of thrift still holds.

In conclusion, the models developed by Dutt (1984) and Rowthorn (1981) provide a necessary positive relation between economic growth and income distribution, which is well in line with Kalecki's (1971) writings. In particular, Rowthorn's and Dutt's theories share with Kalecki, Marx, and Steindl the belief that inequality can explain stagnation and the low levels of aggregate demand. However, the following contributions to this set of models have shown that a positive relation between economic growth and the wage share is less likely than in these early neo-Kaleckian models.

2.3.3 Positive saving from workers

The possibility of considering positive savings out of wages in a neo-Kaleckian model was examined by Rowthorn (1981), Taylor (1990), Mott and Slattery (1994) and Blecker (2002). For a number of reasons, such as retention of a significant portion of profits by corporations (Blecker, 2002), it is assumed that the propensity to save out of wages is less than the propensity to save out of profits ($s_w < s_p$). When saving out of wages is considered, aggregate saving are expressed by equation 2.61 and the saving rate is expressed by equation 2.62:

$$S = S_p + S_w = s_p P + s_w W \tag{2.61}$$

$$g^s = [s_p \pi + s_w(1-\pi)]uv = [(s_p - s_w)\pi + s_w]uv \tag{2.62}$$

where S_w is real aggregate saving from wages and S_p is real aggregate saving from profits.

Once this equation is considered, the possibility of a profit-led growth regime is allowed for because saving from workers reduces the stimulating effect, through higher consumption, of a redistribution of income towards wages. Yet, some authors ponder that given the values of the propensity to save out of profits and out of wages and of the propensity to invest out of profits, the conditions for wage-led aggregate demand are likely to be fulfilled (at least in a closed economy) (Mott and Slattery, 1994).

Additionally, a profit-led result is contingent to the assumption that workers save but do not own a share of the capital stock, something that has been criticized by Pasinetti (1962). Indeed, Dutt (2017) notes that the possibility of a profit-led regime in this case is only a short-run effect, when the share of capital owned by capitalist is given. In the long-run, the capital stock share held by capitalists is allowed to change and growth becomes unambiguously wage-led.

2.3.4 Open economy considerations

The first neo-Kaleckian models did not explicitly focus on how to model an open economy. Dutt (1984), for instance, presents an extension of the model to consider trade with

the rest of the world (without considering capital flows), but it is assumed that the mark-up will be fixed independently of international competition considerations. Other assumptions made by the author are the existence of imported intermediate goods and a fixed exchange rate.

From the analysis of the commodity market equilibrium condition in this model, Dutt (1984) describes the effect of a decrease in the mark-up rate. Besides the effect of raising aggregate demand, output, and the rate of profit, as discussed in the closed economy model, three additional effects operate. Firstly, there is a switch in demand from luxury imported goods (consumed by capitalists) to domestic goods, which represents an increase in aggregate demand. Secondly, there is a decrease in the price level, making domestic goods more competitive. Considering certain price-elasticity of exports, this factor operates to increase output. Finally, there is an increase in foreign saving as imports represent a larger share of redirected income flows, reducing output. In the case of the Indian economy of the 1980s analyzed by Dutt (1984), the last effect would be dominated by the others. Thereby, the conclusion of a stagnationist regime would not be altered by the inclusion of foreign trade in the model.

However, authors such as Blecker (1989) and Bhaduri and Marglin (1990)[17] argue that the results may change dramatically from the analysis of a closed economy to an open one because wage-led growth becomes less feasible once international competition is taken into account. This is because a cut in wages, which redistributes income towards profits, also improves external competitiveness. According to Blecker (1989, p. 296):

> the openness of a nation to foreign price competition may restore the classical conclusion that a redistribution toward wages reduces the growth rate, even when the domestic economy is structured in complete accordance with stagnationist principles.

That is, even in the presence of chronic idle capacity and an endogenous investment function, the open economy regime may be exhilarationist (an increase in the profit share leads to higher economic growth). To Blecker (1989), the authors who do not consider the effects of international trade are not following Kalecki's (1971, ch. 14) argument that international competition can make income distribution more sensitive to money wages.

In an open economy, the resulting regime will be defined by the joint reaction of investment, consumption, and the balance of payments to shifts in income distribution. In this sense, it is necessary to explicitly model the balance of payments and the mark-up in an open economy. In this section, the analysis of an open economy follows Blecker's (1989, 2002) contribution[18].

According to Blecker (2002), once the analysis is focused in an open economy, it is important to consider a few additional aspect. Firstly, the world remains a closed system;

[17] To Mott and Slattery (1994), the argument in Bhaduri and Marglin (1990) is too specific because it deals only with the case of a devaluation of the domestic currency (which causes lower real wage, higher mark-up and improves the international competitiveness of the domestic economy).

[18] The model presented by Bhaduri and Marglin (1990) will not be further analyzed because even their closed economy model differs essentially from the neo-Kaleckian models.

hence, it is not possible to apply this kind of analysis to the world economy as a whole. In a global analysis, the traditional Kaleckian conclusions would still apply. Secondly, the size of the country matters: a smaller country will have a higher proportion of its GDP expressed by foreign trade and investment. Thirdly, the policy regime matters as specific policies, e.g. protectionist trade policy, can alter the sensitivity of a country's trade and investment to changes in relative prices and/or profitability. Finally, the kinds of price-competitive effects that will be presented may be less significant in the long-run than in the short run, as extensively discussed by Blecker (2016).

Regarding the closed economy, Blecker's (1989) model resembles the one exposed by Dutt (1984), with the main difference being that the former includes the income tax rate. Nonetheless, as the consideration of taxes does not change the model's structure, because the government budget balance is assumed to be in equilibrium, it is ignored in the present discussion.

There are a couple of assumptions that need to be changed in order to consider an open economy. The first one is related to the commodity market equilibrium condition. As output in an open economy is determined by equation 2.63, the saving-investment equilibrium condition must include the trade balance, as follows in equation 2.64 (Blecker, 1989):

$$Y = C + I + B \tag{2.63}$$

$$B = S - I \tag{2.64}$$

where B is the real trade balance (difference between exports and imports in real terms). Equations 2.65, 2.66, and 2.67 define the real trade balance, volume of imports, and volume of exports respectively, as follows (Blecker, 1989):

$$B = X - \frac{ep_f}{p}M \tag{2.65}$$

$$M = \left(\frac{ep_f}{p}\right)^{\psi} Y^{\mu} \tag{2.66}$$

$$X = \left(\frac{p}{ep_f}\right)^{\eta} Y_f^{\epsilon} \tag{2.67}$$

where X is the volume of exports, e is the nominal exchange rate (home currency price of foreign exchange), which is fixed by the government's policy or determined by financial factors outside the model, p_f is the foreign currency price of competing products (considered exogenous, given the small country assumption), M is the volume of imports, $\psi < 0$ is the price-elasticity of imports, $\mu > 0$ is the income-elasticity of imports, $\eta < 0$ is the price-elasticity of exports, $\epsilon > 0$ is the income-elasticity of exports, and Y_f is the GDP of the rest of the world. It is assumed that

the Marshall-Lerner condition holds[19]. Thus, starting from an initial equilibrium of balanced trade ($B = 0$), an improvement in price competition (rise in ep_f/p) will improve the trade balance.

The second assumption that must be altered is that of a fixed mark-up rate. It can no longer be considered exogenous due to the impossibility of sustaining that firms will maintain a fixed mark-up rate regardless of international competition. A situation in which international competition increases is a case in point, as firms will be forced to cut mark-ups in order to limit the loss of market share (Blecker, 1989). Thus, it is possible to have "profit squeeze". On the other hand, firms can manipulate their mark-up in order to penetrate foreign markets. Formally, the mark-up factor in an open economy model is considered to be a function of the real exchange rate (equation 2.69) and of a targeted mark-up factor, as shown by equation 2.68:

$$\varphi = \Phi q^{\theta} \tag{2.68}$$

$$q = \frac{ep_f}{p} \tag{2.69}$$

where $\varphi = 1+m$ is the mark-up factor, $\Phi > 1$ is the target mark-up factor (considered exogenous and a reflection of Kalecki's degree of monopoly), q is the real exchange rate, and $0 < \theta < 1$ is the elasticity of the mark-up factor with respect to the real exchange rate. It is assumed that there are no imported intermediate goods and that labor is the only variable input. Therefore, the domestic price level (p) will be determined by equation 2.70, which is equivalent to the Kaleckian price equation (equation 2.8).

$$p = \varphi \bar{w} a \tag{2.70}$$

From equations 2.68, 2.69, and 2.70, it is possible to derive a new equation for the mark-up factor (equation 2.71) and, thus, for the wage share (equation 2.72):

$$\varphi = \Phi(\frac{ep_f}{p})^{\theta} = \Phi^{1/(1+\theta)} z^{-\theta/(1+\theta)} \tag{2.71}$$

$$\varpi = \frac{\bar{w}a}{p} = \Phi^{-1/(1+\theta)} z^{\theta/(1+\theta)} \tag{2.72}$$

where $z = a\bar{w}/ep_f$ is the ratio between the domestic unit labor costs and the price of foreign goods. A real appreciation of the domestic currency, which increases z, leads to an increase in the wage share.

Equation 2.72 represents the possibility of profit squeeze (corresponding to an increase in the wage share) due to increases in z that can occur if money wages rise relatively to

[19]The Marshall-Lerner condition states that a depreciation of the home currency will have a positive effect on the trade balance if the sum of the absolute values of the price elasticities of exports and imports is greater than one; in other words, if net exports are price-elastic (Lavoie, 2014, ch. 7).

labor productivity, if there is a nominal appreciation of the currency (a fall in e), or if there is a cut in the foreign price level. Additionally, the wage share can be increased by a fall in the target mark-up factor. Blecker (1989) explains that, in both cases, the increase in the wage share will be less than proportional, because the elasticities $\theta/(1+\theta)$ and $1/(1+\theta)$ are less than unity.

From the definition of z and from equations 2.70, 2.71, and 2.72, it is possible to define the real exchange rate as follows:

$$q = (z\Phi)^{-1/(1+\theta)} \tag{2.73}$$

Equation 2.73 shows that q (the competitiveness of national products) is inversely related to both the ratio between the domestic unit labor costs and the price of foreign goods and to the target mark-up (in both cases, less than proportionally).

Hence, an increase in the wage share can be associated with either an improvement or a worsening of international competitiveness, depending on whether this increase is due to a rise in z or a decrease in Φ. Blecker (1989) argues that, as a consequence, the relationship between the wage share and the accumulation rate will depend on the source of change of the wage share.

Considering the same saving function as Dutt (1984) (equation 2.50) and an investment function that considers investment as a function of the profit rate and includes an accelerator effect (equation 2.51), as well as the above set of equations of the open economy model, Blecker (1989) analyses the relation between economic growth and income distribution in an open economy. Differently from the previous analyses that considered a fixed mark-up factor, the author explores the effect of shifts in the target mark-up factor and in the ratio of unit labor costs to the price of foreign goods on both the wage share and the rate of accumulation.

Firstly, a decrease in the target mark-up factor means that firms have changed their pricing policy, i.e., they desire a lower mark-up at any given degree of international competitiveness. As Blecker (1989) explains, this would only occur as a result of a major restructuration of the economy or a change in marketing strategy (a shift in the mark-up factor in order to penetrate foreign markets).

As a consequence, there will be a redistribution of income towards wages and, thus, aggregate demand, capacity utilization, and capital accumulation will increase. The balance of payments will also be improved, as domestic products will be more competitive in price terms. Through the accelerator effect, this will also stimulate utilization and the accumulation rate. On the other hand, these effects might be offset by the income-elasticity of import demand. Therefore, a cut in the mark-up rate will stimulate growth in an open economy as long as the absolute values of the price-elasticities of export and import demands are higher than the income-elasticity of import demand (subject to the initial proportion of imports to national income).

A country highly dependent on imports and with very rigid trade represents a country in which a decrease in the target mark-up factor does not stimulate growth. If this is not the case, however, this strategy will stimulate growth, but partly at the expense of the country's trade partners, as this particular country will "export unemployment". Moreover if this strategy is pursued by all countries, it will lead to a worldwide depression.

Secondly, a rise in the ratio of unit labor costs to import prices represents the case of a "profit squeeze", as profit margins will be compressed by domestic costs and by foreign competition. In this case, a rise of unit labor cost will have to be offset by a decrease in the actual mark-up factor so firms can preserve part of their market. The same occurs if there is a currency appreciation or a cut in foreign prices.

A rise in z will, as previously explained, lead to an increase in the wage share and to a reduced competitiveness of domestic products, resulting in a trade deficit. These effects affect the accumulation rate in opposite directions, leading to an undetermined consequence in terms of economic growth.

Therefore, a rise in z will only be successful in enhancing growth if the economy is relatively closed to foreign trade (low price-elasticities of import and export demand in absolute value, low income-elasticity of import demand, and a small proportion of imports to national income). As Blecker (1989) ponders, the structural transformations of the industrialized countries in the post-war period makes it unlikely that an industrialized country has a structure closed to foreign trade.

Additionally, Blecker (1989) explains that there is a contradiction in the argument for wage-led growth in an open economy. This strategy can only succeed if the economy is relatively close to foreign trade but, at the same time, the success of wage-led growth depends on the sensitivity of the mark-up to international competitive pressures (a high value of θ). These conditions are highly unlikely to hold simultaneously.

In conclusion, Blecker (1989) has contributed by demonstrating that an open economy is not necessarily stagnationist, in the sense that there is no antagonism between workers and capitalists in a mature economy with persistent idle capacity. The assumption of a flexible mark-up allows for the possibility of a conflict between a redistribution of income toward wages and the maintenance of international competitiveness. Still, Dutt (2017) presents some arguments that weaken the likelihood of this possibility, as, for instance, a raise in labor productivity growth that can follow an increase in real wages[20] and increase external competitiveness and the fact that the existence of non-traded goods can reduce some of the leaking abroad of an increase in demand. Additionally, Blecker (2016) suggests that a country may benefit from increased international competitiveness by reducing the wage share in the short-run, but the response of other nations and other adjustments may revert this advantage in the long-run.

In any case, as the world as a whole remains a closed system, the stagnationist result would still apply for it. Given the difficulties to coordinate an increase of the wage share

[20]This effect is also discussed by other author such as Storm and Naastepad (2017). See section 2.4.2.

at the global level, the world as a whole, according to this model, would be condemned to stagnationism.

2.3.5 An alternative investment equation

Bhaduri and Marglin (1990) consider the traditional neo-Kaleckian investment equation, in which the investment rate depends on the profit rate and on the utilization rate, unsatisfactory. Consequently, they suggest an alternative investment function which leads to more diverse outcomes than the previous models. Due to these differences, some authors, such as Hein (2014) and Lavoie (2014), categorize them as "post-Kaleckians".

Bhaduri and Marglin (1990) criticize basic investment functions that consider investment as dependent only on the profit rate, such as the one adopted by Robinson (1956) (equation 2.7), as this would be insensitive to the influence of the existing degree of capacity utilization. However, simply introducing the capacity utilization in the function (as in equation 2.51) is not a correct procedure, as it imposes unwarranted restrictions to the relative response of investment to the profit share and the capacity utilization.

The main point of their argument originates from Weisskopf's (1979) decomposition of the profit rate into a product of the profit share, the utilization rate, and the output-capital ratio at full capacity (equation 2.11, reproduced bellow):

$$r = \frac{(1-\varpi)Y}{K} = (1-\varpi)uv = \pi uv \tag{2.11}$$

Substituting equation 2.11 in equation 2.51, the investment function becomes:

$$g^i = \alpha + \beta\pi uv + \gamma u \tag{2.74}$$

This equation implies, for instance, that if u rises and π falls by the same percentage at the same time, firms will necessarily want to invest more, which is not a very sensible result (Blecker, 2002). Consequently, the possibility of a profit-led regime is ruled out by this model.

Moreover, equation 2.74 clearly shows that capacity utilization is counted twice. For Marglin and Bhaduri (1990), the sign of β is undetermined and the assumption that it is greater than zero requires very strong capacity utilization effects. The authors, therefore, propose an investment function that treats the profit share (equal to the profit margin) and capacity utilization as independent and separate arguments, as given by equation 2.75 (not linearized by the authors). Marglin and Bhaduri (1990) explain that the profit share and the utilization rate jointly enter the investment function through their influence on the profit rate.

$$I = I(\pi, u) \tag{2.75}$$

The partial derivatives with respect to the profit share (I_π) and with respect to the utilization rate (I_u) are both assumed to be greater than zero.

The authors shed light on the fact that this equation has the analytical advantage of separating the "demand side" impact on investment (the accelerator effect captured by capacity utilization) from the "supply side" impact (the cost-reducing effect of a lower real wage and higher profit share).

The argument exposed by Bhaduri and Marglin (1990) is mainly in terms of exposing an underlying relation of the traditional neo-Kaleckian investment function rather than asserting that entrepreneurs' investment decisions are taken with respect to the profit share specifically. Their argument becomes clearer with an example that supposes that the mark-up rate is fixed (representing a fixed market structure). The investment rate will only change in this situation due to a change in the utilization rate, that should be captured by the term I_u. An independent shift in the profit rate will only occur if there is a structural change that alters the mark-up and, thus, the profit share. Therefore, it seems reasonable to separate these two effects as the authors suggest. This had already been pointed out by Rowthorn (1981), but not explored in the same sense as by Bhaduri and Marglin (1990).

Differently from the preceding authors, Bhaduri and Marglin (1990) opted not to linearize their investment function due to the belief that this function might behave non-linearly. They argue that the response of investment to the profit share (measured by I_π) may be significantly influenced by the actual utilization rate. Therefore, it is possible that $s_p u > I_\pi$ at low values of u and that $s_p u < I_\pi$ at high values of u. This means that it would be more likely to have a stagnationist regime at low values of u and an exhilarationist regime in the inverse situation.

From the assumption that workers do not save, saving will be given by equation 2.76, in which Y' is equal to one to normalize the function, as follows:

$$S = s_p \pi Y = s_p \pi u \tag{2.76}$$

The price equation is the same as in Dutt (1984):

$$p = (1 + m)\bar{w}a \tag{2.8}$$

The commodity market equilibrium condition (equation 2.2) provides the following IS-curve:

$$s_p \pi u = I(\pi, u) \tag{2.77}$$

In the (u, π) space, the slope of the IS-curve will be given by equation 2.78:

$$\frac{du}{d\pi} = \frac{I_\pi - s_p u}{s_p \pi - I_u} \tag{2.78}$$

Considering the Keynesian stability condition, the denominator in equation 2.78 must be positive, but the numerator does not have a sign restriction. Therefore, if the response

of investment to profitability is weak ($I_\pi < s_p u$), consumption assumes the dominant role in effective demand, characterizing a stagnationist regime, in which a redistribution of income towards wages leads to higher aggregate demand and utilization rate. This is the argument underlying the "underconsumptionist theories". Otherwise, in a situation in which investment responds vigorously to a higher profit share ($I_\pi > s_p u$), assuming the dominant role in expanding aggregate demand, the regime will be exhilarationist[21], in accordance to the "supply side" logic.

Each regime allows the possibility of gains for both classes; that is, situations in which capitalism would not be a "zero-sum" game. In the stagnationist regime, the redistribution of income towards wages will necessarily mean a higher real wage rate and higher real wage bill, but it can also mean higher total profits and, thus, higher profit rate (at a fixed capital stock). Therefore, the stagnationist regime will be cooperative as long as the normalized value of total profit ($P/Y^{'} = \pi u$) increases with an increase in the real wage rate and a correspondent decrease of the profit share (equation 2.79), so that the inequalities 2.80 and 2.81 are satisfied.

$$\frac{d(\pi u)}{d\pi} < 0 \tag{2.79}$$

$$-\frac{\pi}{u}\frac{du}{d\pi} > 1 \tag{2.80}$$

$$uI_u > \pi I_\pi \tag{2.81}$$

Thus, the possibility of a stagnationist cooperative regime, which is the argument behind the social democratic ideology, will depend on a stronger reaction of investors to a variation in the rate of utilization than to the profit share (measured by their respective elasticities), as shown in equation 2.81. However, if this is not the case, a decline in the profit share will lead to an increase in the utilization rate that is insufficient to compensate for the decline in the profit margin (the conflictual stagnationist regime). In this situation, the rate of profit will decline as the profit share declines, as in the "profit squeeze" model (Goodwin, 1967) and the likelihood of conflicting class interests is higher.

In the exhilarationist regime, the capitalist class is unambiguously in a better situation if there is a redistribution towards profits, with a higher profit share, total profit, and profit rate at higher capacity utilization. As to the working class, it will be in a better situation as long as the real wage bill increases with the profit share. From the normalized wage bill in equation 2.82, the condition for a cooperative exhilarationist regime is expressed by inequality 2.83, which is equivalent to inequality 2.84.

[21] With respect to the possibility of an exhilarationist regime in this model, Mott and Slattery (1994) argue that it would only be possible if the model also assumed positive saving out of wages (which is not assumed by Bhaduri and Marglin (1990)), as *"if all wage income is being consumed, a rise in the mark-up will cause this spending to buy exactly enough fewer units to offset the gain in profits per unit and leave total profits unchanged"* (Mott and Slattery, 1994, p. 74).

$$\frac{W}{Y'} = (1-\pi)u \tag{2.82}$$

$$\frac{d(W/Y')}{d\pi} = \frac{d[(1-\pi)u]}{d\pi} > 0 \tag{2.83}$$

$$\frac{\pi}{u}\frac{du}{d\pi} > \frac{\pi}{1-\pi} \tag{2.84}$$

When condition 2.84 holds, the regime can be characterized as cooperative exhilarationist, because an increase in the profit share will increase the level of demand and the rate of utilization so strongly that employment and the wage bill will also increase, in spite of the decrease in the real wage rate. In the opposite case, when condition 2.84 does not hold, an increase in the profit share will lead the working class to a worse situation, with a smaller wage bill (conflictual exhilarationism).

Despite the possibility of "cooperation" between classes in both regimes, in both situations there can be an intra-class conflict and also a long-run limit to the underlying strategy. In the case of a cooperative stagnationist regime, there might be a redistribution of profits within capitalists (for example, towards capitalists that produce wage-goods), leading to a conflict within the capitalist class. Moreover, in the long-run, this strategy can lead to a crisis of underaccumulation, due to an inadequate rate of investment over time *vis-à-vis* the expansion of the labor force and, as a consequence, there will be structural unemployment. Thus, even a stagnationist cooperative regime would require a limit to the growth rate of real wages.

Conversely, in the case of a cooperative exhilarationist regime, the lower real wage rate might generate tensions between workers who are already employed and the ones who are "outsiders". Additionally, Bhaduri and Marglin (1990) explain that, in the long-run, a high accumulation rate may create a crisis of "overaccumulation", in which the capital stock of the economy becomes disproportionately large in face of the existing labor force, creating a higher level of intra-capitalist rivalry.

Table 2.1 resumes the classification of regimes from Bhaduri and Marglin (1990). A regime can be stagnationist or exhilarationist depending on the reaction of the rate of capacity utilization to shifts in the profit share. If there is a negative relation between capacity utilization and profit share, the regime is stagnationist. Otherwise, it is exhilarationist. The second definition is related to the reaction of the profit rate to shifts in the profit share. If this relation is negative, it is a cooperative regime; otherwise, it is a conflictual regime. From these two definitions, it is possible to determine whether the accumulation regime is wage-led or profit-led[22]. Wage-led growth is one in which a higher wage share is associated with a higher rate of accumulation; otherwise, growth is profit-led. It is important to note that, since wage-led growth is a regime in

[22] Although Marglin and Bhaduri (1990) and Bhaduri and Marglin (1990) define "wage-led growth" as a wage-led accumulation regime, more recent studies (Lavoie and Stockhammer, 2013, Onaran and Galanis, 2014) refer to it as wage-led aggregate demand regime (the same applies to profit-led growth).

which a higher wage share is associated with a higher rate of accumulation and accumulation depends on higher profits, it will require a conjunction that is stagnationist - the only way a higher wage share can induce a higher rate of profits is through a higher capacity utilization-, and cooperative - when a higher wage share leads to a higher profit rate.

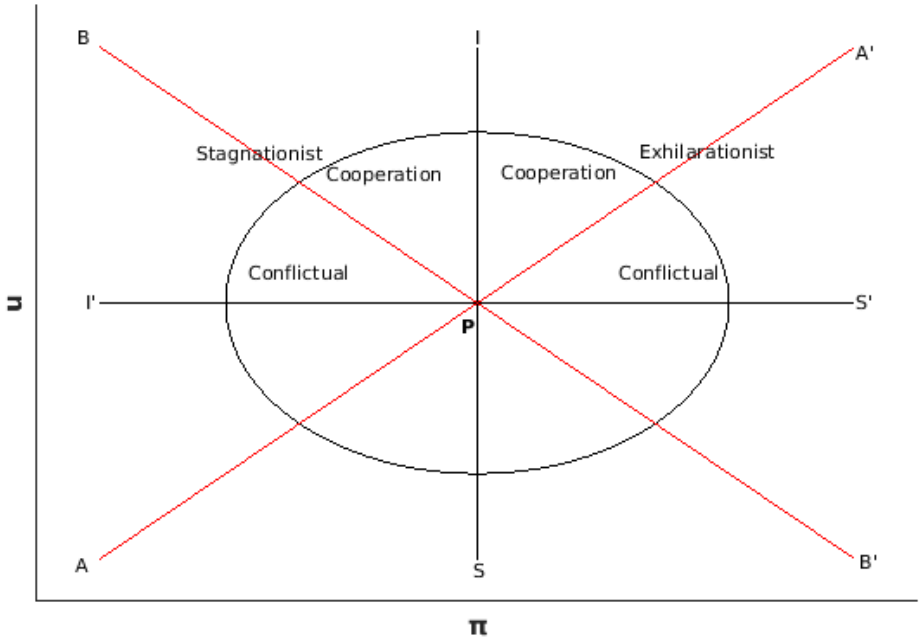
Table 2.1: Possible regimes

Concept	Definition	Mathematical definition
Stagnationist	Wage-led aggregate demand	$\partial u/\partial \pi < 0$
Stagnationist-Cooperative	Profit rate positively related to the profit share	$\partial r/\partial \pi < 0$
Stagnationist-Conflictual	Profit rate inversely related to the profit share	$\partial r/\partial \pi > 0$
Exhilarationist	Profit-led aggregate demand	$\partial u/\partial \pi > 0$
Exhilarationist-Cooperative	Total real labor income positively related to the profit share	$\partial(\bar{w}N/p)/\partial \pi > 0$
Exhilarationist-Conflictual	Total real labor income inversely related to the profit share	$\partial(\bar{w}N/p)/\partial \pi < 0$
Wage-led growth	Capital accumulation rate inversely related to the profit share	$\partial g/\partial \pi < 0$
Profit-led growth	Capital accumulation rate positively related to the profit share	$\partial g/\partial \pi > 0$

Label: N = sum of hours of labor.

Figure 2.4 includes the set of possible regimes in the (π, u) space, an adaptation from Bhaduri and Marglin (1990). The different lines (IS, I'S', AA', and BB') represent IS-curves with different slopes (positive or negative), determining whether the regime is stagnationist or exhilarationist, while the elasticity of these curves at point "P" determines whether the regime is cooperative or conflictual. This figure shows that the regime will depend on the slope of the IS-curve and on the elasticity at point "P".

Figure 2.4: Possible regimes



Source: Adapted from Bhaduri and Marglin (1990).

As the authors explain, each regime exposes the underlying mechanism of an ideological branch. They have the merit, therefore, of condensing in an unique structure all these

different branches and of showing that the difference lies on the value of the parameters of each equation, which are determined by structural factors of the economy.

In conclusion, the model developed by Bhaduri and Marglin (1990) allows for the possibility of an exhilarationist regime in a closed economy. This conclusion is radically different from the one in the neo-Kaleckian models and lies in the alternative investment function. This difference draws a line between these authors and the neo-Kaleckian authors, justifying the label "post-Kaleckian" to Bhaduri and Marglin (1990) (Hein, 2014, Lavoie, 2014).

Critiques to Bhaduri and Marglin's investment function

Despite the arguments against the traditional neo-Kaleckian investment equation, Mott and Slattery (1994) do not agree with the solution expressed by equation 2.75, in which the investment rate is a function of the profit share and the utilization rate, and believe that the previous equation was more adequate. They argue that, despite the fact that a higher mark-up at a given utilization rate will increase profits, an investment that increases productivity will increase profitability at any level of mark-up. Moreover, Mott and Slattery point out that changes in the profit rate and utilization rate can have independent effects if one considers that profits (retained earnings) affect the ability to finance investment as in Kalecki's (1971) "increasing risk principle". To Mott and Slattery, therefore, the traditional Kalecki-Steindl investment function (equation 2.51) is the correct general function to be used in an analysis of the relation between income distribution and output.

Another argument against Bhaduri and Marglin's investment function is discussed by Blecker (2002). The author points out that the functional form assumed to equation 2.75 may limit the possible results, as it requires a "strong profit share effect". When the model is run using a linearized version of equation 2.75, the exhilarationist result is impossible. Similarly, when a Cobb-Douglas functional form is assumed, exhilarationism is only possible in an extreme case where the elasticity of the desired accumulation rate with respect to the profit share is greater than one. However, Lavoie (1992, 2014) notes that this only holds if the constant term of the investment function is positive, but there are no restrictions to its sign. Mott and Slattery (1994) and Hein and Vogel (2008) also show that positive saving out of wages allows for a profit-led regime when using a linearized version of Bhaduri and Marglin's (1990) investment function with positive coefficients.

Finally, Lavoie (2014, ch. 6) argues that π is a bad indicator of profitability when there is overhead labor and target return pricing (see section 2.3.6). Still, in spite of the set of arguments against Bhaduri and Marglin's investment function, Lavoie (2014, p. 375) points out that "*econometricians have taken such an interest in the post-Kaleckian investment function* [Marglin and Bhaduri's investment function] *that it can be considered as nearly part of the canonical Kaleckian model*".

2.3.6 Overhead labor and demand regimes

In section 2.3.1, we discussed the implications of overhead labor to the determination of income distribution and labor productivity. With few exceptions (Dutt, 2012, Lavoie, 1992, 1996*b*, 2009, 2014, Nichols and Norton, 1991, Rowthorn, 1981), most Kaleckian models do not include overhead labor, despite its important implications to the determination of the demand regime. This section explores some of these implications.

In a model that considers a simple Kaleckian mark-up pricing equation, the paradox of costs also applies to overhead costs. Considering that overhead labor earns a multiple $\sigma > 1$ of workers' wages (given by $\bar{w}$), the average wage rate ($w^{'}$) is given by equation 2.85.

$$w^{'} = \frac{\bar{w}N_1 + \sigma\bar{w}N_0}{N} \tag{2.85}$$

Given the relation between overhead labor and direct labor defined in equation 2.41, unit labor costs (ULC) are expressed by equation 2.86 below:

$$ULC = \frac{w^{'}N}{Y} = \bar{w}a_1\left(1 + \frac{\sigma f}{u}\right) \tag{2.86}$$

Taking the price formation equation 2.32 (reproduced below), in which a mark-up is added to unit direct costs, the profit rate determined by the cost side (PC curve) is given by equation 2.87 and represents the amount of profits created at each level of capacity utilization (Rowthorn, 1981).

$$p = (1+m)\bar{w}a_1 \tag{2.32}$$

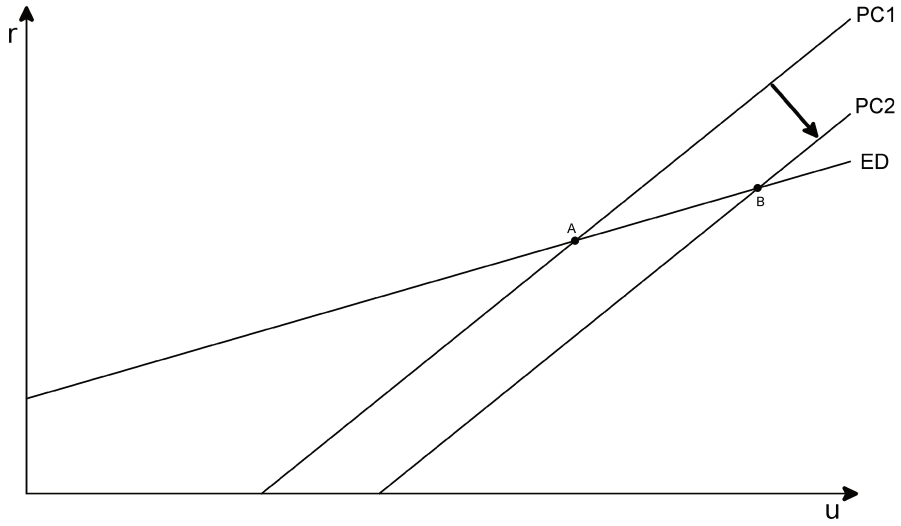
$$r^{PC} = \pi^{PC}uv = \frac{(p - ULC)uv}{p} = \frac{(mu - \sigma f)v}{(1+m)} \tag{2.87}$$

The profit rate determined by demand conditions (ED curve) is given by the equilibrium between the saving function (equation 2.50) and the investment function (equation 2.51), rendering equation 2.88.

$$r^{ED} = \frac{\alpha + \gamma u}{s_p - \beta} \tag{2.88}$$

Both the ED and PC curves are upward sloping in the (u, r) space. An increase in overhead costs (an increase in σf) will decrease the profit rate that is achievable at a certain capacity utilization level. However, capacity utilization will increase, compensating for this effect and leading to an overall higher profit rate, as shown in figure 2.5. Thus, in this model, the paradox of costs also applies to overhead costs (Lavoie, 2009, Rowthorn, 1981).

Figure 2.5: Effect of Higher Overhead Costs - Mark-up Pricing



Source: Adapted from Lavoie (2014).

However, this is not always the case if the model assumes target-return pricing (Lavoie, 1996*b*, 2009). Most firms nowadays can pass additional overhead costs onto consumers by raising prices. In target-return pricing this will come about as firms set prices so a certain rate of return on capital is achieved at a standard (or normal) rate of capacity utilization. This means that the mark-up applied to unit direct costs will be itself a function of overhead costs (Lavoie, 2014, ch. 5) as follows[23]:

$$m^{'} = \frac{r_n + \sigma f v}{u_n v - r_n} \tag{2.89}$$

in which $m^{'}$ is the target return pricing mark-up and r_n is the rate of return at normal capacity utilization (u_n).

In this case, prices will be given by equation 2.90 below:

$$p = (1 + m^{'})\bar{w}a_1 = \left(\frac{u_n + \sigma f}{u_n - r_n/v}\right)\bar{w}a_1 \tag{2.90}$$

Thus, the profit share from the cost side is given by equation 2.91:

$$\pi^{PC} = \frac{p - ULC}{p} = \frac{u(\sigma f + r_n/v) + \sigma f(r_n/v - u_n)}{u(u_n + \sigma f)} \tag{2.91}$$

The derivative of the profit share from the cost side with respect to overhead costs is given by equation 2.92. As the denominator is positive and $u_n > r_n/v$ (so the mark-up in equation 2.89 is positive), the sign of this derivative is determined by the $u - u_n$ term.

[23]Equation 2.89 is derived by setting the amount of profits that must be earned at normal capacity utilization to achieve the target rate of return equal to the amount of profits earned by applying a certain mark-up ($m^{'}$) to total unit costs at normal capacity utilization.

$$\frac{d\pi^{PC}}{d(\sigma f)} = \frac{(u-u_n)(u_n - r_n/v)}{u(u_n+\sigma f)^2} \tag{2.92}$$

In case capacity utilization is higher than its normal value, the profit share curve given by the cost side will shift upwards with an increase of overhead costs. The opposite will happen if the economy is operating at a lower level compared to normal capacity utilization.

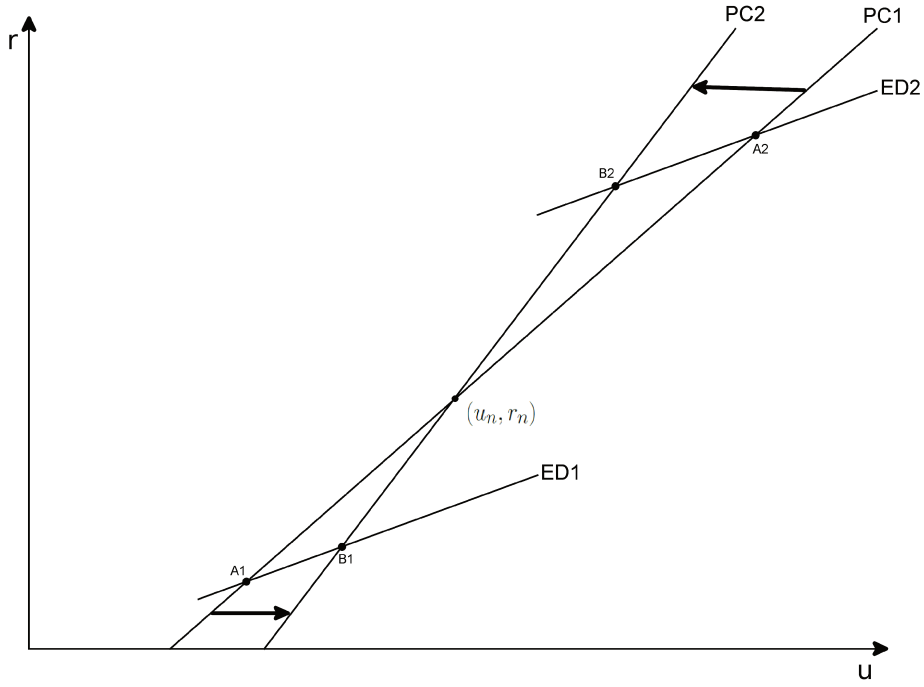
As an increase in overhead costs leads, in this case, to higher price levels, it will have a more limited impact on effective demand, with the possibility of the paradox of costs no longer applying to overhead costs. The rate of profit given by the cost side (PC curve) is given by substituting π by its expression in equation 2.91. This renders the following profit rate expressed by equation 2.93 and its derivative with respect to overhead costs is given by equation 2.94. The sign of this derivative also depends on the level of capacity utilization with respect to the normal capacity utilization rate (if capacity utilization is higher than its normal value, the derivative will be positive, meaning a higher rate of profit at a given rate of capacity utilization).

$$r^{PC} = \pi^{PC} uv = \frac{u(\sigma f v + r_n) + \sigma f(r_n - u_n v)}{(u_n + \sigma f)} \tag{2.93}$$

$$\frac{dr^{PC}}{d(\sigma f)} = \frac{(u-u_n)(u_n v - r_n)}{(u_n+\sigma f)^2} \tag{2.94}$$

The rate of profit from the demand side is still given by equation 2.88 in this case, and its intersection with the curve expressed by equation 2.93 renders the equilibrium values for the rate of profit and capacity utilization (note that the two curves are still upward sloping). Increases in overhead costs (σf) make the PC curve spin counter-clockwise around the point defined by u_n and r_n, while the ED curve remains unaffected. Therefore, at low levels of capacity utilization ($u < u_n$), increases in overhead costs lead to higher capacity utilization and higher profit rate (so the paradox of costs holds), while at high levels of capacity utilization ($u > u_n$) there is a decrease of the value of these variables and the paradox of costs no longer applies to overhead costs, with increases in these costs possibly hampering accumulation even if it is assumed that overhead labor does not save. This mechanism is shown in figure 2.6, in which the increase of overhead costs spins the profits curve from $PC1$ to $PC2$.

Figure 2.6: Effect of Higher Overhead Costs - Target-Return Pricing



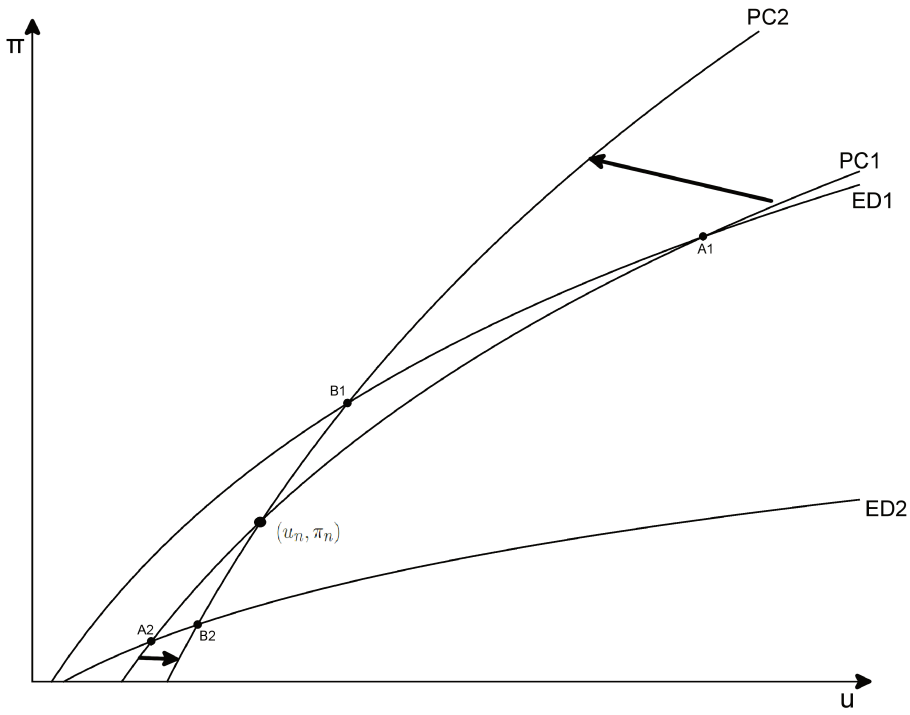
Source: Adapted from Lavoie (2014, ch. 6).

Lavoie (2014) also explores the implications of this model on the assessment of the demand regime of the economy and the understanding of its business cycle. From equation 2.91, the profit share from the cost side will be determined by the rate of capacity utilization, while the profit share from the demand side will also be determined by it (as in models without overhead labor). This means that the profit share and capacity utilization will be jointly determined by the intersection of the curves expressed by equations 2.91 and 2.95 (the latter being determined by the intersection of the curves represented by equations 2.50 and 2.51).

$$\pi^{ED} = \frac{\alpha}{uv(s_p - \beta)} + \frac{\gamma}{v(s_p - \beta)} \tag{2.95}$$

Once again, the effect of increasing overhead costs on capacity utilization and on the profit share will depend on whether capacity utilization is below or above its normal rate. The relation between the profit share and capacity utilization is still given by the slope of the π^{ED} curve, which is not affected by changes in overhead costs. As shown in figure 2.7, if capacity utilization is higher than its normal value and the π^{ED} curve is positively sloped in the (u, π) space, an increase in overhead costs will decrease the profit share, which will be accompanied by a lower capacity utilization rate (from point A1 to B1). At low utilization rates ($u < u_n$), however, the profit share and capacity utilization will increase (from point A2 to B2). In the case of a negatively sloped π^{ED} curve, the effect on capacity utilization is the same, but the profit share moves on the opposite direction.

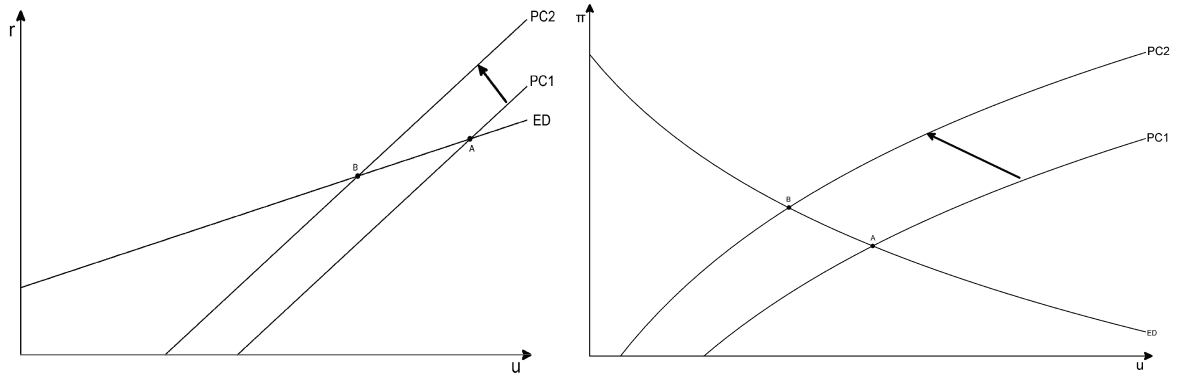
Figure 2.7: Effect of Higher Overhead Costs - Target-Return Princing



Source: Adapted from Lavoie (2014).

Lavoie (2014) notes that increases in the target rate of profit can take the profit share to any direction, depending on the slope of the demand curve. A higher target rate of profit will always drive the π^{PC} and r^{PC} curves up. If, for instance, the π^{ED} curve is negatively sloped, the net effect of an increase in r_n will be a lower rate of capacity utilization, a higher profit share, and a lower rate of profit, as shown by figure 2.8, in which the economy goes from point A to B. In case of a positively sloped π^{ED} curve, the profit share would decrease together with the lower capacity utilization and profit rates. Thus, the profit share cannot be considered a good indicator of firms' profitability - this is another argument to questioning Bhaduri and Marglin's (1990) investment function as mentioned in the previous section.

Figure 2.8: Effect of a Higher Target Rate of Profit



Source: Adapted from Lavoie (2014).

Saving Out of Overhead Income

The second implication for the demand side of considering overhead labor is to assume that it has a different consumption behavior than the one of workers. This assumption has sound ground as empirical evidence shows that, on average, supervisors earn more than productive workers (Mohun, 2014) and that saving rates increase across income quintiles (Carvalho and Rezai, 2016).

Saving out of overhead income is considered by Nichols and Norton (1991), who assume that overhead labor earns more than direct labor and have a smaller propensity to save than do capitalists. The authors conclude that overhead labor may impact the accumulation rate in ambiguous ways and that the effect will ultimately depend *"upon whether the overhead class is more important to aggregate demand or to aggregate supply as a source of saving funds"* (Nichols and Norton, 1991, p. 51).

In a more complex model, which considers target return pricing, Lavoie (2009) sets the saving rate as a function of retained earnings by corporations, overhead labor saving out of their salaries and capital income, and consumption out of capital gains. The author shows that, in this case, increases in overhead costs will have a smaller effect on aggregate demand. Thus, when capacity utilization is above the normal rate the negative effect of increasing overhead costs will be reinforced and when capacity utilization is below the normal rate the positive effect might be canceled.

2.3.7 A class approach to the Kaleckian models

Rather then splitting income between two income groups (i.e., profit earners and wage earners) some authors argue that undertaking a class perspective can provide interesting insights. Indeed, an increasing number of authors suggests that a better understanding of inequality would be allowed for by surpassing the traditional analysis of functional income distribution (Dutt, 2017, Palley, 2015, 2017*a*).

On the one hand, the argument goes back to Pasinetti's (1962) argument that if it is assumed that workers save some portion of their income, it should also be assumed that they own part of the capital stock and, thus, earn a share of profits. Therefore, the simple correspondence between profit earners and capitalists is inaccurate if one assumes saving out of wages.

On the other hand, the correspondence between wage earners and workers is also fairly inaccurate. For instance, more than half of USA capitalists tax units income derived from "labor income" in 2012 (Mohun, 2016) and there is a clear difference between the average wage income of managers and the one of ordinary workers, with the former group earning higher levels of wages than the latter one (Mohun, 2014), which supports the hypothesis that these two groups must have different consumption behaviors.

Therefore, not only the income of each class derives from mixed sources, but also the idea that the wage share is a good measure of inequality is misleading (Dutt, 2017). This

has important implications to empirical studies that try to determine the demand regime of an economy, as well as to the theoretical models.

In a simple model with two classes that earn some amount of wages and some amount of profits, Palley (2017*b*) explores the implications of the distribution of wages in determining the demand regime of an economy. Assuming that capitalists-managers earn a larger share of profits than workers and that workers earn a larger share of wages than the former, total saving is given by equation 2.96 and the saving ratio is given by equation 2.97:

$$S = s_L(\varphi_L W + \sigma_L P) + s_K[(1-\varphi_L)W + (1-\sigma_L)P] \tag{2.96}$$

$$g^s = uv\{s_L[\varphi_L(1-\pi) + \sigma_L\pi] + s_K[(1-\varphi_L)(1-\pi) + (1-\sigma_L)\pi]\} \tag{2.97}$$

in which s_L is workers' propensity to save, φ_L is workers' share of the wage bill, σ_L is workers' share of the capital stock, and s_K is capitalist-managers' propensity to save (assumed to be larger than s_L). Increases in the profit share will redistribute income to capitalists-managers and increase aggregate savings, whereas an increase in workers' share of the wage bill (φ_L) or workers' share of the capital stock (σ_L) decreases the saving rate.

Palley (2017*b*) notes that the derivative of capacity utilization with respect to the profit share[24] depends on workers' share of the wage bill and of the capital stock, as well as on the profit share. Therefore, while increases in workers' shares of labor or profit income always increase aggregate demand, the assessment of a demand regime in terms of the profit share is more complex.

If the capital ownership share of workers is high, increasing the profit share might lead to higher growth, emulating a profit-led regime. On the other hand, if workers' wage bill share is high, increases in the profit share will lead to lower growth, suggesting a wage-led regime. The rationale behind this is simply that workers consume more than capitalists-managers, so if their share in one type of income is high, increasing this income will have strong effects on aggregate demand. Thus, the assessment of the demand regime in terms of functional income distribution can suggest a profit-led regime that comes about due to high workers' ownership share, or the contrary: *"the economy may be profit-led only because of policies that have changed the distribution of wages and lowered workers' share"* (Palley, 2017*b*, p. 60). Yet, increases in workers' wage share will always lead to higher growth and can turn a profit-led economy into a wage-led one. Palley (2017*a*) further explores the implications of this model on the assessment of the relation between inequality and growth, showing that a higher participation of workers on the wage bill lowers inequality and increases growth.

[24] The author assumes an investment function that includes the profit share, profit rate, and capacity utilization as explanatory variables.

As the Kaleckian models usually assume that the regime under which an economy operates is exogenously determined by *"deep primitive parameters"* (Palley, 2014, p. 2), the key point from these contributions is to show that the growth regime of an economy may be endogenously determined (by factors such as the tax rate or the degree of financialization of the economy).

As Palley (2015) states, the consideration of the wage bill division between workers and managers is a procedure to introduce the effects of personal income distribution. In his model, because this division is endogenous, the character of the demand regime (in terms of wage- or profit-led) of the economy is itself endogenous. A redistribution of the wage income towards workers, thus, unambiguously increases growth and capacity utilization regardless of the growth regime.

2.3.8 Theoretical and political contribution of the Kaleckian models

After almost thirty years from its publication, the seminal article by Bhaduri and Marglin (1990) still inspires theoretical debates and political strategies based on empirical evidence. On the theoretical side, the model is a source of debate between Kaleckian and neo-Goodwinian authors. The former group interprets these models as medium-run models that generalize the Kaleckian model; the latter sees them as short-run models that illustrate the Goodwin (1967) business cycle in a demand-led economy (Stockhammer, 2017).

The way each approach then looks at the empirical data reflects what are the most important relations to them. To Kaleckian authors, such as Onaran and Galanis (2014), the focus is on how each aggregate demand component reacts to shifts in income distribution rather than what drives the business cycle - Stockhammer (2017) points out that Bhaduri and Marglin's (1990) model is not interpreted by Kaleckians as a business cycle theory. Neo-Goodwinians, however, prioritize the relationship between the demand and the distribution equations and interpret a profit-led demand curve with a profit squeeze distribution curve as a validation of the Goodwin's (1967) cycle mechanism.

Consequently, different statistical methods are applied by each approach in order to test the regime of an economy. Kaleckians tend to estimate single equations for each aggregate demand component and are more prone to finding wage-led results than neo-Goodwinians, who estimate systems of reduced-form equations for capacity utilization and income distribution (Blecker, 2016, Stockhammer, 2017). Naturally, this divergence between their results leads to further debates between them.

Therefore, while the Kaleckian models have allowed for a better understanding of the mechanisms that drive the relationship between income distribution and economic activity, the debate that emerges from the opposing position of Kaleckian and neo-Goodwinians suggests a number of questions that are still to be explored. For instance, only recent contributions include the financial side, which can explain the verification of a Goodwin mechanism in a wage-led

economy (Stockhammer and Michell, 2017). Also, more attention is being given to what is the adequate empirical method and to the time length it captures (Blecker, 2016).

Despite these methodological questions being still open to debate, the wage-led results of empirical Kaleckian models are taken as support to political positions in favor of increasing wages. The literature suggests guidelines to both the determinants of functional income distribution (Kalecki, 1971, Asimakopulos, 1975) and of the macroeconomic effects of shifts in the income distribution (Steindl, 1976, 1979, Rowthorn, 1981, Taylor, 1983, Dutt, 1984, Amadeo, 1986*a*, Blecker, 1989, Bhaduri and Marglin, 1990).

Public policies can affect these two aspects of an economy. With respect to income distribution, Lavoie and Stockhammer (2013) explain that it can be affected by the tax, social, and labor market policies. Therefore, pro-capital distributional policies, which lead to a long-run increase in the profit share, usually aim at weakening collective bargaining institutions, labor unions, and employment protection legislations. They are also an underlying factor of measures that lead to lower minimum wages or in legislations that exempt capital gains from income taxation (in this case, they affect the distribution of available income). This strategy usually claims to promote labor market or wage flexibility.

On the other hand, pro-labor policies lead to a long-run increase in the wage share. They include policies aimed at strengthening the welfare state, labor market institutions, labor unions, and the collective bargaining institutions. Policies that aim at higher minimum wages or a lower wage and salary dispersion are also classified as pro-labor policies (Lavoie and Stockhammer, 2013).

Given the macroeconomic regime under which a country operates, governments can effectively pursue distributional policies that enhance its growth and economic performance. The analysis from the Kaleckian models, especially the ones by Blecker (1989) and Bhaduri and Marglin (1990), suggests that the characterization of the macroeconomic regime of a country must be investigated empirically.

2.4 Critiques to the Kaleckian Models

The next sections present a summary of part of the critiques to the Kaleckian economic growth and income distribution models. We selected three main discussions presented in recent papers: the question of time length; the relation between the demand regime and employment; and a broad critique to the terms of the debate.

A more theoretical critique to these models comes from authors who question whether economic growth can actually be explained by income distribution. Both Kaleckian- and Sraffian-inspired authors present this critique, which is centered on the questioning of what really drives economic growth. In this sense, Arestis and Baltar (2017*b*) argue that in Kalecki's (1990, 1971) work, income distribution was perceived as something that would affect the intensity of GDP growth (always in a positive way), but would not determine economic growth (which is

determined by capitalist consumption and investment). Additionally, Pariboni (2016) argues that when autonomous components of demand are included in the model, there is no permanent effect of income distribution on the rate of growth. Albeit its importance, this discussion is not presented here because it mainly regards a theoretical debate, while our main concern is an empirical one.

2.4.1 A question of time

Recent contributions question whether empirical studies on the demand regime of an economy properly capture the interaction between functional income distribution and aggregate demand or economic growth. While some authors are concerned with the appropriate method to test the demand regime of a country, others question the stability of the regime itself.

Part of the former group, Blecker (2016) explores the possibility of the relation between economic growth and income distribution being subject to the time length considered. From an analysis of a wide range of empirical studies, the author argues that those that identify a profit-led regime might be more relevant to the short-run behavior of the economy than to its longer-term economic performance.

The reason for this difference lies in the different responsiveness of each aggregate component to shifts in income distribution. Blecker (2016) explains that the reaction of net exports and investment to a redistribution of income are short-run phenomenons, whereas the reaction of consumption is stronger in the longer-run. Because most of the empirical literature has ignored the time dimension, they do not identify this aspect[25].

In the first place, it is likely that profits have a stronger effect on the short-run movements of investment than the accelerator effect, that should dominate in the longer-run. His argument is that profits are a leading variable driving cyclical fluctuations of investment, while, in the long-run, firms will only increase their capital stock in proportion to expected demand. As investment is the aggregate demand component with wider cyclical fluctuations, Blecker (2016) argues that it is necessary to distinguish between the determinants of the cyclical fluctuations and the determinants of longer-term trends.

Secondly, net exports can be negatively affected by a rise in the wage share if this leads to a loss of competitiveness with foreign products (that is, if there is a rise in unit labor costs). However, there is a range of adjustment mechanisms that can offset this effect in the long-run. For instance, the improvement of the country's balance of payments can counterbalance the competitive gains from a decrease in unit labor costs. Moreover, reactions by other countries may also offset the home country's initial improvement over time if they follow a "beggar my neighbor" reaction. To Blecker (2016), this possibility proves that the "export-led" argument is a

[25] Blecker (2016) explains that, for a number of reasons, the studies that follow the structural approach may come relatively closer to identifying long-run relations than the studies that follow the aggregative approach. Both these approaches applied in empirical studies will be discussed in the next chapter.

"fallacy of composition" because it is impossible for all countries to succeed in an export-led growth strategy based on labor costs advantages at the same time.

Finally, the impact of an increase in the wage share on consumption is likely to be greater in the long-run than in the short-run. For instance, standard theories of the consumption function say that the overall marginal propensity to consume is higher in the long-run because households try to maintain a relatively steady consumption expenditure in face of short-run fluctuations in income receipts. Moreover, financialization, through the extension of workers' access to credit, means that their consumption is less constrained by wages in the short-run than in the longer run.

Therefore, to Blecker (2016) it is more likely that an economy is wage-led in the long-run, even though it can appear to be profit-led in the short-run. Interestingly, Bhaduri and Marglin (1990) have a different perspective, as they assume that investment is likely to respond with more caution than consumption to a change in the profit share. Thus, in the short period, the depressing effect of a higher profit share might be dominant as the effect of a higher investment will only materialize in a longer-period, so the economy would actually be profit-led in the long-run.

Arestis and Baltar (2017*b*) offer another explanation for a short-run profit-led result that is not sustained in the long-run. They argue that the positive correlation between the profit share and the level of economic activity can be explained by overhead labor, as argued by Lavoie (2014, 2017), and that this has been reinforced by the liberalization of private finance with the neoliberal reforms of the 1980s, which increased the possibility of household debt. Their argument is that this higher household debt contributes to the increase of the profit share when economic activity is high while it also shortens the business cycle (in relation to the period after the World War II), leading to a lower long-run tendency of economic growth. Thus, financial liberalization does not change the long-run demand regime, but leads to a more irregular GDP growth with a lower trend.

While these arguments suggest that a certain demand regime, the wage-led one, prevails in the long-run, some authors reject this idea altogether. To Nikiforos (2016) the characterization of an economy as universally wage- or profit-led is a misguiding one, as the relation between income distribution and economic growth changes over time through an endogenous mechanism that alters the propensities to save and invest.

The model by Nikiforos (2016) assumes that the propensity to invest out of profits will decrease with increases in the profit share, because the importance of profits as a source of finance is lower at high levels of profitability, expectations will be less driven by profitability and more driven by the size of the market, and claims by the financial sector might increase with the profit share. Also, the propensity to save is assumed to increase with increases in the profit share, as higher capitalist income will mean a lower marginal propensity to consume.

Combining these two relations with an endogenous determination of the profit share, according to which the rate of change of the profit share is proportional to its level and to the

degree of distribution-ledness of the economy, Nikiforos (2016) shows that the regime will be endogenous. Therefore, not only there will be alternate periods of wage- and profit-led regimes, but also the pursuit of growth based on income redistribution to one of the income groups in accordance with the demand regime will lead to its demise and replacement, so the system's own contradictions lead to a period of crisis and to another regime.

Clearly, this interpretation has similarities with the long waves approach by the French Regulation School and the Social Structures of Accumulation (SSA) approach in the USA[26]. Indeed, Nikiforos (2016) argues that the research under which Marglin and Bhaduri's (1990) article was written eventually overlapped with the SSA and that its focus was to understand what had lead to the end of the "Golden Age", which was understood as the result of a change in the regime given by its own contradictions. In a similar analysis, the recent crisis and the following stagnation can be understood as a consequence of the neoliberal institutional arrangement that emerged as a solution to the profit-squeeze and crisis in the 1970s (Nikiforos, 2016). Currently facing its own crisis, which emerged from the combination of a wage-led regime and an increasing profit share, this arrangement will eventually be replaced by a new one, leading to a new stage of accumulation.

With respect to empirical studies, the approach given by Blecker (2016) and Nikiforos (2016) differ. The former scrutinizes what would be the appropriate method to capture the demand regime of an economy and the latter questions the validity of studies that test the demand regime of an economy using long time series if they do not consider the possibility of important changes in this period (structural changes). Indeed, if one accepts that the demand and growth regimes might endogenously change, policy implications driven from studies that take the average behavior of the economy over very long periods can be problematic as they do not reflect what will be the effect under the current regime.

2.4.2 Demand regimes and employment

Albeit presumably avoiding a trade-off between equality and economic growth, a policy to increase real wages in a wage-led economy can lead to unwanted effects in the labor market. This effect is due to the way labor productivity reacts to increases in real wages and in economic activity (Storm and Naastepad, 2017) and leads to the possibility that wages become more concentrated, hampering at least part of the improvement in equality.

Storm and Naastepad (2017) incorporate two effects that are discussed among heterodox economists. The first one is the Kaldor-Verdoorn effect, which is the increase in productivity growth as GDP increases due to economy-wide deepening of the division of labor and learning by doing process. The second one is the "Marxian" labor-saving technological progress (what Lavoie (2014) calls the Webb effect), which is the investment in more efficient

[26]For an explanation of these approaches, see Guttmann (2016).

and less labor-intensive technologies in reaction to a higher real wage. Combining these two effects, labor productivity growth becomes endogenous, as expressed in equation 2.98:

$$\hat{\lambda} = \lambda_0 + \lambda_1 \hat{Y} + \lambda_2 \hat{w} \tag{2.98}$$

where $\hat{\lambda}$ is labor productivity growth, $\hat{Y}$ is demand growth, $\hat{w}$ is real wage growth, and $\lambda_0 > 0$, $0 < \lambda_1 < 1$, and $\lambda_2 > 0$ are parameters.

Employment growth is determined by the difference between output growth and labor productivity growth. Considering the endogenous determination of the labor productivity growth from the previous equation, employment growth is determined by equation 2.99.

$$\hat{N} = \hat{Y} - \hat{\lambda} = (1 - \lambda_1)\hat{Y} - \lambda_0 - \lambda_2 \hat{w} \tag{2.99}$$

Assuming that a wage-led growth regime prevails, output growth is a positive function of real wages (equation 2.100) and employment growth can be expressed by equation 2.101:

$$\hat{Y} = \hat{Y_A} + y_w \hat{w} \tag{2.100}$$

$$\hat{N} = (1 - \lambda_1)Y_A - \lambda_0 + [(1 - \lambda_1)y_w - \lambda_2]\hat{w} \tag{2.101}$$

where $\hat{Y_A}$ is autonomous demand growth and y_w is a parameter.

The derivative of the employment growth rate to real wages is shown in equation 2.102. Therefore, the impact of a real wage increase on employment growth is determined by two opposite effects: a positive effect due to an increase in output (given a wage-led demand) and a negative effect through the direct and indirect (Kaldor-Veerdorn effect) increase in labor productivity growth. From some stylized facts, Storm and Naastepad (2017) argue that the value of 2.102 is likely to be negative.

$$\frac{d\hat{N}}{d\hat{w}} = (1 - \lambda_1)y_w - \lambda_2 \tag{2.102}$$

This poses a contradiction to the policy implications derived from the Kaleckian economic growth and income distribution models, especially in the case of a wage-led regime. On the one hand, restrained real wages might lead to higher employment, but this will be accompanied by lower economic activity and lower technological dynamism. On the other hand, increases in real wages will increase output and labor productivity growth, but there will be a decrease in employment growth (lower employment intensity of economic growth).

Additionally, this decrease in employment growth that follows an increase in real wages can lead to an increase in wage inequality. For instance, Neto and Ribeiro (2018) show that technological change worsens intra-working class income distribution because it benefits skilled workers over non-skilled workers and that this can mitigate the positive effects of technological change on the economy. If this technological change is the result of an increase in the real wage

growth rate in a wage-led demand economy (as in Storm and Naastepad's (2017) model), the outcome might be of lower employment and higher intra-wage inequality, despite of a higher wage share.

A way out of this paradox is suggested by Storm and Naastepad (2017) in order to reconcile functional income distribution, economic growth, employment growth, and productivity growth. They suggest that a permanent reduction of individual working hours and fiscal intervention or active demand management can lead to higher employment growth.

2.4.3 Moving forward?

Skott (2017) questions how robust is our understanding of the economic relations between economic growth and income distribution from the Kaleckian models. He argues that the observed correlations between the two variables are contingent in the sense that they depend on which was the external shock that affected both of them. Assuming that the parameters of the equations can change with an external shock that also affects income distribution[27], a change in the wage share can lead to either an increase or a decrease of output. Moreover, when feedback effects from demand conditions to distribution are included, an identification problem might arise: it becomes harder to know what is driving what, so driving any causality in terms of a demand regime might be problematic without assessing the slope of both the distributional and the demand curves.

Therefore, Skott (2017) questions the helpfulness of focusing on the growth benefits of an income redistribution instead of exploring how policy instruments affect both inequality and economic growth, especially given that the profit share is an outcome and not a policy instrument by itself. To some extent, Blecker (1989) goes in this direction by showing that the source of change in income distribution matters, but most models take income distribution as exogenous. Although it seems that stressing the increase in economic growth that would come with an income redistribution towards wages sounds as a strong political argument, it is true that a broader understanding of how policy instruments affect both of these variables can be informative and avoid situations in which it seems to be a conflict between the equality and growth objectives.

From a different perspective, Dutt (2017) also criticizes the focus on the possibilities of wage- or profit-led growth by arguing that the literature should focus more on equality-led growth, especially because the wage share is not always a good indicator of inequality. Thus, it seems that there is an increasing perception that the terms of the debate on the relation between equality and growth have been misplaced. This perception does not invalidate the contributions that have been made by these models, but bespeaks shortcomings that, once overcame, can lead

[27] The possibility of parameter changes to external shocks make empirical estimations subject to the Lucas critique (Skott, 2017).

to a more precise understanding of the economic relations behind economic growth and income distribution.

2.5 Conclusion

The theoretical models reviewed in this chapter concern the effect of a shift in income distribution on the economic performance. They show that it can have different effects on each aggregate demand component and that the sign of the effect is uncertain for some components. More specifically, the demand and accumulation regimes can be either wage- or profit-led.

As discussed in chapter 1, Brazil experienced a period of economic growth with improvements in the country's income distribution before the 2007-2008 crisis. After a period of economic growth driven by exports, consumption increased and, through the accelerator effect, investment and output also increased, as it would be expected in a wage-led growth regime.

However, after the crisis, the Brazilian economy faced lower investment and growth rates despite the maintenance of the income transfer policies. Moreover, Arestis et al. (2016) argue that the context of an appreciated domestic currency led to higher imports in face of growing consumption. This period would suggest, in line with Kaleckian models, a profit-led growth regime.

Hence, the Kaleckian economic growth and income distribution models offer a relevant theoretical background to the analysis of the role of wages in the Brazilian economic performance since the 2000s. In order to have more evidence of the relation between economic growth and income distribution in Brazil in this period, the next chapter undertakes an empirical analysis of the demand and accumulation regimes in the country.

The analysis of the shocks on the Brazilian economy during these years may provide a broader understanding that goes beyond the definition of the economic regime of the country. Indeed, if one agrees with Nikiforos's (2016) and Skott's (2017) arguments, the empirical study in the next chapter ought to be understood as a study of the relation between aggregate demand and income distribution in a specific economic context. This suggests that it is also helpful to test whether there has been a parameter change that can explain a weaker reaction of aggregate demand and investment to income distribution by the end of the period.

Chapter 3

Brazilian economic regime (2003 to 2014)

The literature review on the Kaleckian economic growth and income distribution models suggests the need of an empirical study on the relation between these variables. Not only the regime is uncertain (Blecker, 1989, Bhaduri and Marglin, 1990), but it can change from time to time (Palley, 2014, Blecker, 2016, Nikiforos, 2016). This means that a country should not be characterized uniquely as wage- or profit-led. However, econometric estimations might suggest the operating regime in a specific period, what can bring elements to better understand the performance of different economies. Especially with respect to the Brazilian case, since the 2000s, the econometric analysis might provide evidence to whether there has been a shift in the economic regime after the global financial crisis of 2007-2008.

Previous studies have tested the demand and growth regimes of the Brazilian economy, but they do not lead to a consensus on whether it is wage- or profit-led as they use different methods and cover different time periods. Additionally, most of them assume a stable relation between the variables throughout the period of estimation. The contribution of our study is to explicitly consider the possibility of a change in the demand and accumulation regimes when the underlying economic conditions change. In order to investigate this possibility, we estimate the demand and accumulation regimes for the Brazilian economy from 2003 to 2014. All estimations were done in the EViews software.

This chapter is organized in six sections. Section 3.1 discusses previous studies on the Brazilian economic regime. Section 3.2 presents the method used in this study, while section 3.3 presents the database. Section 3.4 discusses some stylized facts from the data. Section 3.5 reports the results from our estimations. Finally, section 3.6 draws some conclusions.

3.1 Previous studies on the Brazilian regimes

A number of authors have tested the effect of an income distribution on either economic growth or aggregate demand in the Brazilian economy, as summarized in table 3.1. Similarly to studies that have been applied to other countries, these studies rely on different

methods and find divergent results. However, part of the focus of the studies on the Brazilian economy has been on exploring the effect of the real exchange rate, reflecting the national debate on the need of a competitive exchange rate to economic growth.

Table 3.1: Empirical literature on the Brazilian economic regime

Reference	Time period	Dependent/endogenous variable(s)	Method	Conclusion
Bruno (2003)	1970 to 2001	Aggregate demand	OLS	Regime switch
Araújo and Gala (2012)	2002Q1 to 2008Q1	Capital accumulation	OLS	Profit-led accumulation regime
Oreiro and Araújo (2013)	1994Q3 to 2008Q4	Capital accumulation	OLS	Profit-led accumulation regime
Feijó, Câmara and Cerqueira (2015)	1951 to 1989	Aggregate demand (GDP)	OLS	Profit-led demand regime
Feijó, Lamonica and Bastos (2015)	1995Q1 to 2009Q4	Income distribution and accumulation rate	SVAR	Wage-led accumulation
Morrone (2015)	1950 to 2008	Capital accumulation	Granger	Neutral accumulation regime
Gonçalves (2016)	2004Q1 to 2010Q4	Capacity utilization and profit share	VAR	Profit-led demand and profit squeeze dist.
Tomio (2016)	1956 to 2008	Aggregate demand (GDP)	OLS	Wage-led aggregate demand
Jesus et al. (2017)	1970 to 2008	Economic growth and capacity utilization	VAR	Profit-led growth and capacity utilization

Note: Q refers to quarters.

Araújo and Gala (2012) estimate ordinary least squares (OLS) equations for the investment, saving, and net exports functions. They find a wage-led internal growth regime, but a profit-led regime when the external sector is taken into account. They also show that a depreciation of the national currency would have a positive effect on the accumulation rate. Yet, the robustness of these results may be questioned as there is no assessment on the stationarity of the series and the sample coverage is narrow (28 observations).

Oreiro and Araújo (2013) include the possibility of different accumulation regimes over time due to non-linearities in the relationship between the real exchange rate and economic growth. This is done by assuming that investment is a quadratic function of the real exchange rate in order to capture the idea that, if the real exchange rate is overvalued, the regime is profit-led (i.e., reductions in real wages through a currency devaluation will increase capacity utilization and economic growth), while if it is undervalued, the regime is wage-led[1]. The authors find a profit-led accumulation regime in Brazil and evidence that a devaluation of the national currency increases capital accumulation; but, as this is a non-linear relation, at very high levels of the real exchange, the effect is of reducing capital accumulation. Considering the effect of the real exchange rate, they conclude that, in the period in which the national currency was undervalued (2001Q2 to 2005Q3), the regime in Brazil was wage-led, but when it was overvalued (2005Q4 to 2008Q4) and there was still a redistribution of income towards wages, the accumulation rate started to decrease. Therefore, the authors suggest that the regime has been profit-led since the last quarter of 2005, so that *"the process of increasing the share of wages in income since 2004 has served to reduce, rather than stimulate, capital accumulation and long-term growth of the Brazilian economy"* (Oreiro and Araújo, 2013, p. 383)[2].

Feijó, Câmara and Cerqueira (2015) and Tomio (2016) follow the method by Hein and Vogel (2008) and estimate OLS equations for consumption, investment, and net exports for

[1] Undervalued and overvalued currencies, in this case, refer to how far the currency is from an "optimal" rate, which maximizes the rate of capital accumulation.

[2] The authors also present a capacity utilization function, but it only includes the exchange rate, so the regime would be given through the effect of the exchange rate on the profit share.

different time periods. Feijó, Câmara and Cerqueira (2015) are concerned with the period of high inflation, concentration of markets and wage control going from 1951 to 1981 and find a profit-led regime, which is explained by the high dependence of investment on internal funds (so that investment was highly sensitive to the wage share) and by the emergence of a durable consumer goods domestic market, which benefited from the concentration of income. Tomio (2016), on the other hand, includes the more recent period (1956 to 2008) and finds a wage-led regime for the domestic and open economy. A drawback of considering such a long time series is, of course, that the conditions that explain a profit-led regime in Feijó, Câmara and Cerqueira's (2015) study were not necessarily so strong in the following decades, so it is plausible that the regime has shifted and the economy became wage-led as in Tomio's (2016) results. Indeed, Bruno (2003), who estimates single equations for investment, saving and net exports for the Brazilian economy from 1970 to 2001, suggests that this economy was profit-led in the 1970s and 1980s and became wage-led in the 1990s after the opening of the economy[3].

Morrone (2015) estimates a Kaleckian investment function through a VAR model which includes the investment rate, capacity utilization, and the profit share. The author estimates the model with the level variables and tests for Granger-causality applying Toda and Yamamoto's (1995) procedure. He concludes that there is Granger-causality from capacity utilization to capital accumulation; but there is no Granger-causality from the profit share to capital accumulation, suggesting that this variable would not be affected by an income redistribution. However, because the Granger-causality test is a Wald test on the lagged variables only, the possibility remains that there is a contemporaneous relation between both variables within this model.

Finally, the remaining authors have used a dynamic systems approach (VAR) in order to identify the relation between aggregate demand or accumulation and income distribution in Brazil, but there is a diversity in terms of the variables that were included as well as of the control variables used. Feijó, Lamonica and Bastos (2015) estimate a SVAR model including income distribution, the accumulation rate, and the debt ratio and find a wage-led accumulation regime and a negative effect of the debt ratio on accumulation. Gonçalves's (2016) study is inspired by Barbosa-Filho and Taylor (2006), so it estimates a VAR model with capacity utilization and the profit share as endogenous variables, while including different control variables as exogenous. Irrespectively of the controls added to each model, they suggest a profit squeeze distribution regime and a profit-led demand regime. Finally, Jesus et al. (2017) understand that the Brazilian growth period of the 2000s was positively influenced by exports, but the main role was played by the increase in internal demand, which reflected the income redistribution policies put in place by the government. They test a VAR model with the profit share, the output growth rate and the rate of capacity utilization. The estimated response of capacity utilization to the profit share is positive and significant in the first two periods, but it becomes insignificant from the third period onwards. Similarly, the response of the growth rate to a shock in the profit share is positive and

[3]Despite a sound economic analysis of these results, Bruno's (2003) study relies on a quite small number of observations for each sub-period, which might reduce the robustness of its results.

significant only in the first period. However, they do not find support from the Granger-causality tests of causality running from the profit share to the growth rate or the capacity utilization rate.

Our study contributes to this empirical literature by considering the possibility of a regime switch that may have resulted from a lower stimulus of an income redistribution from profits to wages on economic activity and investment. Thus, it aims at exploring whether the relation between the variables can change as the economic cycle unfolds and the underlying economic conditions change. Except for Oreiro and Araújo (2013) and Bruno (2003), the studies that test the economic regime of the Brazilian economy assume a stable economic regime throughout the period of the estimates, despite considering extensive periods in which the Brazilian political and economic conditions suffered considerable changes. The analysis in section 1.3 suggested some factors that may have played a role in the determination of the Brazilian economic regime in the period between 2003 and 2014 - as these factors changed during this period, it is likely that the economic regime also changed. In terms of the method, we applied the structural vector autoregressive model, which, to the best of our knowledge, was only applied by Feijó, Lamonica and Bastos (2015) for the Brazilian economy - however, the authors did not test for a structural break in the estimated relations. This method has the advantage of avoiding the simultaneity bias that may be present in the OLS estimates (method applied by most of the literature reported in table 3.1) and imposing restrictions on the structural parameters that are coherent with the economic theory (see section 3.2). In conclusion, this dissertation tests for a structural break in the relation between the variables within a SVAR approach, which seems to be the most appropriate to this type of estimation problem.

3.2 Method

The empirical literature on the Kaleckian economic growth and income distribution models can be split into two broad empirical methods (Blecker, 2016). The first one, inaugurated by Bowles and Boyer (1995), is known as the "structural approach", by which single equations are estimated for each aggregate demand component (saving, investment, and net exports) and the overall effect is given by summing the partial effects of an income redistribution on each aggregate demand component. According to Blecker (2016), a great advantage of this method is to determine the sign and magnitude of the marginal effect of an income redistribution on each aggregate demand component, differentiating the domestic regime from the overall regime. However, Blecker (2016) also notes that most papers that follow this approach treat income distribution as exogenous (so they are subject to simultaneity bias) and follow the simple ordinary least squared (OLS) method, not accounting for systemic dynamics.

An alternative approach is called "aggregative approach" by Blecker (2016) and, according to Stockhammer (2017), it is mostly used by neo-Goodwinians authors. It consists on directly estimating the effect of an income redistribution on capacity utilization (as a reduced form equation), usually by applying a vector autoregressive (VAR) model. As Blecker (2016, p.

379) notes, both approaches are subject to simultaneity bias in case the wage share is endogenous and a function of output[4], so *"perhaps the greatest advantage of the aggregative approach is that it easily addresses the simultaneity of demand and distribution* (...) [and it] *may also capture the dynamic interactions that the estimation of individual structural equations could miss"* (in this case, the models are also "systems" models and they estimate a distributional relationship). Yet, the author states that a disadvantage of this method is that it only provides short-run relations as capacity utilization is obtained by calculating deviations of current output from potential output given by a Hodrick–Prescott (HP) filtered trend, which forces the mean of the variable to be equal to zero and, by definition, rules out the possibility of long-term relations. Another pitfall of these studies is that they tend to fail to include other control variables, which can lead to omitted variable bias (Blecker, 2016, Stockhammer, 2017).

Concerning the purpose of the present study, there are important limitations arising from strictly following either of these methods, leading us to a third alternative which has been less used in the literature. Because our focus is on the possibility of a structural break in the investment function, we are interested in both the overall demand regime and the investment function, rendering the aggregative approach less suitable to our purposes.

Consequently, the structural approach would be the best alternative to our study, but some characteristics of this approach render its interpretation fragile. As Blecker (2016) argues, this approach estimates each equation through OLS and, thus, can be subject to simultaneity bias. However, a second criticism (related to the first one) can be made to the way the results are interpreted from the OLS estimations, especially considering the consumption equation as represented in equation 3.1 (Onaran and Galanis, 2014):

$$ln(C) = c_0 + c_p ln(P) + c_w ln(W) \tag{3.1}$$

where P is aggregate profits, W is aggregate wages, and $c_p > 0$ and $c_w > 0$ are parameters. From the estimated elasticities, marginal effects are estimated at the sample mean and the derivative of consumption with respect to the profit share is given by equation 3.2 as follows:

$$\frac{\partial C/Y}{\partial P/Y} = \frac{\partial C/Y}{\partial \pi} = c_p \frac{C}{P} - c_w \frac{C}{W} \tag{3.2}$$

However, the coefficients estimated by OLS represent *ceteris paribus* effects, that is, the effect of a change in one variable on the dependent variable while all other variables remain constant. This implies that the effect of an income redistribution from profits to wages cannot be captured by the c_p and c_w parameters as it is usually assumed by this literature[5].

Thus, not only the OLS estimates by the structural approach are subject to simultaneity bias because it ignores the systems dynamics of the model, but also the interpretation of

[4]This is one of the implications of theoretical models that consider overhead labor.

[5]Naturally, it would still be possible to capture the effect of an increase in wages (keeping profits constant) or an increase in profits (keeping wages constant).

the estimated consumption function ignores the *ceteris paribus* characteristics of the parameters. One solution to both of these issues would be to estimate a VAR model for the consumption function and to interpret the effect of an increase in wages on both profits (and, thus, on the profit share) and consumption. However, further complications would arise to compute the effect of the other equations in order to have the overall effect.

A third option offers a compromise between the aim of our study and the basic desirable properties of the model for empirical estimations. As discussed above, a systems approach must be taken into account and, for the purpose of our analysis, an investment function ought to be estimated. These requirements are fulfilled by a VAR model inspired by Onaran and Stockhammer (2005), which includes the following y vector of endogenous variables. This is an extension of the aggregative approach, as more control variables are added:

$$y = \begin{bmatrix} GY \\ IY \\ ps \end{bmatrix} \tag{3.3}$$

where $GY = Y_t/Y_{t-1}$ is the growth rate, $IY = I_t/Y_t$ is the investment rate, and $ps = P_t/VA_t$ is the profit share of value added.

Due to their importance to the Brazilian economy, we include the real exchange rate (RER), world GDP (Yf), and real interest rate (r) variables. In order to limit the number of endogenous variables, these variables are included as exogenous and are represented in the z matrix expressed in equation 3.4. Additionally, a structural break for the profit share is considered in a second estimation.

$$z = \begin{bmatrix} RER_t \\ Yf_t \\ r_t \end{bmatrix} \tag{3.4}$$

A VAR(1) model, which includes one lag of each endogenous variable, can be represented in its structural form as follows, where x and z are endogenous variables (Enders, 2015):

$$x_t = b_{10} - b_{12}z_t + \gamma_{11}x_{t-1} + \gamma_{12}z_{t-1} + \epsilon_{xt} \tag{3.5}$$

$$z_t = b_{20} - b_{21}x_t + \gamma_{21}x_{t-1} + \gamma_{22}z_{t-1} + \epsilon_{zt} \tag{3.6}$$

In a matrix form, the model can be represented as follows:

$$\begin{bmatrix} 1 & b_{12} \\ b_{21} & 1 \end{bmatrix} \begin{bmatrix} x_t \\ z_t \end{bmatrix} = \begin{bmatrix} b_{10} \\ b_{20} \end{bmatrix} + \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix} \begin{bmatrix} x_{t-1} \\ z_{t-1} \end{bmatrix} + \begin{bmatrix} \epsilon_{xt} \\ \epsilon_{zt} \end{bmatrix}$$

$$Ay_t = A_0 + A_1 y_{t-1} + \epsilon_t \tag{3.7}$$

where y represents the vector of endogenous variables and A, A_0, and A_1 are matrices with parameters.

However, equation 3.7 cannot be estimated through OLS, as the error term of each variable indirectly affects the other variable, leading to simultaneous equation bias (Enders, 2015). Multiplying all terms in equation 3.7 by the inverse of the A matrix[6] renders the reduced form of the VAR (equation 3.9), which can be estimated through OLS because there is no contemporaneous relation between the variables.

$$y_t = \Phi_0 + \Phi_1 y_{t-1} + e_t \tag{3.9}$$

Yet, the contemporaneous relation among the variables can be retrieved from the reduced form if some restrictions are imposed to the structural form. This is necessary because the structural form has more parameters than the reduced form. For instance, one can assume that $b_{21} = 0$, so z_t has a contemporaneous effect on x_t but x_t only affects z_t with a lag. The structural form then becomes:

$$\begin{bmatrix} 1 & b_{12} \\ 0 & 1 \end{bmatrix} \begin{bmatrix} x_t \\ z_t \end{bmatrix} = \begin{bmatrix} b_{10} \\ b_{20} \end{bmatrix} + \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix} \begin{bmatrix} x_{t-1} \\ z_{t-1} \end{bmatrix} + \begin{bmatrix} \epsilon_{xt} \\ \epsilon_{zt} \end{bmatrix}$$

Multiplying by A^{-1} renders:

$$\begin{bmatrix} x_t \\ z_t \end{bmatrix} = \begin{bmatrix} b_{10} - b_{12}b_{20} \\ b_{20} \end{bmatrix} + \begin{bmatrix} \gamma_{11} - b_{12}\gamma_{21} & \gamma_{12} - b_{12}\gamma_{22} \\ \gamma_{21} & \gamma_{22} \end{bmatrix} \begin{bmatrix} x_{t-1} \\ z_{t-1} \end{bmatrix} + \begin{bmatrix} \epsilon_{xt} - b_{12}\epsilon_{zt} \\ \epsilon_{zt} \end{bmatrix}$$

With appropriate substitutions and by calculating the variance and covariance of the error terms, it is possible to recover the structural form.

The procedure for estimating a VAR model consists on the identification of the model; its estimation through OLS; analysis of the residuals' behavior; and, finally, interpretation of the results. In the first step, the integration order of the variables is assessed through unit root tests and the non-stationary variables are taken in first difference (the model will reflect short-run effects). Moreover, the p lag order of the VAR(p) model is assessed through the information criteria, especially the Schwartz information criterion, which tends to render a more parsimonious model (Enders, 2015).

In a second step, diagnostic tests are applied to the VAR model in order to analyze whether the residuals are well behave. Therefore, autocorrelation, normality and heteroskedasticity tests are applied and the stability of the model is checked.

[6] The inverse of the A matrix is:

$$A^{-1} = \frac{1}{1 - b_{12}b_{21}} \begin{bmatrix} 1 & -b_{12} \\ -b_{21} & 1 \end{bmatrix} \tag{3.8}$$

Finally, the interpretation of our model focuses on the impulse response functions and the variance decomposition. Significance in a VAR model cannot be analyzed in a straightforward manner because the model might suffer from multicollinearity due to the addition of many lags and because Granger-causality tests are performed only on the lagged effects (not taking into account the contemporaneous relations).

Impulse response functions (IRF) show the response of each variable after a shock on another variable, while variance decomposition shows the percentage of the variance of one variable explained by each endogenous variable. Because they consider the contemporaneous relation between the variables (the structural form), the restrictions applied to the structural form will have crucial implications to the final analysis.

In order to recover the parameters of the structural form from the restricted form, restrictions to the structural form are needed, what can be done through different methods (Lütkepohl, 2005). The structural parameters are recovered by defining restrictions to the A or B (or both) matrices, which relate the residuals from the structural (ϵ) and the reduced (e) forms:

$$B\epsilon_t = Ae_t \tag{3.10}$$

The basic intuition comes from the moving average representation of the VAR, so that it becomes a function of the innovations (Enders, 2015). Then, the definition of the restrictions is, essentially, an errors decomposition.

According to Lütkepohl (2005), in the AB-model, in which restrictions are added to both the A and B matrices, $2n^2 - 0.5n(n+1)$ restrictions are needed (n represents the number of endogenous variables) to identify the $2n^2$ elements of the A and B matrices. The Choleski decomposition determines a triangular A matrix with all elements above the principal diagonal equal to zero and ones in the main diagonal, but, due to its *ad hoc* nature, it may be more interesting to impose restrictions derived from economic theory. This is the case of the structural VAR (SVAR), which avoids the strong assumptions from the Choleski decomposition and allows the researcher to impose restrictions that are coherent with the economic theory (Enders, 2015). As mentioned in the previous section, to the best of our knowledge, only Feijó, Lamonica and Bastos's (2015) study has estimated the economic regime of the Brazilian economy through this method, which seems to be more adequate for the reasons discussed in this section.

In order to identify our model, at least 12 restrictions ($n = 3$) are needed. Short-run restrictions are applied by restricting the A (contemporaneous relation between the variables) and B matrices, as follows:

$$A = \begin{bmatrix} 1 & C(2) & C(3) \\ 0 & 1 & 0 \\ C(1) & 0 & 1 \end{bmatrix}, B = \begin{bmatrix} C(4) & 0 & 0 \\ 0 & C(5) & 0 \\ 0 & 0 & C(6) \end{bmatrix} \tag{3.11}$$

Therefore, we assume that capacity utilization is contemporaneously affected by the investment rate and by the profit share[7]; that investment is not contemporaneously affected by either capacity utilization or the profit share (there is a lag between investment decisions and expenditure); and that the profit share is contemporaneously affected by capacity utilization (reflecting the immediate effect of a lower share of overhead labor with increases in capacity utilization) but not by the investment rate. Additionally, the B matrix is a diagonal matrix so that the standard deviations of the structural shocks are estimated (Eviews, 2016). These restrictions are equivalent to defining the residuals as follows:

$$e_1 = C(4) * \epsilon_1 - C(2) * e_2 - C(3) * e_3 \tag{3.12}$$

$$e_2 = C(5) * \epsilon_2 \tag{3.13}$$

$$e_3 = -C(1) * e_1 + C(6) * \epsilon_3 \tag{3.14}$$

where e is the reduced form residual and ϵ is the structural form residual (the subscripts $1, 2$, and 3 refer to the capacity utilization, investment rate, and profit share equations respectively).

3.3 Database

Data sources and other information concerning the time series are listed in table 3.2 and discussed in more detail below. All variables are seasonally adjusted by the Census X12 additive procedure (except for the world GDP and Brazilian GDP growth rate, which are available seasonally adjusted at the original sources) and are taken in logarithm. Given the data availability, our sample goes from the first quarter of 2003 to the last quarter of 2014, providing 48 observations (when lags are added to the model or the variables are differentiated, the number of observations included in the model decreases).

[7] We assume that a decrease in the profit share will have at least some effect on capacity utilization in the same quarter, especially because of the effect of a higher wage share on consumption. Blecker (2016, p. 385) argues that it is likely that the impact of an income redistribution on consumption is stronger in the long-run than in the short-run because *"households attempt to maintain* some *degree of stability in consumption in response to transitory fluctuations in income"*. Still, this does not mean that there will not be an increase in consumption in the short-run following an increase in the wage-share, even if it is perceived as a transitory increase and, thus, is lower than it would be in the long-run. Additionally, Blecker (2016) analyzes the USA economy, but the patterns he identifies may not apply to the Brazilian economy. In particular, income redistribution in Brazil in the 2000s and early 2010s increased the lower class income, who is likely to have a very high propensity to consume and little access to credit (which is part of the reason why households would maintain some degree of stability in consumption). The fact that part of the income redistribution was due to cash transfers from the government to very poor households suggests that the effect on consumption ought to be very strong. Therefore, it is not far-fetched to assume that this had an immediate effect on consumption.

Table 3.2: Database

Variable	Name	Source	Periodicy
IY	Brazilian investment rate	IBGE (2017*c*, Table 1846)	Quarterly
GY	Brazilian GDP growth rate, real	IBGE (2017*c*, Table 1621)	Quarterly
RER	Real effective exchange rate, based on consumer price index	IMF (2017)	Quarterly
R	Real interest rate, based on $IPCA$	Brazilian Central Bank (2017, Table 4390)	Monthly
$IPCA$	Broad national consumer price index	Brazilian Central Bank (2017, Table 433)	Monthly
Y_f	G20 GDP, real	OCDE (2017)	Quarterly
W	Aggregate Wages	IBGE (2017*a*,*b*)	Quarterly (interpolated)
Y_{fc}	GDP at factor cost (value added)	IBGE (2017*c*, Table 1846)	Quarterly
P	Aggregate Profits	$Y_{fc} - W$	
ps	Profit share	P/Y_{fc}	

3.3.1 Capacity utilization and the investment rate

In order to avoid the use of a measure of the capital stock or of the potential output[8], we include the the investment rate ($IY = I/Y$) and the growth rate of GDP (GY=Y_t/Y_{t-1}-1), which is used as a proxy of capacity utilization, as higher growth leads to higher capacity utilization[9]. These variables are provided by IBGE (2017*c*) on a quarterly basis.

3.3.2 Profit share

Brazilian GDP data from the income approach is available only at annual frequency. Bastos (2012) suggests adjusting the quarterly series to the official annual data from the national accounts by applying Denton's (1971) approach, which provides a close pattern to the annual one.

This method consists of interpolating a variable of low-frequency totals (benchmark) by using a high-frequency indicator variable and adding the restriction that the interpolated series must sum up to the level of the benchmark. Therefore, the indicator variable only determines the quarterly behavior of the series (so the level of the quarterly series is determined by the benchmark but it is proportional to the indicator series).

As Bastos (2012) directly estimates the wage share and his sample finishes in 2010, it is necessary to apply the Denton interpolation method to the aggregate wages using an updated database. To do so, we use the annual data for GDP from IBGE (2017*a*), which goes from 2000 to 2014 and separates the value added between workers' income, gross operating surplus, and mixed income, and the data by IBGE (2017*b*) on labor income[10], which goes from the first month of 2002 to the last month of 2015, as indicator variable.

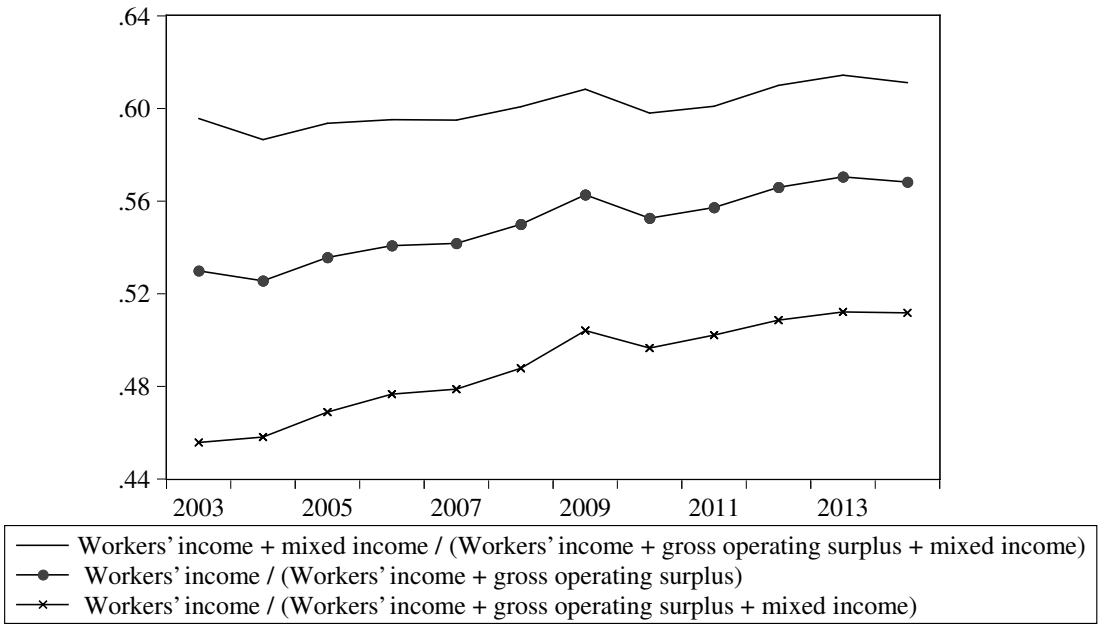
[8] Some authors use the HP-filtered trend in order to measure the potential output and, thus, capacity utilization. However, there are serious problems with the use of such method, as it *"introduces spurious dynamic relations that are purely an artifact of the filter and have no basis in the true data-generating process"* (Hamilton, 2016, p. 21). Blecker (2016) also points out this issue when assessing the aggregative approach.

[9] An alternative would be to use a direct measure of capacity utilization. However, this measure only reflects the industrial capacity utilization, making it insufficient to capture the whole dynamics of the Brazilian economy.

[10] In order to have the total amount of wage income, we multiplied the average nominal income of the main work (in Portuguese, *Rendimento médio nominal do trabalho principal, efetivamente recebido no mês de referência, pelas pessoas de 10 anos ou mais de idade, ocupadas na semana de referência*) by the number of people employed (in

When calculating the wage share from the national accounts, a decision has to be made regarding whether mixed income (self-employed income) is labor or capital income. As Bastos (2012) explains, there are three ways of doing so: considering that mixed income is capital income; that it is split between labor income and capital income in the same proportion as the remaining income; or that it is labor income. Figure 3.1 shows the resulting wage share from each of these options (calculated from the annual national accounts). All these labor shares grew in the period of 2004 to 2014, but the increase in workers' share was larger than the one of mixed income share, so both the shares that consider that labor income is a sum of these two types of income show a smaller increase than the one that only considers workers' income.

Figure 3.1: Three methods to calculate the wage share - 2003 to 2014



Source: IBGE (2017*a*). Own elaboration.

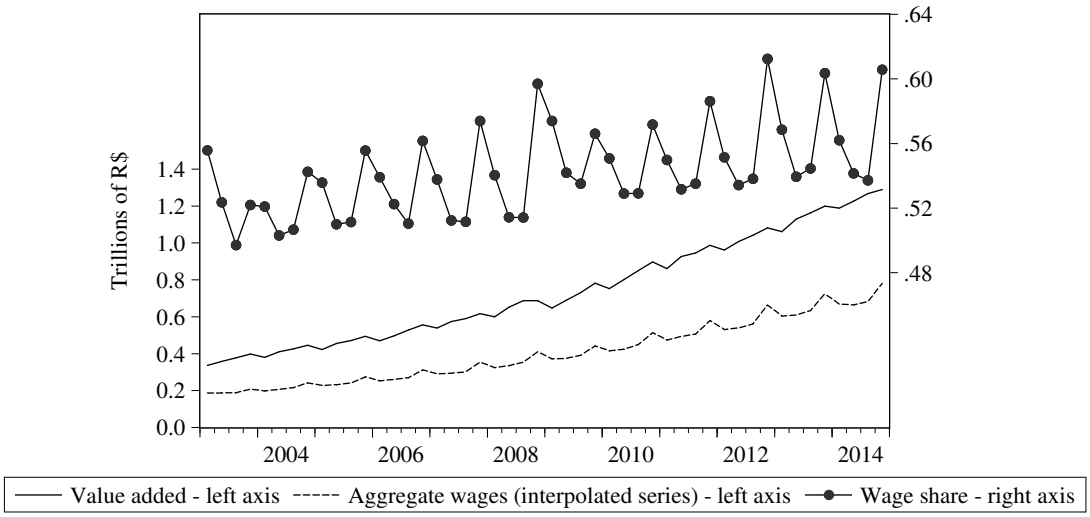
We assume that mixed income is split between labor income and capital income in the same proportion as the remaining income, so the wage share is given by dividing the workers' income by the sum of their income and the gross operating surplus. Therefore, our benchmark variable is the sum of workers' income and the labor share of mixed income (IBGE, 2017*a*) and our indicator variable is the quarterly aggregate labor income (IBGE, 2017*b*). The interpolated series[11] and the corresponding wage share (divided by the quarterly value added from IBGE (2017*c*)) are presented in figure 3.2. We opt to use the wage share in value added instead of the wage share in GDP because increases in the former indicate a redistribution of income from profits to wages while increases in the latter can be due to an income redistribution from indirect

Portuguese, *Pessoas de 10 anos ou mais de idade, ocupadas na semana de referência*). Quarterly data is obtained by adding the monthly data.

[11] The interpolated series was calculated using the Stata Software.

taxes or profits to wages. As the latter case demands a more complex analysis of how indirect taxes are spent, which can differ from how profit income is spent, it seems more appropriate to consider the wage share of value added in our estimations. Additionally, changes in the ratio imported raw materials with respect to GDP can affect the share of wages in GDP without affect its share in value added.

Figure 3.2: Value added, interpolated aggregate wages and the wage share - 2003 to 2014



Source: IBGE (2017*a*,*c*). Own elaboration.

The profit share (ps) is then obtained by applying equation 3.15:

$$ps = 1 - ws \tag{3.15}$$

3.3.3 Real interest rate

In order to have the quarterly real interest rate, we deflate the monthly Central Bank nominal interest (Selic) by the Broad National Consumer Price Index (IPCA), both provided by the Brazilian Central Bank (2017). Then, we calculate the quarterly accumulated real interest rate.

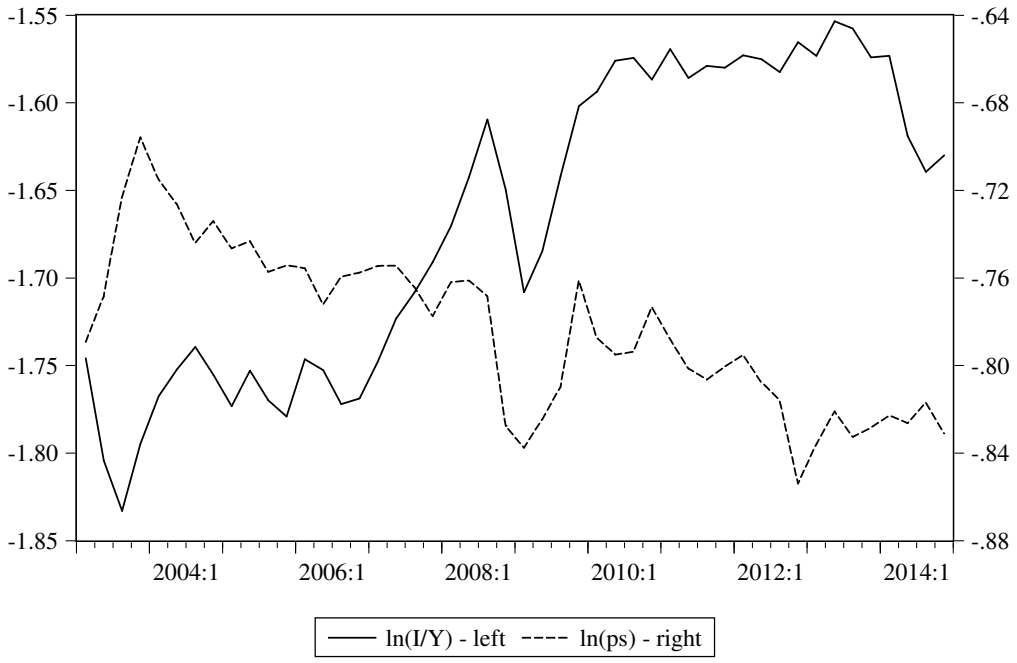
3.3.4 World GDP

As the world GDP (World Bank, 2017) taken, for instance, by Onaran and Galanis (2014) is not available on quarterly basis, we take the sum of the G20 economies' GDP provided by OCDE (2017) and subtract the Brazilian GDP, which is provided by the same database. These variables are in "US Dollars of 2010" and are seasonally adjusted.

3.4 Stylized Facts

Some stylized facts can be drawn from the observation of our main time series. With respect to the accumulation regime, the investment rate (IY) has been negatively correlated with the profit-share (ps) for most of the period between 2003 and 2014 (correlation coefficient of -0.74), as demonstrated in figure 3.3. However, there are three moments in which this relation seems to have behaved in a different manner. Firstly, between 2008Q3 and 2009Q4 they seem to have been both affected in the same direction by the global financial crisis. Secondly, from 2010Q2 to 2013Q1, the investment rate has had a weaker response to the still expressive decrease in the profit share. Finally, from 2013Q2 until the end of the period, the investment rate has presented a decrease despite of a stable profit share. Therefore, it seems that a period in which investment grew despite of the decrease in the profit share was followed by a period in which investment decelerated while the profit share continued to decrease. This suggests that there has been a change in the relation between these two variables.

Figure 3.3: Accumulation Regime

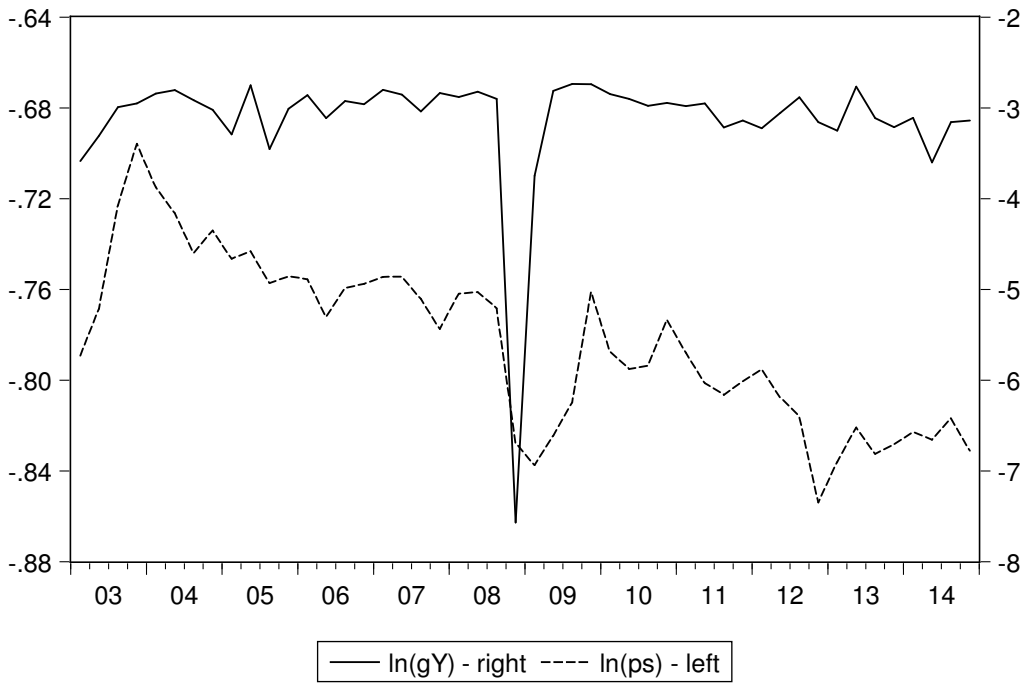


Source: IBGE (2017*a*,*b*,*c*). Own elaboration.

The demand regime can be analyzed through the relation between the proxy for capacity utilization (GY) and the profit share (figure 3.4). In this case, it seems that the GY behavior was rather insensitive to changes in the profit share until the economic crisis. After the crisis, however, a decrease of this variables has been simultaneous to the decrease of the profit share, which would be interpreted as a profit-led regime, but could also be a result of

the deceleration of the investment rate. Indeed, the correlation between the variables has been positive in the period (correlation coefficient of 0.29).

Figure 3.4: Demand Regime



Source: IBGE (2017*a*,*b*,*c*). Own elaboration.

From these stylized facts, three crucial moments of change in the relation between the variables can be selected:

- The global financial crisis (2007Q4 to 2009Q4);
- The deceleration of the investment rate since 2010Q2;
- The decrease in the investment rate since 2013Q2.

These breaks suggest that there has not been a stable relation between the profit share and the investment rate or the capacity utilization rate, so structural breaks must be added to the baseline model. Since our main focus is on the behavior of the accumulation rate, we analyze the two latter hypotheses by testing whether there has been a break in the regime at these dates.

3.5 Empirical results

This section reports the empirical results. The unit roots tests are reported in section 3.5.1. The first specification (section 3.5.2) estimates the model with no structural break, the

second one (section 3.5.3) shows the results when the structural break is included in the model, and the third one (section 3.5.4) checks whether the results are robust by estimating a model only for the period before the structural break.

3.5.1 Unit Roots

In order to assess whether our series are stationary, we apply two unit root tests: the Augmented-Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests. Both tests are applied to the differenced series of non-stationary series in order to confirm that the original series has only one unit root.

The ADF test is applied following the procedure in Enders (2015). Following the specification of the test, the equation and parameters tested are defined as follows in equation 3.16. The residuals of all the equations are checked for autocorrelation using the autocorrelation function. Either there is no evidence of autocorrelation or it is corrected by adding more lags.

$$\Delta Y_t = \alpha + \beta t + \gamma Y_{t-1} + \sum_{i=1}^{p-1} \delta \Delta Y_{t-i} + e_t \tag{3.16}$$

Phillips and Perron (1988) suggest the use of a non-parametric approach with respect to the nuisance parameter (as a different solution to the residual autocorrelation in equation 3.16). It complements the traditional ADF test as it does not require the researcher to specify the lag length.

In case these two tests diverge, we also apply the KPSS test. Kwiatkowski et al. (1992) argue that the standard unit root tests fail to reject the hypothesis of a unit root for many economic series because of the way the classical hypothesis testing is carried out (a null hypothesis is only rejected if there is strong evidence against it) and thus suggest a test that can overcome this problem by setting the null hypothesis that the series is stationary.

Finally, when the results confirm that the series is non-stationary, we apply the breakpoint unit root test, in order to confirm its non-stationarity even in the presence of a structural break.

The information on the tests are reported in the appendix section and table 3.3 summarizes the conclusion regarding the integration order of each series. All series are stationary, except for the logarithm of the investment rate (LN_IY) and the logarithm of world GDP (LN_YF), which are differentiated in order to be included in the SVAR model.

Table 3.3: Integration order of the variables

Variable	Integration order
LN_PS	I(0)
LN_R	I(0)
LN_RER	I(0)
LN_IY	I(1)
D(LN_IY)	I(0)
LN_YF	I(1)
D(LN_YF)	I(0)
LN_GY	I(0)

3.5.2 First specification: baseline SVAR model

In this section, we undertake a first approximation to our research question by analyzing the demand and accumulation regimes for the whole period between 2003 and 2014. Thus, we are concerned with the overall effect without considering the possibility that a change in the relation between the variables has taken place. Firstly, we determine the specification of the SVAR model and, then, we analyze its output.

Model specification

This model includes the y vector of equation 3.3 as endogenous, the z vector of equation 3.4 as exogenous (a contemporaneous and a lagged value of each exogenous variable is added), and a constant term. The assessment of the number of lags to be included in the SVAR follows the Akaike (AIC), Schwarz (SC), and Hannan-Quinn (HQ) information criteria reported in table 3.4. In order to have a parsimonious model, we start with one lag as suggested by the SC criterion and estimate a SVAR(1) model.

Table 3.4: Information criteria - Specification 1

Lag	AIC	SC	HQ
0	- 8.43	- 7.57	- 8.11
1	- 9.73	-8.50*	- 9.28
2	- 9.79	- 8.19	- 9.20
3	- 9.66	- 7.69	- 8.94
4	-10.29*	- 7.96	-9.43*

Note: * Selected lag order.

The stability of the model is assessed through the inverted roots of the characteristic polynomial, which must be inside the unit circle (modulus smaller than one). Additionally, it is important to have well behave residuals, with no residual autocorrelation up to lag six,

homoskedasticity, and normal distribution. The information on these characteristics of the model are reported in table 3.5 and show that no root lies outside the unit circle, so the SVAR model satisfies the stability condition, and that the residuals are well behaved, presenting no serial autocorrelation, no heteroskedasticity, and normal distribution (considering a significance level of 5%).

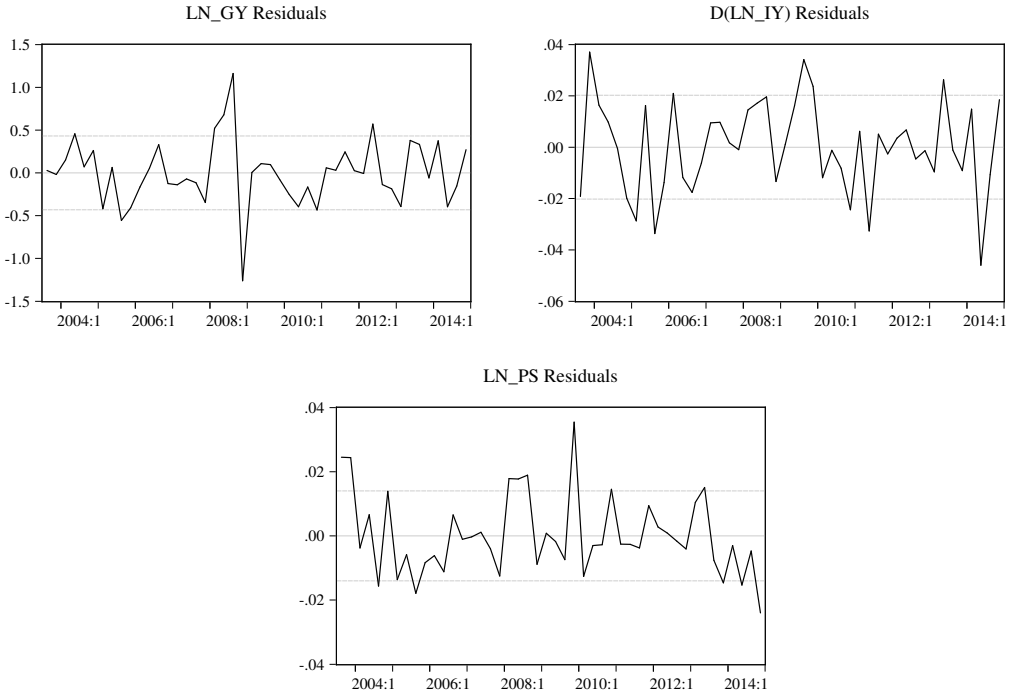
Table 3.5: Model diagnostic statistics - Specification 1

Roots of Characteristic Polynomial			
Root	Modulus		
-0.66	0.66		
0.59	0.59		
0.17	0.17		
VAR Residual Serial Correlation LM Tests			
Lags (h)	LM-Stat	Prob	
1	8.59	0.48	
2	3.75	0.93	
3	5.26	0.81	
4	14.21	0.12	
5	5.60	0.78	
6	2.92	0.97	
VAR Residual Heteroskedasticity Tests (White)			
Chi-sq	df	Prob.	
123.61	108	0.14	
VAR Residual Normality Tests (Structural VAR orthogonalization)			
Component	Jarque-Bera	df	Prob.
1	0.34	2	0.84
2	3.35	2	0.19
3	2.46	2	0.29
Joint	6.14	6	0.41

Note: VAR residual serial correlation LM test null hypothesis: no serial correlation at lag order h. VAR residual heteroskedasticity test (White) null hypothesis: no heteroskedasticity. VAR residual normality test null hypothesis: residuals are multivariate normal.

Indeed, the residuals of the three equations seem to be well behaved (figure 3.5). Therefore, the SVAR(1) is an adequate specification and can be further interpreted.

Figure 3.5: Residuals' behavior - Specification 1



Model estimation and interpretation

The output of the SVAR(1) is reported in table 3.6 below. As this is a SVAR model, each equation is estimated by applying the OLS method but no contemporaneous endogenous variable is included as explanatory variable. The capacity utilization equation shows that it is positively affected by the lagged values of the investment rate and of the profit share, positively affected by the real exchange rate and world GDP, and negatively affected by the interest rate. The investment rate equation shows a positive effect of the lagged values of capacity utilization and of the profit share, positive effect of the real exchange rate and world GDP, and approximately no effect of the real interest rate. Finally, the profit share equation shows that it is negatively affected by the investment rate and by the real exchange rate, positively affected by the world GDP, and not affected by the real interest rate.

Table 3.6: Model output - Specification 1

	LN_GY	D(LN_IY)	LN_PS
LN_GY(-1)	-0.63	0.01	0.00
	(0.18)	(0.01)	(0.01)
	[-3.59]	[0.83]	[0.2]
D(LN_IY(-1))	3.03	0.10	-0.07
	(3.65)	(0.17)	(0.12)
	[0.83]	[0.61]	[-0.56]

Table 3.6 continued from previous page

	LN_GY	D(LN_IY)	LN_PS
LN_PS(-1)	4.95	0.26	0.62
	(3.26)	(0.15)	(0.11)
	[1.52]	[1.69]	[5.86]
C	-4.92	0.07	-0.19
	(2.12)	(0.1)	(0.07)
	[-2.32]	[0.73]	[-2.8]
LN_RER	2.97	0.10	0.09
	(1.7)	(0.08)	(0.06)
	[1.75]	[1.25]	[1.69]
LN_RER(-1)	-2.36	-0.07	-0.12
	(1.69)	(0.08)	(0.06)
	[-1.39]	[-0.82]	[-2.18]
LN_R	-0.16	0.00	0.00
	(0.08)	(0)	(0)
	[-2.1]	[0.04]	[0.33]
LN_R(-1)	-0.10	0.00	0.01
	(0.09)	(0)	(0)
	[-1.17]	[-1.01]	[2.6]
D(LN_YF)	115.24	1.36	0.67
	(22.84)	(1.08)	(0.74)
	[5.05]	[1.26]	[0.9]
D(LN_YF(-1))	-0.78	-0.98	0.71
	(18.23)	(0.86)	(0.59)
	[-0.04]	[-1.14]	[1.2]
R-squared	0.70	0.37	0.89
Adj. R-squared	0.63	0.21	0.86
Sum sq. resids	6.66	0.01	0.01
S.E. equation	0.43	0.02	0.01
F-statistic	9.46	2.34	32.65

Note: Standard errors in ( ) & t-statistics in [ ].

Granger-causality tests are applied to the model in order to verify whether the past values of the variables help to explain the present value of each one of them. Therefore, the test does not consider the contemporaneous relation between them, so any conclusion in terms of causality (or precedence) must be taken with care as the contemporaneous coefficients might be significant even if there is no Granger-causality. Table 3.7 reports the statistics for the Granger-causality tests, for which the null hypothesis is that the excluded variable does not Granger-cause

the dependent variable. There is evidence of Granger-causality only from the profit share to the investment rate (at the 10% significance level).

Table 3.7: Granger-causality tests - Specification 1

Dependent variable: LN_GY				Dependent variable: D(LN_IY)				Dependent variable: LN_PS			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
D(LN_IY)	0.69	1	0.41	LN_GY	0.69	1	0.41	LN_GY	0.04	1	0.84
LN_PS	2.31	1	0.13	LN_PS	2.85	1	0.09	D(LN_IY)	0.32	1	0.57
All	3.76	2	0.15	All	4.62	2	0.10	All	0.32	2	0.85

Note: Null hypothesis is that the excluded variable does not Granger-cause the dependent variable.

The significance of the exogenous variables is assessed through the Wald test for joint significance reported in table 3.8. The real exchange rate does not have a significant effect on either the capacity utilization or accumulation rates, but it is significant in the profit share equation if a significance level of 15% is considered. The total impact of the real exchange rate on the profit share would be negative (-0.03), meaning that a real currency devaluation would lead to a lower profit share, a result which is at odds with the Kaleckian models and some empirical evidence (Arestis and Baltar, 2017*a*) and may be due to the treatment of the real exchange rate as an exogenous variable (probably because both the real exchange rate and the profit share are affected by the world GDP).

The real interest rate has a significant and negative impact (-0.26) on capacity utilization, which can be accounted to the negative impact on credit demand, and a significant and positive (0.01) impact on the profit share, which can be explained by the cost-push channel of monetary policy (Lima and Setterfield, 2010) and by the Sraffian argument that the interest rate represents the financial and opportunity costs of capital (Serrano and Summa, 2012). There is no significant impact of the real interest rate on the investment rate at the 10% significance level. Indeed, there is no robust evidence in the literature to support a negative impact of the interest rate on investment, as the literature offers mixed evidence (Sharpe and Suarez, 2015). Surveys reported by Sharpe and Suarez (2015) suggest that the interest rate would have an asymmetric effect on investment, being more relevant when it increases than when it decreases, but this might depend on its level, so more research in this sense could be done for the Brazilian economy.

Finally, world GDP has a positive and significant effect on both the capacity utilization rate (114.46) and the profit share (1.38). As world GDP increases, it leads to an increase in Brazilian exports, *ceteris paribus*, increasing its capacity utilization and redistributing income to exporters, which leads to a higher profit share. However, there is no significant effect of world GDP on the investment rate, which may affect investment indirectly through its effect on capacity utilization.

Table 3.8: Significance of the exogenous variables - Specification 1

	Capacity utilization equation			Accumulation equation			Profit share equation		
Null hypothesis	t-stat	df	Probability	t-stat	df	Probability	t-stat	df	Probability
LN_RER+LN_RER(-1)=0	1.14	36	0.26	1.36	36	0.18	- 1.52	36	0.14
LN_R+LN_R(-1)=0	- 2.73	36	0.01	- 0.86	36	0.40	2.56	36	0.01
D(LN_YF)+D(LN_YF(-1))=0	5.42	36	0.00	0.38	36	0.71	2.00	36	0.05

In order to recover the contemporaneous coefficients, some restrictions have to be imposed to the contemporaneous relation between the variables. As previously discussed, we restrict the A and B matrices according to equation 3.11, rendering the following structural coefficients[12]:

Table 3.9: Structural coefficients - Specification 1

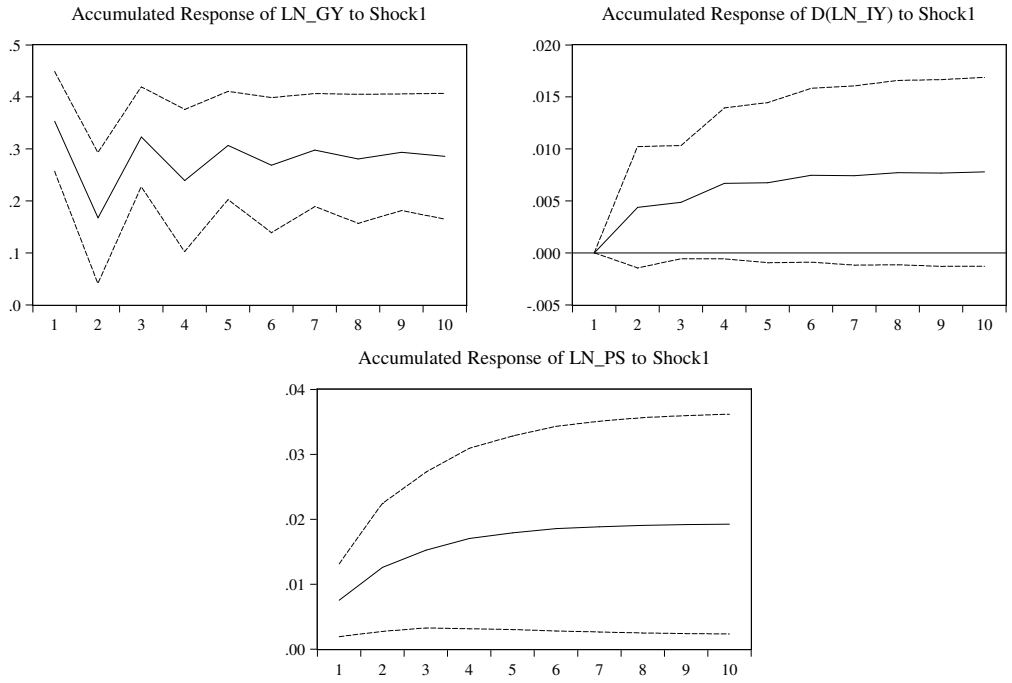
	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	-0.02	0.01	2.25	0.02
C(2)	-12.99	4.10	3.16	0.00
C(3)	11.50	11.56	-0.99	0.32
C(4)	0.44	0.10	4.47	0.00
C(5)	0.02	0.00	9.59	0.00
C(6)	0.01	0.00	7.34	0.00

Coefficients $C(1)$, $C(2)$, and $C(3)$ are associated with the contemporaneous effect of capacity utilization on the profit share, the investment rate on capacity utilization, and the profit share on capacity utilization, respectively. They reveal a positive contemporaneous effect of capacity utilization on the profit share, a positive contemporaneous effect of the investment rate on capacity utilization, and a negative contemporaneous effect of the profit share on capacity utilization. Coefficients $C(4)$, $C(5)$, and $C(6)$ indicate the standard deviations of the shocks.

The accumulated impulse response functions derived from this structural decomposition are reported in figures 3.6 to 3.8. Figure 3.6 reports the accumulated effects of a shock in the residual associated with capacity utilization, which leads to an increase in this variable. This will lead to an increase in both the investment rate, following the accelerator effect, and in the profit share. Figure 3.7 shows the accumulated effect of a shock in the residual associated with the investment rate, leading to an increase in this variable. There will also be an increase in capacity utilization and an increase in the profit share. Finally, figure 3.8 reports the accumulated effect of a shock in the residual associated with the profit share, which leads to an increase in this variable. In the first period, there will be a decrease in the capacity utilization rate and, as time goes by, the accumulated effect will be close to zero. The accumulated effect on the investment rate is positive but also close to zero.

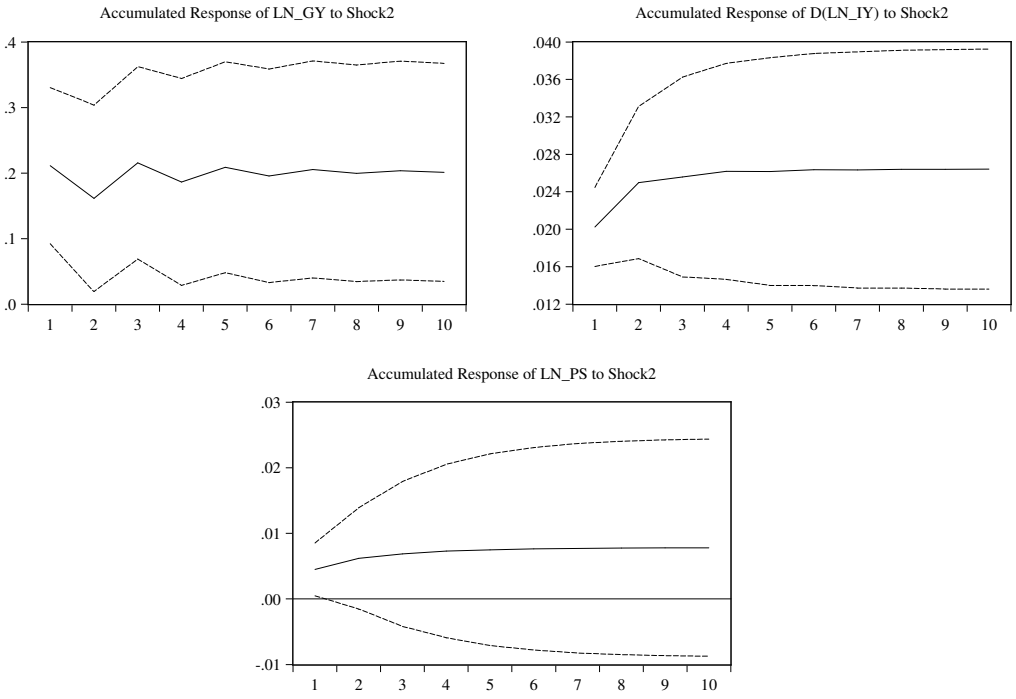
[12]Coefficients $C(1)$ to $C(3)$ have the opposite sign of that of the contemporaneous effect of one variable on the other, due to the transformation explained in section 3.2.

Figure 3.6: Accumulated responses to a shock on capacity utilization - Specification 1



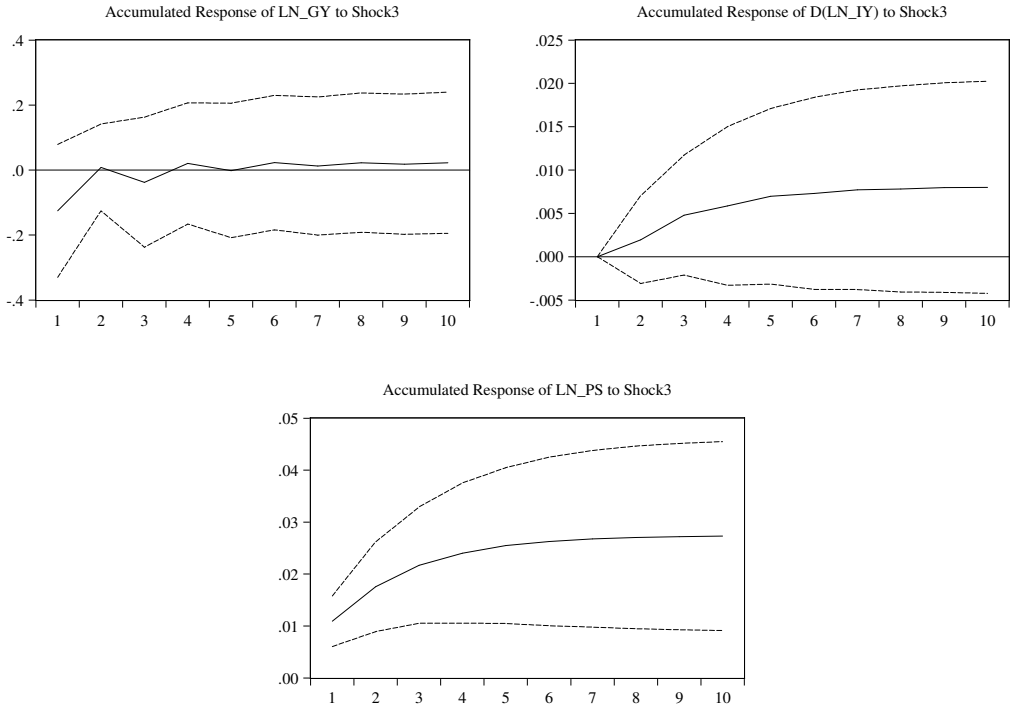
Note: Accumulated Response to Structural One S.D. Innovations +- 2 S.E. Confidence level of 95%.

Figure 3.7: Accumulated responses to a shock on the investment rate - Specification 1



Note: Accumulated Response to Structural One S.D. Innovations +- 2 S.E. Confidence level of 95%.

Figure 3.8: Accumulated responses to a shock on the profit share - Specification 1



Note: Accumulated Response to Structural One S.D. Innovations +- 2 S.E. Confidence level of 95%.

Because the variables are taken in logarithmic form, the accumulated responses to a shock on the profit share can be transformed in elasticities in order to analyze the economic regime in the period. We calculate the elasticities and the 90% confidence intervals for the accumulated effects at the tenth period, as reported in table 3.10. The results suggest that both regimes would be profit-led, so an increase of 1% in the profit share would lead to an increase of 0.81% in capacity utilization and 0.29% in the investment rate. However, such effect is not significant for the demand equation, but it is for the investment equation (at a significance level of 10%).

Table 3.10: Elasticities at the tenth period - Shock on the profit share - Specification 1

	LN_GY	D(LN_IY)	LN_PS
Accumulated effect to shock 3	0.02	0.01	0.03
Standard Error	0.11	0.01	0.01
Confidence interval of 90%	0.02+/-0.18	0.01+/-0.01	0.03+/-0.02
Elasticity to the profit share	0.81%	0.29%	1.00%

Table 3.11 reports the variance decomposition for each variable, showing the percentage of the variance of one variable explained by each structural shock over 10 periods. For all the variables, the variance decomposition is fairly stable through time. The variance of capacity utilization is approximately 68% explained by itself, approximately 18% explained by a shock

in the investment rate, and approximately 14% explained by a shock in the profit share after 10 periods, suggesting that the investment rate is more important than the profit share to explain the variance of capacity utilization. The variance of the investment rate is predominantly due to itself (approximately 92%), with little participation of the accelerator effect (approximately 5%) and of the profit share (approximately 3%) after 10 periods. Finally, the profit share is mostly explained by itself (approximately 62%) and by capacity utilization (approximately 31%), indicating a low participation of the investment rate (approximately 8%) after 10 periods.

Table 3.11: Variance Decomposition - Specification 1

	Variance Decomposition of LN_GY:				Variance Decomposition of D(LN_IY):				Variance Decomposition of LN_PS:			
Period	S.E.	Shock1	Shock2	Shock3	S.E.	Shock1	Shock2	Shock3	S.E.	Shock1	Shock2	Shock3
1	0.43	67.37	24.12	8.51	0.02	0.00	100.00	0.00	0.01	28.85	10.33	60.82
2	0.49	66.38	19.64	13.97	0.02	4.21	94.95	0.84	0.02	30.64	8.59	60.77
3	0.52	68.18	18.60	13.22	0.02	4.18	93.25	2.56	0.02	30.45	8.02	61.53
4	0.53	67.96	18.15	13.88	0.02	4.84	92.38	2.78	0.02	30.62	7.85	61.53
5	0.53	68.24	17.98	13.78	0.02	4.83	92.14	3.03	0.02	30.59	7.79	61.62
6	0.54	68.21	17.90	13.88	0.02	4.93	92.02	3.05	0.02	30.61	7.77	61.62
7	0.54	68.26	17.87	13.87	0.02	4.93	91.99	3.09	0.02	30.61	7.76	61.63
8	0.54	68.26	17.86	13.88	0.02	4.94	91.97	3.09	0.02	30.61	7.76	61.63
9	0.54	68.27	17.85	13.88	0.02	4.94	91.97	3.09	0.02	30.61	7.76	61.63
10	0.54	68.27	17.85	13.88	0.02	4.94	91.96	3.09	0.02	30.61	7.76	61.63

Note: Structural factorization.

In conclusion, this structural VAR model describes important features of the variables. Regarding the demand regime, it suggests a profit-led regime, but the effect of a shock in the profit share is not significant at the 10% significance level and just 14% of the variance of capacity utilization is explained by the profit share. The accumulation regime is also profit-led and the effect of the profit share on the investment rate is significant at the 10% significance level; but both the accelerator effect and the income distribution effect determine surprisingly little of the variance of the investment rate, so investment dynamics is mainly determined by its own dynamics. Finally, the distribution regime could be defined as "wage-squeeze" type of regime, as the profit-share seems to increase with increases in capacity utilization. One possible explanation for such effect is the existence of overhead labor, as discussed by Lavoie (2014).

3.5.3 Second specification: testing for a structural break

In this section we discuss the SVAR model that includes a structural break in the relationship between the profit share, capacity utilization, and accumulation rate by including an interaction dummy for the profit share. Two methodological issues have to be dealt with in this case: how to determine the structural breaks and how to include them in the SVAR model.

Regarding the first issue, within OLS models, structural breaks can be defined by applying a test such as the Chow breakpoint test or the Quandt-Andrews breakpoint test (Eviews, 2016). The first option is a test on whether a break suggested by the researcher is significant or

not, while the second one tests a break which is endogenously estimated. In order to apply such tests in a SVAR context, one alternative is to estimate each OLS equation of the SVAR model and apply one of these tests to them. Such approach has the drawback of only considering the lagged variables, so, if the contemporaneous effect is stronger than the lagged effect, it might not capture a change in the relation even if it has taken place[13].

Yet, to the best of our knowledge, there is no other way of testing for structural breaks within SVAR models, so we apply both the Chow and the Quandt-Andrews breakpoint tests to the $LN\_PS(-1)$ variable in the investment rate and the capacity utilization equations from the baseline specification, as reported in table 3.12. The Quandt-Andrews test suggests that there is no breakpoint in the capacity utilization equation; but, considering a significance value of 11%, there is evidence of a breakpoint in the investment rate equation in 2010Q1. We then test the possibility of a break in 2010Q1 and 2013Q1 (both these dates were suggested by the stylized facts discussed in section 3.4) by applying the Chow test. The results of this test suggest a break in 2010Q1 for the investment rate equation and a break in 2013Q1 for the capacity utilization equation (both at the 5% significance level).

Table 3.12: Breakpoint tests for the $LN\_PS(-1)$ variable

	Quandt-Andrews		Chow (2010Q1)		Chow (2013Q1)	
OLS equation	Max. LR F-Stat.	Prob.	F-stat	Prob. F(1,35)	F-stat	Prob. F(1,35)
LN_U	4.52	0.26	0.70	0.41	4.44	0.04
D(LN_IY)	6.49	0.11	6.49	0.02	0.28	0.60

Note: Quandt-Andrews breakpoint test null hypothesis: no breakpoints within 20% trimmed data. Identified breaks by the Quandt-Andrews breakpoint test: 2008Q4 for the LN_U equation and 2010Q1 for the $D(LN\_IY)$ equation. Chow breakpoint test null hypothesis: no breaks at specified breakpoints.

Because the second structural break, which would be zero until 2013Q1 and assume the value of the profit share after this date, was not significant, the model reported in the following section includes only the first structural break (LN_PS_BK1), which is defined as follows:

$$LN\_PS\_BK1 = \begin{cases} 0, & \text{if } t < 2010Q2; \\ LN\_PS, & \text{otherwise.} \end{cases} \tag{3.17}$$

The second methodological issue relates to how this interaction dummy can be added to the SVAR model. A first alternative is to treat it as an endogenous variable in the same way that the profit share is treated, but this would lead to a blurry interpretation of its effect, as impulse response functions would also consider the effect of the other variables on this interaction dummy. Thus, it seems more plausible to treat it as an exogenous variable; but, only its lagged value can be added as the SVAR model cannot be estimated through OLS in case there is a contemporaneous relation between profits and the dependent variables.

[13] In the model estimated in the previous sections, this is only an issue in the capacity utilization equation, as we assume no contemporaneous effect of the profit share on the investment rate.

Model specification

This second specification includes the y vector (equation 3.3) of endogenous variables, the z vector (equation 3.18) of exogenous variables which includes the structural break for the profit share and contemporaneous and a lagged value of the other exogenous variables, and a constant term.

$$z = \begin{bmatrix} RER \\ YF \\ R \\ LN\_PS\_BK1 \end{bmatrix} \tag{3.18}$$

The assessment of the number of lags to be included in the SVAR follows the AIC, SC, and HQ information criteria reported in table 3.13. Also in this case, we start with one lag as suggested by the SC and HQ criteria and estimate a SVAR(1) model.

Table 3.13: Information criteria - Specification 2

Lag	AIC	SC	HQ
0	- 8.95	- 7.97	- 8.59
1	- 9.96	-8.61*	-9.47*
2	- 9.97	- 8.25	- 9.34
3	- 9.87	- 7.78	- 9.10
4	-10.36*	- 7.90	- 9.46

Note: * selected lag order.

Diagnostic statistics are reported in table 3.14. The SVAR model respects the stability condition, the residuals are well behaved, presenting no serial correlation or heteroskedasticity, and, except for the investment rate equation, all residuals are normally distributed (considering a significance level of 10%).

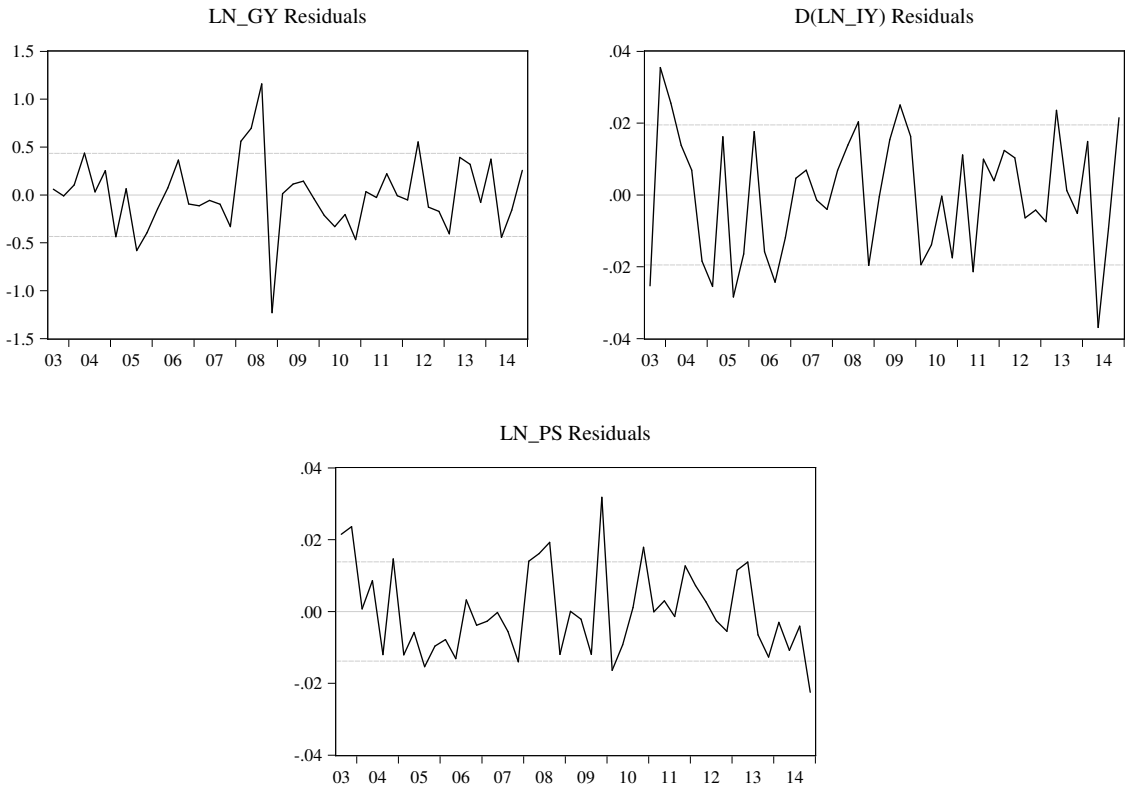
Table 3.14: Model diagnostic statistics - Specification 2

Roots of Characteristic Polynomial			
Root	Modulus		
- 0.67	0.67		
0.52	0.52		
0.07	0.07		
VAR Residual Serial Correlation LM Tests			
Lags (h)	LM-Stat	Prob	
1	9.17	0.42	
2	4.79	0.85	
3	6.53	0.69	
4	13.44	0.14	
5	6.01	0.74	
6	3.74	0.93	
VAR Residual Heteroskedasticity Test (White)			
Chi-sq	df	Prob.	
134.85	120	0.17	
VAR Residual Normality Tests (Structural VAR orthogonalization)			
Component	Jarque-Bera	df	Prob.
1	0.72	2	0.70
2	6.09	2	0.05
3	2.81	2	0.25
Joint	9.62	6	0.14

Note: VAR residual serial correlation LM test null hypothesis: no serial correlation at lag order h. VAR residual heteroskedasticity test (White) null hypothesis: no heteroskedasticity. VAR residual normality test null hypothesis: residuals are multivariate normal.

Figure 3.9 adds further evidence that the residuals are well behaved. Therefore, the SVAR(1) model is further interpreted.

Figure 3.9: Residuals' behavior - Specification 2



Model estimation and interpretation

The output of the model is reported in table 3.15. The conclusions regarding most of the relations presented in the previous model are basically the same, with small changes in some of the coefficients' magnitudes. Yet, there is some difference in the parameters associated with the lagged value of the profit share ($LN\_PS(-1)$), which becomes higher for the capacity utilization equation (from 4.95 to 5.67) and lower for the investment rate equation (from 0.26 to 0.12). The interaction dummy variable ($LN\_PS\_BK1(-1)$) suggests a weaker effect of the lagged profit share on capacity utilization after the break and a stronger effect on the accumulation rate. Thus, the model suggests a more profit-led capacity utilization before the break and a more profit-led accumulation after the break - still, the analysis of the capacity utilization equation would also have to consider its contemporaneous effect, so such conclusion is further inquired in the next section.

Table 3.15: Model output - Specification 2

	LN_GY	D(LN_IY)	LN_PS
LN_GY(-1)	-0.63	0.01	0.00
	(0.18)	(0.01)	(0.01)
	[-3.53]	[0.8]	[0.16]

Table 3.15 continued from previous page

	LN_GY	D(LN_IY)	LN_PS
D(LN_IY(-1))	3.60	-0.01	-0.12
	(3.91)	(0.18)	(0.12)
	[0.92]	[-0.04]	[-0.98]
LN_PS(-1)	5.67	0.12	0.55
	(3.68)	(0.17)	(0.12)
	[1.54]	[0.7]	[4.7]
C	-4.21	-0.07	-0.26
	(2.67)	(0.12)	(0.08)
	[-1.58]	[-0.55]	[-3.08]
LN_RER	3.25	0.05	0.07
	(1.83)	(0.08)	(0.06)
	[1.78]	[0.55]	[1.15]
LN_RER(-1)	-2.67	-0.00	-0.09
	(1.85)	(0.08)	(0.06)
	[-1.44]	[-0.06]	[-1.53]
LN_R	-0.16	-0.00	-0.00
	(0.08)	(0)	(0)
	[-1.89]	[-0.47]	[-0.03]
LN_R(-1)	-0.09	-0.01	0.01
	(0.09)	(0)	(0)
	[-1.04]	[-1.42]	[2.3]
D(LN_YF)	115.11	1.38	0.68
	(23.1)	(1.04)	(0.73)
	[4.98]	[1.33]	[0.93]
D(LN_YF(-1))	-4.51	-0.25	1.07
	(20.28)	(0.91)	(0.65)
	[-0.22]	[-0.27]	[1.66]
LN_PS_BK1(-1)	-0.13	0.03	0.01
	(0.3)	(0.01)	(-0.01)
	[-0.44]	[1.93]	[1.35]
R-squared	0.70	0.43	0.90
Adj. R-squared	0.62	0.27	0.87
Sum sq. resids	6.62	0.01	0.01
S.E. equation	0.43	0.02	0.01
F-statistic	8.34	2.64	30.23

Note: Standard errors in ( ) & t-statistics in [ ].

The significance of the structural break is assessed in table 3.16. In the capacity utilization equation, the break is not significant; but, in the investment rate equation, the lagged LN_PS_BK1 variable is significant at the 10% significance level, suggesting that there might have been a change in the accumulation regime but not in the demand regime.

Table 3.16: Significance of the $LN\_PS\_BK1(-1)$ variable

Equation	Coefficient	Std. Error	t-Statistic	Prob.
LN_U	- 0.13	0.30	- 0.44	0.66
D(LN_IY)	0.03	0.01	1.93	0.06

The inclusion of the interaction dummy variable might lead to different conclusions from those from the baseline model, so we once again apply the Granger-causality test and estimate the impulse response functions and the variance decomposition. Table 3.17 reports the Granger-causality tests, which do not identify any Granger-causality between the variables (at the 10% significance level), suggesting that the relation between the profit share and the accumulation rate is weaker in this model than in the baseline model (without considering the break).

Table 3.17: Granger-causality tests - Specification 2

Dependent variable: LN_GY				Dependent variable: D(LN_IY)				Dependentvariable: LN_PS			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
D(LN_IY)	0.85	1	0.36	LN_GY	0.63	1	0.43	LN_GY	0.02	1	0.88
LN_PS	2.38	1	0.12	LN_PS	0.49	1	0.48	D(LN_IY)	0.96	1	0.33
All	3.35	2	0.19	All	1.45	2	0.48	All	1.00	2	0.61

Note: The null hypothesis is that the excluded variable does not Granger-cause the dependent variable.

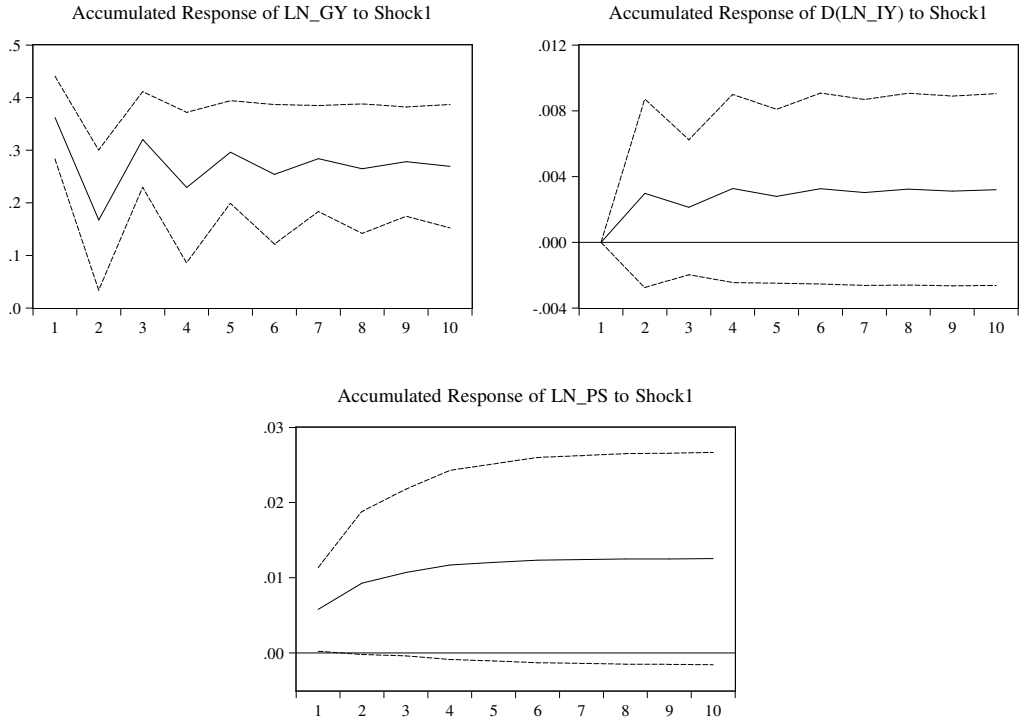
The structural parameters are recovered by restricting the A and B matrices according to equation 3.11 and are reported in table 3.18. The main difference with respect to the baseline model is the lower $C(3)$ parameter, which expresses a higher contemporaneous effect of the profit share on capacity utilization in this second specification. The other coefficients are very close to the ones of the previous model.

Table 3.18: Structural coefficients - Specification 2

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	-0.02	0.01	2.00	0.05
C(2)	-12.87	3.36	3.83	0.00
C(3)	4.07	8.69	-0.47	0.64
C(4)	0.39	0.06	5.99	0.00
C(5)	0.02	0.00	9.59	0.00
C(6)	0.01	0.00	9.21	0.00

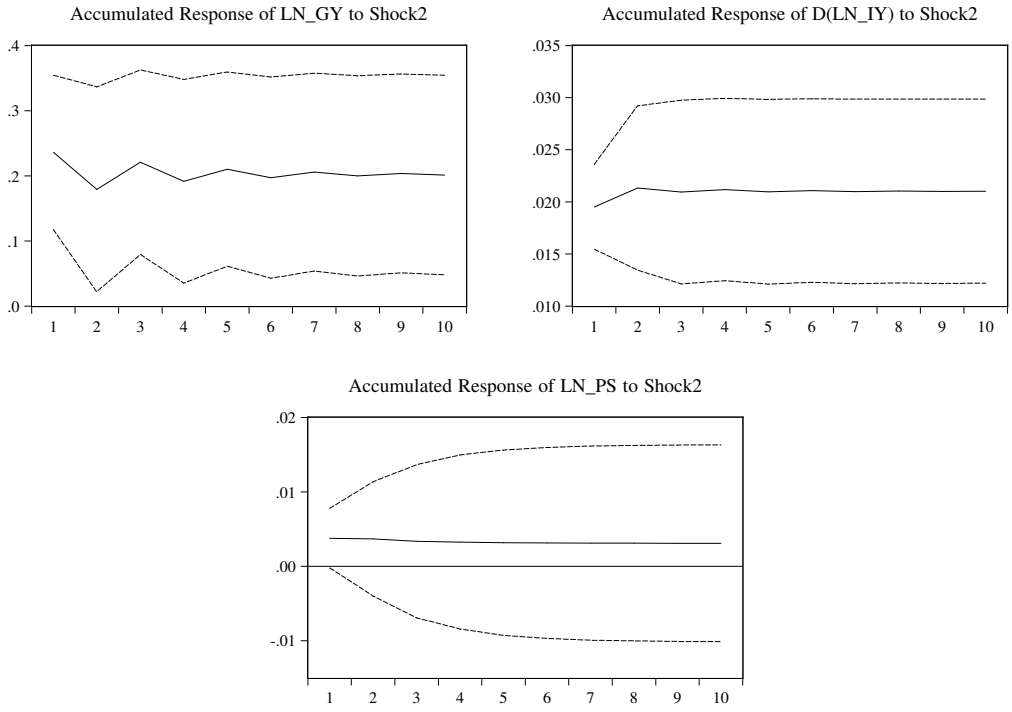
The accumulated responses of all variables to a shock in the residuals related to capacity utilization (figure 3.10) show a positive accelerator effect and a positive effect on the profit share, in line with the previous model. The accumulated responses to a shock in the accumulation rate (figure 3.11) are also similar to those in the previous model, with increases in capacity utilization and in the profit share. Finally, the accumulated responses to a shock in the residual related to the profit share (figure 3.12) once again show a positive effect on the accumulation rate and on capacity utilization. The difference with respect to the previous model is a higher increase in capacity utilization following an increase in the profit share and a lower increase in the accumulation rate.

Figure 3.10: Accumulated responses to a shock on capacity utilization - Specification 2



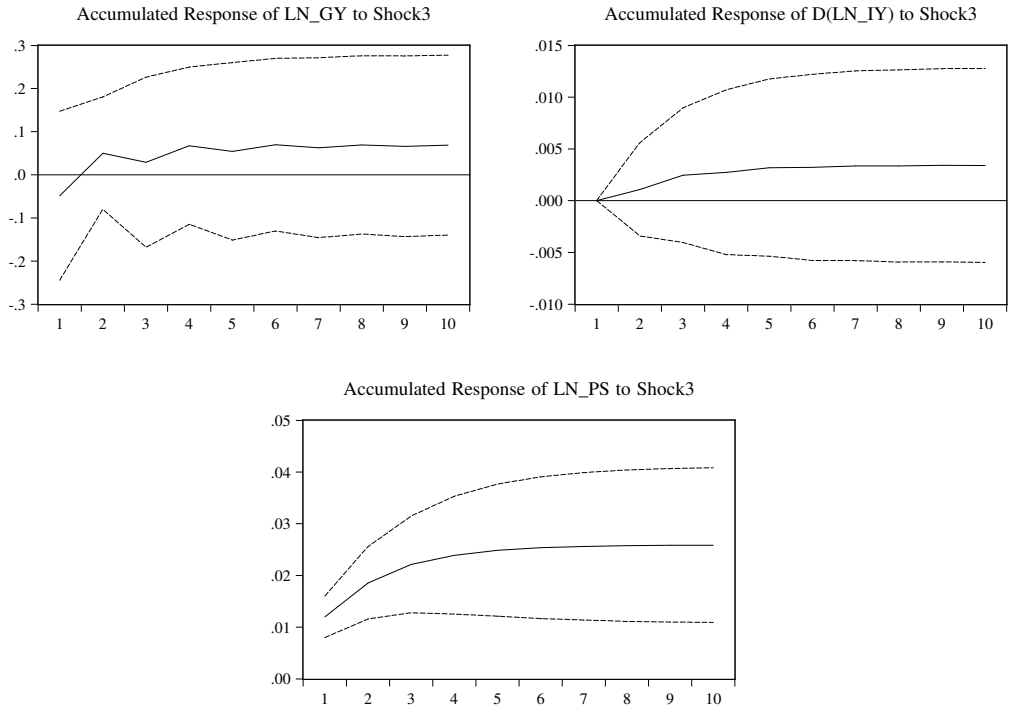
Note: Accumulated Response to Structural One S.D. Innovations +- 2 S.E. Confidence level of 95%.

Figure 3.11: Accumulated responses to a shock on the investment rate - Specification 2



Note: Accumulated Response to Structural One S.D. Innovations +- 2 S.E. Confidence level of 95%.

Figure 3.12: Accumulated responses to a shock on the profit share - Specification 2



Note: Accumulated Response to Structural One S.D. Innovations +- 2 S.E. Confidence level of 95%.

The elasticities and confidence intervals at the 90% level regarding the effects of shock 3 are reported in table 3.19. They suggest that an increase of 1% in the profit share leads to an increase of 2.33% in capacity utilization, but this effect is not significant at the 10% significance level. Additionally, the elasticity of the investment rate with respect to the profit share is lower in this model and equal to zero. Considering the sign of the parameters associated with the structural break, these results suggest that the elasticity of capacity utilization with respect to the profit share would have decreased (but the break is not significant) and the elasticity of the investment rate with respect to the profit share would have increased, turning a neutral accumulation regime into a profit-led one.

Table 3.19: Elasticities at the tenth period - Shock on the profit share - Specification 2

	LN_GY	D(LN_IY)	LN_PS
Accumulated effect to shock 3	0.07	0.00	0.03
Standard Error	0.10	0.00	0.01
Confidence interval of 90%	0.07+/-0.17	0+/-0	0.03+/-0.02
Elasticity to the profit share	2.33%	0.00%	1.00%

Variance decomposition is reported in table 3.20. The contribution of the shock related to capacity utilization to its variance increases (from approximately 68% to 73%), while the contribution of the profit share decreases considerably (from 14% to 5%) in comparison to the previous model. There is also a lower contribution of the residuals related to the profit share and to the accelerator effect to the variance of the investment rate (from approximately 3% to 1% and from approximately 5% to 3% respectively), with this rate being more dependent on itself. Finally, there is also a decrease in the contribution of the residuals related to capacity utilization (from approximately 31% to 18%) and to the investment rate (from approximately 8% to 5%) to the variance of the profit share, so also this variable is more dependent on its own behavior in this model.

Table 3.20: Variance decomposition - Specification 2

	Variance Decomposition of LN_GY:				Variance Decomposition of D(LN_IY):				Variance Decomposition of LN_PS:			
Period	S.E.	Shock1	Shock2	Shock3	S.E.	Shock1	Shock2	Shock3	S.E.	Shock1	Shock2	Shock3
1	0.43	69.32	29.42	1.26	0.02	0.00	100.00	0.00	0.01	17.49	7.42	75.09
2	0.49	70.43	24.51	5.05	0.02	2.25	97.46	0.30	0.02	18.55	5.76	75.69
3	0.52	72.47	22.80	4.73	0.02	2.41	96.81	0.78	0.02	18.25	5.48	76.28
4	0.53	72.69	22.23	5.08	0.02	2.73	96.47	0.79	0.02	18.34	5.39	76.26
5	0.53	72.99	21.95	5.05	0.02	2.79	96.37	0.84	0.02	18.31	5.38	76.31
6	0.53	73.06	21.85	5.10	0.02	2.84	96.32	0.84	0.02	18.32	5.37	76.31
7	0.53	73.11	21.79	5.09	0.02	2.85	96.30	0.85	0.02	18.32	5.37	76.31
8	0.53	73.13	21.77	5.10	0.02	2.86	96.29	0.85	0.02	18.32	5.37	76.31
9	0.53	73.14	21.76	5.10	0.02	2.87	96.28	0.85	0.02	18.32	5.37	76.31
10	0.53	73.14	21.76	5.10	0.02	2.87	96.28	0.85	0.02	18.32	5.37	76.31

Note: Structural factorization.

Overall, the model suggests a stronger profit-led demand regime and a smaller contribution of the profit share to capacity utilization variance than the previous model, but there is no strong evidence of a change in the demand regime as the break is not significant. However, a more accurate analysis would require testing whether the contemporaneous coefficient also suffered a break. On the other hand, the model supports the hypothesis of a stronger effect of the profit share on the accumulation rate after the break. This suggests an accumulation regime switch from neutral to profit-led, so the continuation of the decreases in the profit share meant stronger restrictions to investment after the first quarter of 2010, which is in line with the stylized facts from section 3.4.

3.5.4 Third specification: robustness of the structural break

In order to verify whether there has indeed been a stronger effect of the profit share on the accumulation rate after the break, we estimate the first specification for a smaller period that goes just from 2003Q1 to 2010Q1. Despite the lower number of observations of such model, which leads to higher standard errors, it has the advantage of also allowing the estimation of the structural parameters, enabling us to compare them with the baseline specification.

Model specification

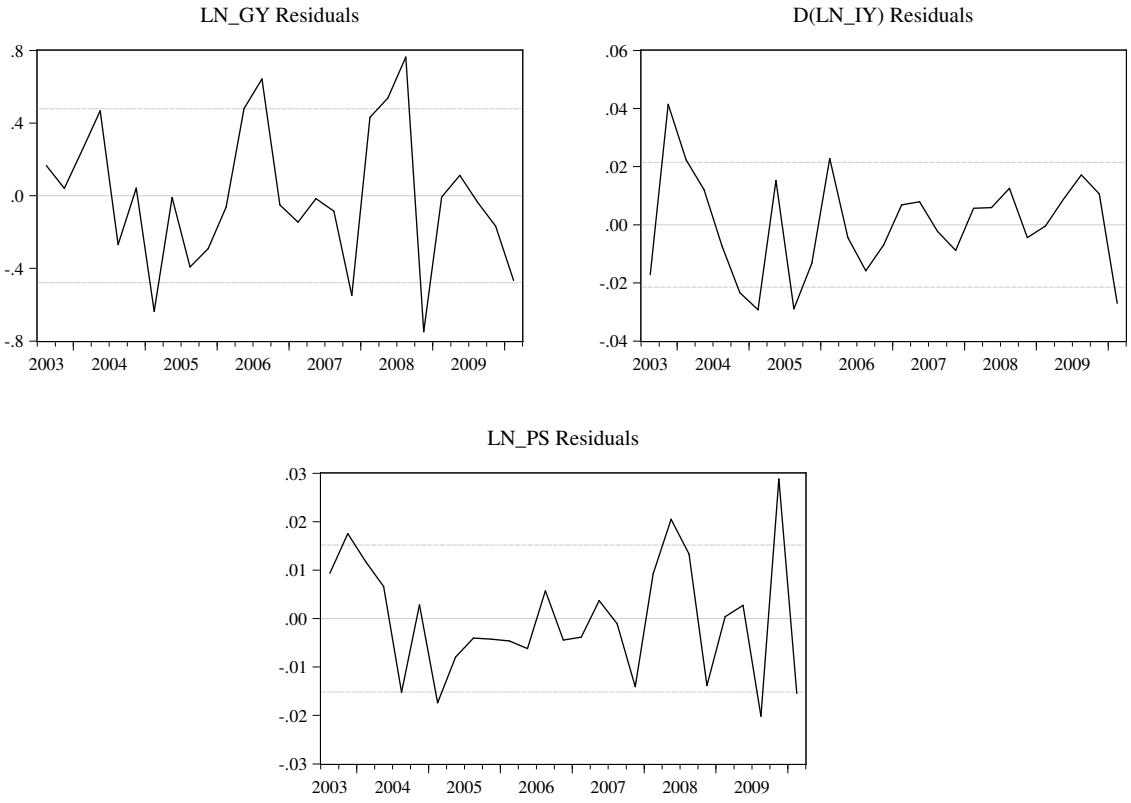
In order to have a model which can be directly compared to the previous ones, we start with a SVAR model with one lag. Once again, the residuals are well behaved and the model satisfies the stability condition (table 3.21). Figure 3.13 also suggests that the residuals are well behaved and, thus, we further interpret the SVAR(1) model.

Table 3.21: Model diagnostic statistics - Specification 3

Roots of Characteristic Polynomial			
Root	Modulus		
- 0.73	0.73		
0.24 - 0.23i	0.34		
0.24 + 0.23i	0.34		
VAR Residual Serial Correlation LM Tests			
Lags	LM-Stat	Prob	
1	7.65	0.57	
2	12.79	0.17	
3	10.54	0.31	
4	7.29	0.61	
5	8.38	0.50	
6	5.32	0.81	
VAR Residual Heteroskedasticity Tests (White)			
Chi-sq	df	Prob.	
130.32	108	0.07	
VAR Residual Normality Tests (Structural VAR orthogonalization)			
Component	Jarque-Bera	df	Prob.
1	5.32	2	0.07
2	4.21	2	0.12
3	1.76	2	0.41
Joint	11.29	6	0.08

Note: VAR residual serial correlation LM test null hypothesis: no serial correlation at lag order h. VAR residual heteroskedasticity test (White) null hypothesis: no heteroskedasticity. VAR residual normality test null hypothesis: residuals are multivariate normal.

Figure 3.13: Residuals' behavior - Specification 3



Model estimation and interpretation

The model output is reported in table 3.22. If the coefficients related to the profit share are compared to the ones in table 3.6 (baseline specification), they corroborate the conclusion from the second specification, which showed a stronger effect of profits on the accumulation rate but lower effect on capacity utilization after the structural break - suggesting that the accumulation regime had become more profit-led and the demand regime had become less profit-led after 2010Q1.

Table 3.22: Model output - Specification 3

	LN_GY	D(LN_IY)	LN_PS
LN_GY(-1)	- 0.71	0.01	- 0.00
	(0.28)	(0.01)	(0.00)
	[-2.52]	[0.57]	[-0.06]
D(LN_IY(-1))	- 0.58	0.04	- 0.35
	(6.43)	(0.28)	(0.20)
	[-0.09]	[0.15]	[-1.72]
LN_PS(-1)	9.21	0.19	0.43

Table 3.22 continued from previous page

	LN_GY	D(LN_IY)	LN_PS
	(6.25)	(0.28)	(0.19)
	[1.47]	[0.67]	[2.15]
C	- 0.59	0.06	- 0.20
	(3.63)	(0.16)	(0.11)
	[-0.16]	[0.37]	[-1.77]
LN_RER	4.36	0.13	- 0.02
	(3.43)	(0.15)	(0.10)
	[1.27]	[0.86]	[-0.17]
LN_RER(-1)	- 3.95	- 0.10	- 0.04
	(3.38)	(0.15)	(0.10)
	[-1.16]	[-0.68]	[-0.34]
LN_R	- 0.29	- 0.01	0.00
	(0.34)	(0.01)	(0.01)
	[-0.82]	[-0.61]	[0.046]
LN_R(-1)	- 0.65	- 0.01	- 0.02
	(0.53)	(0.02)	(0.01)
	[-1.20]	[-0.42]	[-0.87]
D(LN_YF)	118.74	1.24	0.69
	(41.39)	(1.85)	(1.31)
	[2.87]	[0.67]	[0.52]
D(LN_YF(-1))	2.03	- 0.58	2.03
	(28.54)	(1.28)	(0.90)
	[0.07]	[-0.45]	[2.24]
R-squared	0.82	0.55	0.86
Adj. R-squared	0.73	0.32	0.79
Sum sq. resids	3.89	0.01	0.00
S.E. equation	0.48	0.02	0.02
F-statistic	8.70	2.35	11.89

Note: Standard errors in ( ) & t-statistics in [ ].

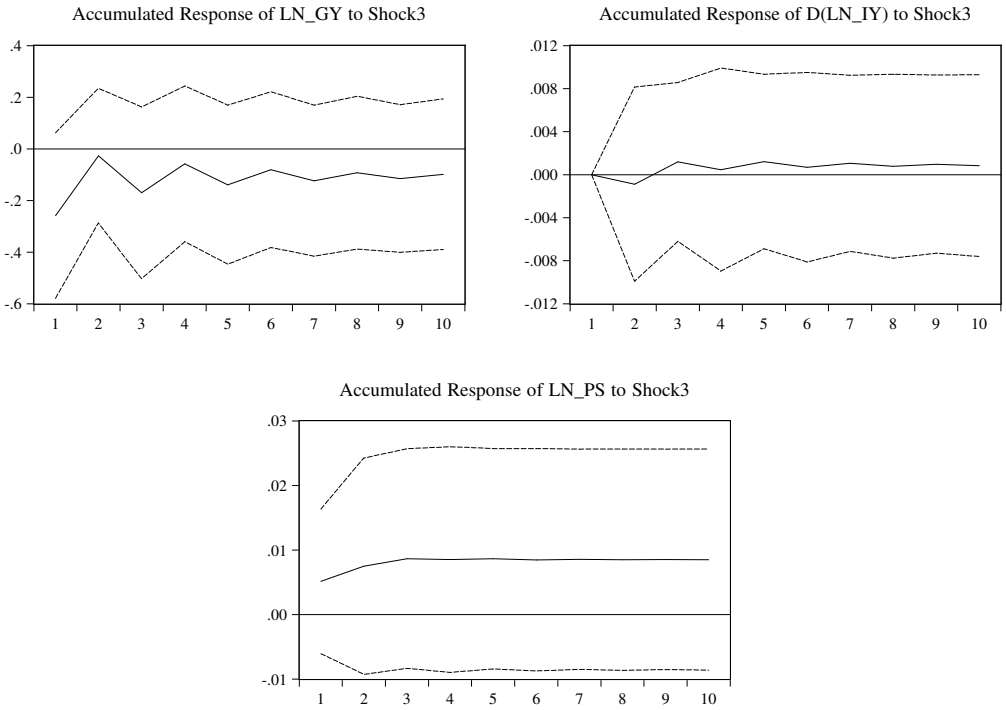
However, when the structural parameters are retrieved by applying the restrictions from equation 3.11, as reported in table 3.23, we find a higher $C(3)$ parameter than in the baseline specification. Thus, the contemporaneous effect of the profit share on capacity utilization is considerably lower than in the first specification, so the impulse response functions have to be analyzed to check whether the demand regime was indeed more profit-led before 2010Q1.

Table 3.23: Structural parameters - Specification 3

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	-0.04	0.02	2.30	0.02
C(2)	-23.16	26.62	0.87	0.38
C(3)	50.39	84.96	-0.59	0.55
C(4)	1.01	1.10	0.92	0.36
C(5)	0.02	0.00	7.35	0.00
C(6)	0.01	0.00	3.22	0.00

The accumulated response functions of a shock related to the profit share are reported in figure 3.14 (for simplicity, the responses to the other shocks have been omitted, as they are similar to those from the baseline specification). They suggest a wage-led demand regime and a profit-led accumulation regime in the period prior to 2010Q1. If compared to the accumulated impulse response function in the baseline specification (figure 3.8), they suggest a lower responsiveness of the investment rate to the profit share before 2010Q1.

Figure 3.14: Accumulated responses to a shock on the profit share - Specification 3



Note: Accumulated Response to Structural One S.D. Innovations +- 2 S.E. Confidence level of 95%.

The elasticities and 90% confidence intervals regarding the effects of shock 3 are reported in table 3.24. Because this model has a smaller number of observations, its standard errors are much higher than the previous ones, so the confidence intervals are quite broad. Still, the results show a negative elasticity of capacity utilization with respect to the profit share,

suggesting a wage-led demand regime, and a smaller elasticity of the investment rate with respect to the profit share, suggesting a neutral accumulation regime.

Table 3.24: Elasticities at the tenth period - Shock on the profit share - Specification 3

	LN_GY	D(LN_IY)	LN_PS
Accumulated effect to shock 3	-0.10	0.00	0.01
Standard Error	0.15	0.00	0.01
Confidence interval of 90%	-0.1+/-0.26	0+/-0	0.01+/-0.02
Elasticity to the profit share	-10.00%	0.00%	1.00%

Variance decomposition, reported in table 3.25, shows that the contribution of the profit share to capacity utilization variance was considerably higher until the break than it was when the whole period was included in the model (respectively, 42.04% and 13.88% at the tenth period). Additionally, it shows that the contribution of the profit share to the variance of the investment rate was lower in the period until the break than in the whole period (respectively, 1.31% and 3.09% at the tenth period).

Table 3.25: Variance decomposition - Specification 3

	Variance Decomposition of LN_GY:				Variance Decomposition of D(LN_IY):				Variance Decomposition of LN_PS:			
Period	S.E.	Shock1	Shock2	Shock3	S.E.	Shock1	Shock2	Shock3	S.E.	Shock1	Shock2	Shock3
1	0.48	56.80	13.90	29.30	0.02	0.00	100.00	0.00	0.02	71.14	17.41	11.46
2	0.56	48.38	12.45	39.17	0.02	5.04	94.81	0.16	0.02	66.42	22.53	11.05
3	0.59	48.61	11.00	40.39	0.02	4.98	94.01	1.00	0.02	63.77	25.17	11.05
4	0.61	48.13	10.66	41.20	0.02	5.22	93.68	1.10	0.02	63.59	25.38	11.03
5	0.62	47.94	10.42	41.64	0.02	5.29	93.50	1.21	0.02	63.60	25.37	11.03
6	0.63	47.87	10.30	41.83	0.02	5.32	93.42	1.26	0.02	63.59	25.37	11.04
7	0.63	47.82	10.24	41.94	0.02	5.34	93.37	1.29	0.02	63.59	25.37	11.04
8	0.63	47.80	10.21	41.99	0.02	5.35	93.35	1.30	0.02	63.59	25.37	11.04
9	0.63	47.78	10.20	42.02	0.02	5.36	93.34	1.31	0.02	63.59	25.37	11.04
10	0.63	47.78	10.19	42.04	0.02	5.36	93.33	1.31	0.02	63.59	25.37	11.04

Note: Structural factorization.

Therefore, this third specification supports the results of the second specification by showing an increase in the sensitiveness of the accumulation rate to the profit share after 2010Q1, both in terms of the size of the parameter and of the contribution of the profit share to the variance of the investment rate, which are larger in the baseline specification than in the third specification. The results also suggest that a break should be considered in the contemporaneous effect of the profit share on capacity utilization (which was not considered in the second specification), as the contemporaneous effect is lower in this third specification, leading to a negative response of capacity utilization to shocks on the profit share despite of a higher value of the parameter associated with the lagged profit share. Additionally, the variance decomposition of capacity utilization shows that the contribution of the profit share decreases when the whole period is

considered, contributing to the conclusion that income distribution had a lower average impact in the whole period than it had before the break.

3.6 Conclusion

This section presented three different specifications in order to test the demand and accumulation regimes of the Brazilian economy from 2003Q1 to 2014Q4. Despite testing these relations in a relatively small period, the behavior of the economy after the crisis suggests that some of the relations might have changed, so the parameters may not have been stable. Therefore, we tested in sections 3.5.3 and 3.5.4 the hypothesis that profitability became more significant to the capacity utilization and accumulation rates after 2010Q1 (the break was suggested by the breakpoint tests).

The baseline specification, reported in section 3.5.2, estimates the average relations between the variables in the period from 2003Q1 to 2014Q4. This models suggests that the profit share had a very low effect on capacity utilization and on the accumulation rate, but this effect was positive for both of them, suggesting weak profit-led regimes. Regarding the distribution regime, the model suggests that the profit share would increase with increases in capacity utilization. One possible explanation for this result is the effect of overhead labor (Lavoie, 2014).

The second and third specifications tested whether there has been a structural break in the effect of the profit share on the investment rate and capacity utilization, leading to a regime switch. We find evidence of a change in the intensity of profitability on capacity utilization in the second specification, but the break is not significant and this specification has the drawback of not considering the contemporaneous effect of the profit share on capacity utilization. The third specification, which only considers the period from 2003Q1 to 2010Q1, suggests a wage-led demand regime, while the first specification suggests a profit-led regime when the estimation period goes until 2014Q4. Thus, the comparison between the first and third specifications suggests a regime switch which is not captured by the second specification because this one only includes a break in the lagged effect. Because the baseline specification reports the average effect from 2003Q1 to 2014Q4 and it seems that, between 2003Q1 to 2010Q1, the regime was wage-led, the results suggest that it became profit-led from 2010Q2 to 2014Q4.

For the accumulation regime, we find more robust evidence that it was neutral before 2010Q1 and that it became profit-led after the break. Indeed, not only the structural break was significant in the second specification, but also both the second and third specifications suggest that the accumulation regime was neutral before the break, while the first one suggests a weak profit-led accumulation regime for the whole period. Additionally, due to the low participation of the other two variables in the variance decomposition of the investment rate, the model suggests that its dynamic is largely driven by its own dynamics.

In conclusion, the models estimated in this chapter suggest that there has, indeed, been a regime switch in both the demand and accumulation regimes. The stronger effect of profitability on the investment rate and demand may be related to the changes in the world scenario and to the higher indebtedness ratios of households and firms, as explored in chapter 1.

Conclusion

The better international scenario in the 2000s, expressed by higher external demand for the Brazilian export products and the higher commodities prices, had a positive impact on the Brazilian economy and allowed the government to implement income transfer policies with the aim of redistributing income towards the lower class (Arestis and Baltar, 2017*a*). These income transfer policies basically consisted of real minimum wage increases, direct cash transfers (*Bolsa Família*), and pension benefits for rural workers. Additionally, the higher economic growth rates led to an increase in employment and formalization rates, further redistributing income towards the lower classes (Baltar, P., 2015, Biancarelli, 2014).

Thus, income distribution became more egalitarian in the period as there was an increase in the wage share of income and a decrease in the Gini index and poverty rates, as discussed in chapter 1. Despite some questioning of how far this process of income redistribution actually went, as the shares of top incomes remained high (Medeiros et al., 2015*a*,*b*) and some features of the Brazilian economy that operate to concentrate income were not dealt with (Biancarelli, 2014, Carvalho and Rugitsky, 2015), the better position of the lower class meant incorporating it into the consumption and credit markets and, thus, creating new consumption demand (Baltar, P., 2015, Biancarelli, 2014).

Consequently, after an initial period of economic growth driven by exports, domestic demand became more relevant to economic growth from 2006 onwards, leading to an increase in GDP and investment growth rates. Because it took place simultaneously to the increase in the wage share, this better economic scenario has been interpreted as partially resulting from the income redistribution process in place (Arestis et al., 2016, Baltar, P., 2015, Biancarelli, 2014, Serrano and Summa, 2012). Thus, scrutinizing the role of wages in such process allows for a better understanding of the economic outcomes in the years of economic growth, as well as in the years of deceleration, when income redistribution was not enough to sustain the previous growth rates.

The Kaleckian economic growth and income distribution models offer a relevant theoretical background for such analysis, as they bespeak the mechanisms by which changes in functional income distribution affect each aggregate demand component. The literature review on these models, presented in chapter 2, shows that the accumulation and demand regimes can be profit- or wage-led depending on the difference between workers' and capitalists' propensities to save, the responsiveness of investment to the accelerator effect and to the profit share, the

degree of openness of the economy, and the export price and import income elasticities (Lavoie and Stockhammer, 2013).

The more recent literature on these models goes beyond these mechanisms, by incorporating, for instance, overhead labor (Lavoie, 1992, 1996*b*, 2009, 2014), a better depiction of social classes (Palley, 2015, 2017*a*), non-linearities (Nikiforos, 2016), and labor productivity (Storm and Naastepad, 2017). Thus, they suggest that there are other economic relations taking place and influencing how the economy and employment respond to changes in income distribution. A contribution of part of this more recent literature is to question the likelihood of having stable economic regimes, both in terms of a long time period and of the type of exogenous shocks on the economy (Nikiforos, 2016, Skott, 2017).

Indeed, the analysis of the Brazilian economy from 2003 to 2014 suggests that the period of economic growth with income redistribution (2006 to 2010) was followed by a period in which income redistribution was not enough to sustain the previous growth rates (2011 to 2014). In the former period, there was an increase in the wage share and consumption and investment growth rates increased (except for a decrease in investment in 2009, as an effect of the global financial crisis of 2007-2008). This suggests that the higher wage share led to higher consumption, as the propensity to consume out of wage income is expected to be higher than that of profits. Higher consumption and exports then led to an increase in investment due to the accelerator effect, despite of the decrease in the profit share.

The 2007-2008 global financial crisis had a negative effect on the Brazilian economy, leading to a negative GDP growth rate in 2009 (-0.1%). Despite the recovery in terms of output and all demand components in 2010, the crisis led to a more challenging international scenario in the years to come as international competition increased (Hiratuka and Sarti, 2015), so Brazilian imports growth exceeded that of exports and part of the increase in domestic demand was transfered abroad (Arestis et al., 2016). Additionally, between 2011 to 2014, consumption continued to increase, but at a lower rate, suggesting that the ongoing income redistribution towards wages had a lower impact on consumption growth than it did before. Investment growth rates suffered a strong reduction, from an average of 9.36% per year from 2006 to 2010 to 2,3% per year from 2011 to 2014. As exports also reduced their growth rate, there was no strong domestic or external stimulus for economic growth, so the average GDP growth rate reduced from 4.52% per year from 2006 to 2010 to 2.35% per year from 2011 to 2014.

As income redistribution from wages to profits was still in place in this latter period, a better understanding of the role of wages in the determination of aggregate demand and investment is required in order to investigate why the increases in the wage share were no longer enough to sustain the previous economic growth and investment rates. In this sense, chapter 1 raised some economic conditions that might have changed and led to a weaker stimulus from the wage share to economic activity and investment.

In a Kaleckian perspective, some characteristics of the economy will determine its economic regime; but nothing guarantees that these parameters are stable and, thus, that the

economic regime is itself stable. The argument put forward in this dissertation is that, in the Brazilian economy in the last years, the international scenario and the financial situation of the private sector might have triggered a set of mechanisms that affected the responsiveness of investment and consumption to an income redistribution.

Consequently, the likelihood of increases in the wage share sustaining high levels of investment and aggregate demand decreased. For instance, the fact that households faced higher indebtedness levels might have led them to have a lower propensity to consume, as a larger share of their income was committed to debt services and they were reluctant to take on new loans. Thus, increases in the wage share led to smaller increases in consumption. Additionally, firms might have become more dependent on profitability and, thus, lowered their investment. The international scenario was much more challenging to Brazil as international competition was higher and risk perception related to the country increased, so firms' profitability might have become more relevant in order to prove that they were creditworthy. Therefore, the reductions in the profit share started to have larger negative effects on investment.

In order to explore this possibility, chapter 3 presented a SVAR model in which the demand and accumulation regimes were estimated. The baseline model (first specification) showed that the accumulation and demand regimes were profit-led (or weakly profit-led) if the period between 2003 and 2014 is considered. However, when the model includes an interaction dummy variable for the profit share (second specification), one observes that investment became profit-led after the break in the first quarter of 2010, but it was under a neutral regime before the break. This result is confirmed by the model that only includes the period before the break (third specification), which also suggests that demand was wage-led prior to the break. Comparing it to the baseline specification, the third specification suggests that the increases in the wage share offered a weaker stimulus to demand after the break.

Therefore, the empirical evidence provides some support to the hypothesis that there was a regime switch, or, at least, a change in the intensity of the regime, in the period. As investment became more dependent on profitability, going from a neutral regime to a profit-led regime, the further decreases in the profit share meant a larger negative stimulus to investment. This, together with the lower increases in consumption due to the more fragile financial situation of households, led to a demand regime switch from wage-led to profit-led.

In terms of the dynamics of the Brazilian economic growth from 2003 to 2014, our results suggests that the income redistribution towards wages stimulated growth and did not prevent higher investment rates, so a higher wage share can have a role in enhancing economic growth in Brazil. However, the impact of the 2007-2008 crisis and some changes in the domestic economy weakened this relation, leading to a structural break in 2010. After this break, income redistribution was no longer enough to sustain the previous growth and investment rates.

Therefore, our results suggest that economic policy decisions should not be taken without a broad analysis of the current economic situation of the country. This is not to say that a wage-led strategy should not have been pursued in Brazil after 2011, but rather that if one

aims to combine economic growth and a more egalitarian income distribution, the underlying economic conditions that allow for such outcome must also be analyzed and targeted.

In the case of the Brazilian economy discussed in this dissertation, it is possible that the higher indebtedness levels of firms and households and the more challenging international scenario prevented a successful wage-led strategy after 2011. Still, this strategy could have been more successful had the government provided conditions that maintained the positive stimulus of income redistribution towards wages. In this sense, despite the constraint placed by the more complicated international scenario, which could hardly be changed by the Brazilian government, other elements could have been targeted, such as a more active fiscal policy that would have provided a positive sign to investors (by sustaining public investment, for instance).

More research can certainly contribute to this analysis and, in this sense, it would be helpful to estimate different specifications and include alternative variables. Additionally, our results suggest that an interesting path of research, which is already partially covered by the literature[14], would be a broad analysis of what are the determinants of the demand and accumulation regimes and how they interact and change through time. Indeed, an important contribution of the Kaleckian economic growth and income distribution literature would be to provide policy tools that allow for successful wage-led strategies, that is, strategies that effectively and sustainably combine economic growth and income redistribution.

[14]For example, Carvalho and Rezai (2016), Nikiforos (2016), and Skott (2017).

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Appendix: Unit root tests

Table A.1: ADF test

Deterministic terms	cons, trend		cons, trend		cons		cons		cons		none	
Ho	$\gamma = 0$		$\gamma = \beta = 0$		$\gamma = 0$		$\gamma = \alpha = 0$		$\gamma = 0$ (normal dist.)		$\gamma = 0$	
	t-stat	p-value	F-stat	p-value	t-stat	p-value	F-stat	p-value	t-stat	p-value	t-stat	p-value
LN_PS	-4.40	0.01										
LN_R	-4.91	0.00										
LN_RER	-1.67	0.75	5.20	>10%	-2.77	0.07	5.20	<5%	-2.77	0.01		
LN_IY	-2.33	0.41	3.34	>10%	-1.12	0.70	0.87	>10%			-0.75	0.39
D(LN_IY)	-6.35	0.00										
LN_YF	-3.21	0.09										
D(LN_YF)	-3.15	0.11	4.95	>10%	-3.11	0.03						
LN_GY	-5.95	0.00										

Table A.2: PP test

Deterministic terms	cons, trend		cons		none	
Ho	$\gamma = 0$		$\gamma = 0$		$\gamma = 0$	
	Adj. t-stat	p-value	Adj. t-stat	p-value	Adj. t-stat	p-value
LN_PS	- 4.35	0.01				
LN_R	- 4.94	0.00				
LN_RER	- 1.72	0.73	- 2.72	0.08		
LN_IY	- 2.16	0.50	- 1.07	0.72	- 0.85	0.34
D(LN_IY)	- 6.18	0.00				
LN_YF	- 2.15	0.51	- 1.15	0.69	7.03	1.00
D(LN_YF)	- 3.29	0.08				
LN_GY	- 5.90	0.00				

Table A.3: KPSS test

Deterministic terms	cons, trend		cons	
Ho	$\gamma < 0$		$\gamma < 0$	
	LM Stat	Critical value 10%	LM Stat	Critical value 10%
LN_YF	0.12	0.12	0.90	0.35

Table A.4: Breakpoint unit root test

Deterministic terms	cons, trend			cons, trend			cons		
Ho	$\gamma = 0$			$\gamma = 0$			$\gamma = 0$		
	t-stat	p-value	break (trend, cons)	t-stat	p-value	break (cons)	t-stat	p-value	break (cons)
LN_IY	- 4.14	0.44	2013q1	- 3.89	0.44	2014q1	- 3.69	0.29	2009q2
LN_YF	- 8.74	<0.01	2008q3	- 4.61	0.10	2008q3	- 4.07	0.13	2009q1