**An Empirical Test of the Post-Kaleckian Model applied to functional income distribution and long-run growth regime in Brazil**

Cleiton Silva de Jesus (UEFS)

Ricardo Azevedo Araujo (UnB)

Carlos Eduardo Drumond (UESC)

**Resumo**

O objetivo principal deste trabalho é investigar empiricamente se economia brasileira teve, no período 1970-2008, um regime de crescimento puxado pelos salários ou pelos lucros. Com base em um modelo de crescimento pós-kaleckiano canônico, foram estimados alguns modelos vetores auto regressivos (VAR). São três os principais resultados extraídos das funções de impulso-resposta generalizadas fornecidas pelos modelos VAR. Em primeiro lugar, um aumento da participação dos lucros na renda tem efeitos positivos, tanto sobre o crescimento econômico quanto sobre a taxa de utilização da capacidade instalada, o que sugere um regime de crescimento puxado pelos lucros. Em segundo lugar, um aumento da participação dos lucros na renda afeta positivamente tanto a relação entre o produto observado e o produto potencial quanto a acumulação de capital, o que reforça o resultado anterior. Em terceiro lugar, choques positivos na taxa de utilização da capacidade instalada afetam positivamente tanto o crescimento econômico quanto a acumulação de capital através do efeito acelerador.

**Palavras-chave:** distribuição de renda, regimes de crescimento, economia brasileira.

**Abstract**

The main purpose of this paper is to investigate empirically whether the Brazilian economy was profit-led or wage-led in the period 1970-2008. To this end, a canonical Post-Kaleckian macro model is presented and, based on this framework, some vector autoregressive (VAR) models are estimated. The main results extracted from the generalized impulse-response functions provided by the VAR models are three. First, a positive profit share innovation affects, in the same direction, both economic growth and rate of capacity utilization, suggesting a profit-led pattern. Second, a profit share shock affects positively both the ratio between actual and potential output and the capital accumulation, which reinforce the previous result. Third, a capacity utilization shock is shown to positively affect both the output growth and the capital accumulation through the accelerator effect.

**Keywords:** income distribution, growth regime, Brazilian economy.

**JEL classification:** E12; D33; O11.

**Área 4 -** Macroeconomia, Economia Monetária e Finanças

**1. Introduction**

If the recent economic crisis has renewed the interest in issues of income distribution and economic growth in different academic circles[[1]](#footnote-1), such themes are hallmarks of the Post-Keynesian tradition. The Kaleckian growth model – KGM hereafter – designates the growth model that was initially coined by Kaldor (1956) and Robinson (1956, 1962) and extended by Dutt (1984), Rowthorn (1982) as well as by Bhaduri and Marglin (1990). The KGM passes through three main phases that are labeled as ‘generations’.

Although Kaldor (1956) has built his seminal model on the notion of full capacity utilization, Dutt (1984) and Rowthorn (1982), working independently, have built what is known as the second generation of the KGM by endogenizing the rate of capacity utilization in the lines of Steindl (1952). One of the main contributions of this generation is the possibility of a ‘stagnationist’ or wage-led regime in which an increase in the profit share implies a reduction in the rate of accumulation. The key assumption behind this result is that the growth rate of investment is a function of the profit rate as well as of the rate of capacity utilization.

Bhaduri and Marglin (1990) have extended this view by envisaging the possibility of an ‘exhilaritionist’ or profit-led regime that can be obtained by substituting the profit rate by the profit share in the investment equation. One of the properties of the third generation model, as it became known, is the possibility of a ‘non-stagnationist’, or profit-led regime in which eventually falls in consumption due to a lower real wage are overcompensated by an increase in investment led by a profit share expansion.

Meanwhile, on the empirical front, a bourgeoning literature documenting a stagnation trend accompanied by an increase in the profit share has been observed in many economies worldwide, which shows that a decrease in the wage share may be behind the deceleration of growth in many countries [see among others, Stockhammer (2009), Storm and Naastepad (2012) and Hein (2012)]. But we cannot say beforehand that a higher profit share may be harmful to economic growth and in last instance the prevalence of wage-led or profit-led regimes in particular economies is an empirical question. What we know is that larger economies such as Germany, France and US are more prone to be wage-led according to the empirical evidence presented by a number of authors such as Hein and Vogel (2008), Ederer, Onaran, and Stockhammer (2009), Naastepad and Storm (2007) and Elder and Stockhammer (2008). But the prevalence of profit-led regime is also found in smaller and more open economies such as Austria or Netherlands.

These results can be explained in terms of the fact that for the components of aggregate demand we have that the consumption is wage-led, while investment and net exports are profit-led. The degree of openness of an economy can determine if the profit-led components, namely investment and net exports, is larger than the wage-led component, namely consumption. In larger economies, such as US, Germany and France the domestic component is large enough to offset the influence of the external sector thus giving rising to a wage-led regime. In smaller and more open economies, the influence of the external sector is sufficient to offset that of the domestic demand thus giving rise to a profit-led regime.

Focusing on different effects that particular distributive set ups have on particular components on aggregate demand, Blecker (2016) shows that an increase in wages leading to a higher wage share has a two sided-effect on the economic performance. On the one hand, it has a negative effect on domestic competitiveness that may lower aggregate demand due to its negative effect on net exports. On the other hand, higher wages imply higher purchasing power of the class with the higher propensity to consume, thus leading to higher aggregate demand. According to the author, the first effect tends to prevail in the short run while the second in the long run. In this vein, the most probable outcome in the short run is a profit-led regime and a wage-led regime in the long run[[2]](#footnote-2).

Although we consider this classification of key importance, some authors such as Skott (2015) and Razmi (2016) consider that much attention has been placed on the profit-led and wage-led regimes while, in fact, such classification disregards some other key aspects of economic growth. Skott (2015) for instance considers that the emphasis on determining the growth regime may not be appropriate insofar as variables such as profit share are not exogenous but endogenous to the growth process, and thus not under the control of policy makers. He also claims that there would not be a unidirectional causation between profit share and economic growth, with exogenous shocks having either negative or positive effect on the correlation between the two variables. For Razmi (2016) the inadequacy of this debate when applied to low-income countries rests on the fact that it ignores some aspects of the structure of the economy, namely the existence of non-tradable goods and shortage of capital goods. According to him, when such aspects are properly taken into account in the model the scope for wage-ledness vanishes.

Although recognizing the relevance of such criticisms, the present paper intends to show that the adoption of a VAR methodology to determine the growth regime of the Brazilian economy from 1970 to 2008 overcomes some of the criticisms raised above. This methodology was also adopted by Onaram and Stockhammer (2004, 2006)[[3]](#footnote-3) and allows us to consider that not only demand and capital accumulation but also distribution are endogenous variables, thus avoiding the Skott (2015) criticism. Besides, the Brazilian economy is better characterized as an emerging economy with important differences from the low-income economy depicted by Razmi (2016).

In this vein, we believe that the debate between profit-led and wage-led regimes is crucial to understand the Brazilian growth experience since 1970 until 2008. During this period, the real GDP grew on average 4.55% (6.4% in the 1970-1985 period and 3.2% in the 1986-2008 period) and the labor productivity grew on average 1.75% (3.33% in the 1970-1985 period and 0.65% in the 1986-2008 period). The degree of industrial capacity utilization and the profit-share float around 81.5% and 57.8%, respectively.

It is important to take into account that during the period under consideration, the Brazilian economy faced a transition from a closed to a more open economy due to the trade liberalization process that began in the end of eighties but that took place mainly in the nineties. Before that, namely from 1970-1988, the import substitution and protection of infant industries were the springboards of the Brazilian strategy of economic growth [see Araujo et. al (2015)]. From 1989-2002, a period post-liberalization was characterized by low and unstable growth rates and poor performance in terms of exports. This scenario contrasts with the period from 2002-2008, when terms of trade soared and the current account was in surplus. Although exports may be an important aspect to understand the Brazilian growth experience in the 2000’s, it should be also taken into account that during this period the main role in spurring growth was played by an increase in internal demand due to the redistribution of income that accrues both from the social programmes, such as ‘Bolsa Família’, and the strong minimum wage policy. In this sense, we consider that both internal and external demand has played an important role to explain the Brazilian growth experience in the period under consideration.

In order to make this assessment, we use a VAR model that takes into account three variables that are key to understand the Brazilian growth experience, namely the profit share, the growth rate of output and the rate of capacity utilization. In alternative specifications, we also used the ratio between actual and potential output, accumulation rate and terms of trade. Three important results were found: First, a positive profit share innovation affects, in the same direction, both economic growth and the degree of capacity utilization. Second, a profit share shocks affect positively both the ratio between actual and potential output and the capital accumulation. Third, a capacity utilization shock is shown to positively affect both the output growth and the capital accumulation.

This paper is structured as follows: the second section presents formally the Bhaduri-Marglin’s model, the third section presents a review of the empirical literature on income distribution and economic growth, and the fourth section presents the econometric model as well as the empirical results. Finally, the fifth section summarizes the conclusions.

**2. The Post-Kaleckian Growth Model**

In what follows let us consider the Post-Kaleckian[[4]](#footnote-4) model of growth and distribution as the benchmark of our analysis. Such model is due to Bhaduri-Marglin (1990) and considers that the investment function reacts positively to profits and capacity utilization, namely *u*, given that the profit-share, namely *π*, is used as a measure of profitability. According to Lavoie (2010), the rationale for this specification rests on the fact that the profit rate that should enter the investment equation is the profit rate computed at normal prices, namely the normal profit rate, and not the actual profit rate. By considering the well-known relation between these variables, namely *r* = *π*.*u*, where *r* is the profit rate, *π* is the profit share and *u* is the rate of capacity utilization, and that the normal rate of capacity utilization is constant and can be normalized to one, we conclude that *rn* = *π*, where *rn* is the normal profit rate. In this case, the investment function, *I*, normalized by the stock of capital, *K*, may be written as:

 (1).

With partial derivatives  and . According to Bhaduri and Marglin (1990, p. 380), influences of existing capacity on investment cannot be captured satisfactorily by simply introducing a term for capacity utilization. The investment function should also consider profit share and capacity utilization as independent and separate variables in the lines of expression (1). Following Blecker (2002, p. 137) let us assume for the sake of convenience only a linear investment function:

 (1)’.

Where *α* is a measure of the animal spirits,  > 0 measures the sensibility of the investment to the profit share and measures the sensibility of the investment to the capacity utilization, which captures the accelerator effect. We consider that the saving behavior is given by a modified version of the Cambridge Equation in which we assume that the propensity to save out of wages, given by  is different from zero, meaning that workers save a fraction of their labor income. Following Hein (2014) let us assume that the propensity to save out of profits, namely , is equal for both social classes. In face of these assumptions, the saving function normalized by the stock of capital can be written as:

 (2).

By equalizing (1)’ to (2), and considering that , we obtain after some algebraic manipulation, the profit rate that equalizes savings and investment:

 (3).

By substituting (3) into , we obtain the rate of capacity utilization as a function of the profit share:

 (4).

Note that a necessary condition for a positive rate of capacity utilization and profit rate is that the denominator of the right hand side of expressions (3) and (4) be positive, namely: . From expression (4) it is possible to conclude that:

 (5).

Since the denominator is positive, the sign of the derivative depends on the sign of the numerator. If  then the sign of the derivative is positive (negative), meaning that the rate of capacity utilization is positively (negatively) affected by an increase in the profit-share, which yields an ‘exhilaritionist’ (‘stagnationist’). This result shows that the difference between the propensities to save out of profits and wages plays an important role in this analysis. On the one hand, by considering the stylized fact  , if the difference between  and  is sufficiently large in order to make , then the most probable outcome is a ‘stagnationist’ regime. On the other hand, if the difference between  and  is sufficiently small that  then an ‘exhilaritionist’ outcome may be obtained. The insight for this result is straight: if the propensity to save out of profit is not much different the propensity of save out of wages, then an increase in the profit share may have a positive effect on the rate of capacity utilization due to its positive effect on aggregate consumption. The balanced growth rate of the economy, *g\**, is then obtained by replacing expressions (3) and (4) into (2), which yields:

 (6).

Taking the derivative of expression (6) in relation to the profit share, *π*, one obtains:

 (7).

By rearranging terms, it is possible to conclude that the sign of the derivative depends on the sign of the numerator. By considering the stylized fact , if the profit effect is stronger than the capacity effect, meaning that , growth is profit-led since the numerator will be unambiguously positive. If , the sign of the numerator will depend both on the magnitude of the difference between  and  and on the term . If  then the regime is still profit-led but if  then the regime will be wage-led. These results emphasized the point raised by Blecker (2002) and Hein (2014) that the scope for wage-ledness is reduced when the possibility of savings out of wages is taken into account, since a wage-led regime requires a high differential between the propensities to save form profits and wages.

As highlighted by Hein (2014), in this set-up it is also possible to obtain an intermediate regime that corresponds to the case in which the demand is wage-led and accumulation (and thus growth) is profit-led, namely  and  respectively. This regime occurs if and. In this case, according to Hein (2014, p. 262), “although redistribution in favor of wages is expansionary with respect to aggregate demand and capacity utilization, it will not be supported by capitalists because it will mean a lower rate of profit to them”.

In summary, three regimes are possible in the canonical Bhaduri-Marglin Post-Kaleckian model when we allow savings out of wages, and they depend not only on the relative magnitudes of capacity utilization and profit share effects in the investment function but also on the magnitudes of propensities to save out of wages and profits (and these are empirical questions).

**3. Review of the Empirical Literature**

The seminal Bhaduri-Marglin’s model has motivated a series of empirical works related to growth regimes and functional income distribution. Since the contribution of Bowles and Boyer (1995), the empirical research on Post-Kaleckian literature has become fruitful, especially for the case of advanced capitalist countries. As pointed by Blecker (2016), two empirical strategies had been used to test the wage-led/profit-led hypothesis: the structural approach (or single-equation approach) and the aggregative approach (or system approach). The first strategy takes income distribution as exogenous, and is based on estimating separated equations to consumption, investment and net exports. The growth regime in this case depends on the magnitude of parameters related to income distribution in each equation[[5]](#footnote-5). The second one (the strategy that we will use in this paper) is a simultaneous approach based on VAR analysis, and considers that income distribution is endogenous. Hence the growth regime depends on the response of growth, capital accumulation rate or capacity utilization to income distribution shocks. In this literature review we will focus on two group of studies: i) in the estimates based on system approach considering the international literature and ii) in the available empirical works related to the Brazilian economy, regardless of the empirical methodology used.

*3.1 International literature*

Stockhammer and Onaran (2004) are pioneers in the use of VAR models in the Post-Kaleckian tradition. Using a structural VAR approach with data (semiannual) from the early 1960s to the late 1990s for the USA, UK and France, Stockhammer and Onaran (2004) investigated the relation between capital accumulations, capacity utilization, profit share, unemployment and labor productivity growth. The main point of this paper is to question the exogeneity of income distribution, by considering a simultaneous approach in which distribution, demand and capital accumulation are all endogenous variables. The main finding of the Stockhammer and Onaran’s paper is that the impact of profit share on demand and employment is not statistically significant for the US, UK and France. Although the advantages of the use of VAR approach compared to the simple structural estimations, especially the absence of endogeneity problems, Stockhammer and Onaran’s model has many variables (five) and lags (four), thus raising problems related to low degree of freedom (the number parameters estimated in the model exceeds the size of the sample).

This same approach employed by Stockhammer and Onaran (2004) was used in Onaran and Stockhammer (2004) to study the growth experience in two developing countries: Turkey (1965-1997) and South Korea (1970-2000). In this work, they used data of income distribution, accumulation, growth, and employment. The VAR model is estimated with two lags to, according to authors (p. 77) “control for the problems that might arise from autocorrelation and nonstationarities in the time series”. In fact, the estimated models are stable and the Lagrange Multiplier test showed that autocorrelation is not a problem. The results provided by the empirical analysis (impulse response functions) showed that decreasing the wage share does not stimulate accumulation, growth, and employment, both in Turkey as in South Korea.

Barbosa-Filho and Taylor (2006) also use a VAR model to test the relation between capacity utilization and profit-share for the US economy with quarterly data from 1948.Q1 to 2002.Q4. The authors found evidences that the USA economy was profit-led during the period, but the estimated VAR model has been criticized. First, Stockhammer and Stehrer (2011) pointed that the Barbosa-Filho and Taylor’s model suffer autocorrelation and their main result is very sensitive to the lag length. Second, Blecker (2016) argued that the use of the Hodrick-Prescott filter in Barbosa-Filho and Taylor’s model is a problematic way to measure the utilization rate for long-term purposes.

In order to evaluate the performance of the Japanese economy in the 1990s and 2000s decades, Nishi (2012) used quarterly data of profit share, debt ratio, and capital accumulation, and estimated a structural VAR model with these variables. Although the unit root test suggested that just the profit share series is stationary, the author used the argument of Sims et al (1990) and estimated the model with nonstationary series. Following the Akaike and Schwarz information criteria, two VAR models are estimated: one with five lags and other with one lag. The accumulated impulse response functions derived from the VAR model showed that a positive shock on the profit share continuously stimulates capital accumulation rate and, at the same time, an increase in the debt ratio restrains the capital accumulation rate. It is important to highlight that the author did not perform autocorrelation and stability test, and this makes the VAR model susceptible to criticisms.

In an innovative approach, Carvalho and Rezai (2016) investigated the effects of changes in the personal income distribution on demand growth regime in the USA economy (1967-2010). To this end, they estimated a two-dimensional threshold VAR model for labor share and capacity utilization, using the Gini coefficient as the threshold variable. This strategy is used to investigate whether the level of income inequality affects the growth regime. Following Barbosa-Filho and Taylor (2006), Carvalho and Rezai (2016) utilized Hodrik-Prescott filter to construct the series of capacity utilization. Two linear accumulated impulse-response functions were calculated: one to high-inequality regime and other to low-inequality regime. The authors show that the impact of wage share innovation on capacity utilization is negative in both accumulated impulse-response functions, but in the high-inequality regime this impact is more negative. According to the authors interpretation, this suggest that the increase in income inequality has turned the USA economy more profit-led, and the main result of Barbosa-Filho and Taylor (2006) is due to the high-inequality level after 1981.

*3.2 Brazilian literature*

The relation between distribution and growth is part of the Brazilian economists’ agenda for a long time [see among others, Tavares and Serra (1971), Hoffmann and Duarte (1972), Fishlow (1972) and Langoni (1973)]. A well-known dictum coined by Delfim Netto, a former minister of Finance and Planning during the military government is a good example of such connections. According to him, it was necessary to ‘make the cake grow to distribute it’. With this statement he intended to justify the increase in the profit share of the Brazilian economy during the military dictatorship in the seventies when unions were repressed and became unable to fight for wage indexation in an environment of high inflation[[6]](#footnote-6). According to Baer (2001, p. 81) “[o]ne traditional justification for a concentration in the distribution of income has been that the upper income groups have a greater propensity to save than the lower income group. Thus, to increase investment and future productivity, income concentration must be tolerated for a while”. This shows clearly that the effects of income distribution on growth are recognized by scholars who focused on the Brazilian economy.

However, only recently a few papers employed econometric methodologies to test the growth regime in Brazil starting from a Post-Kaleckian structure (Araujo and Gala, 2012; Oreiro and Araujo, 2013; Marrone, 2015 and Feijó et al, 2015a and 2015b). Table 1 summarizes this literature and show that the global result provided by the authors is not unambiguous: it is difficult to define the Brazilian economy as profit-led or wage-led just looking at these works.

**Table 1.** Summary of the empirical literature on demand growth regime to Brazilian economy.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Paper** | **Methodology** | **Sample** | **Obs** | **Total demand regime** |
| Araujo and Gala (2012) | OLS | 2002.Q1 to 2008.Q4 | 28 | Profit-led |
| Oreiro and Araujo (2013) | OLS | 1994.Q3 to 2008.Q4 | 56 | Wage-led or Profit-led |
| Marrone (2015) | Granger Causality | 1950 to 2008 | 59 | Ambiguous |
| Feijó et al. (2015a) | SVAR | 1995.Q1 to 2009.Q4 | 60 | Wage-led |
| Feijó et al. (2015b) | DGLS | 1951 to 1989 | 38 | Profit-led |

Source: Own elaboration.

Araujo and Gala (2012) used quarterly data from 2002.Q1 to 2008.Q4 and found a wage-led regime, when considered the case of a closed economy, but they found a profit-led regime when considered the total demand regime (when the net exports function is included in the empirical model). Besides of this work has been turned seminal in the Brazilian literature, Araujo and Gala did not performed any unit root or diagnostic tests, and the sample cover is short. This means that the results reported by the authors cannot be robust.

Oreiro and Araujo (2013) utilized quarterly data from 1994.Q3-2008.Q4 in order to analyze the relation between economic growth, income distribution and real exchange rate in a non-linear macrodynamic model. In the theoretical model, they assume that the accumulation rate depend not just of the capacity utilization and profit-share, but also of the exchange rate and the square of the exchange rate. Based on these assumptions, it is possible to estimate the real exchange rate that maximizes the accumulation rate (named optimal exchange rate). After perfoming unit root and cointegration tests, Oreiro and Araujo (2013) estimated, by ordinary last square methodology, equations to profit share and capacity utilization. The authors concluded that the optimal exchange rate was 2.03 during the period. Exploring this result and looking at the exchange rate time series, it is possible to identify two sub-periods of exchange rate overvaluation (1994.Q3-2001.Q1 and 2005.Q4-2008.Q4) and one period of exchange rate undervaluation (2001.Q2-2005.Q3). According to the definition proposed in the theoretical model presented by the authors, in the period of exchange rate undervaluation, the accumulation regime was wage-led, but in the others two periods of exchange rate overvaluation, the accumulation regime was profit-led.

Morrone (2015) employed the Toda-Yamamoto approach to Granger causality test in order to verify whether profit share and capacity utilization (the inverse of the ratio capital/output) temporally precedes capital accumulation and whether profit share temporally precedes capacity utilization in the Brazilian economy. He considered the period 1950-2008 (annual data) and employed unit root tests before the statistical causality analysis. According to the author, the main result indicated the existence of both wage-led and profit-led regimes in Brazil, so that profit share do not cause, in the Grange sense, both capital accumulation and capacity utilization. Here, two points should be taken into account: i) the Granger causality test has not been used to test the growth regime in the empirical literature specially because this test is not able to determine the direction of contemporaneous causality and ii) the interpretation of the results provided by the Granger causality test is not clear and causes misunderstandings.

Feijó et al (2015a) utilized quarterly data from 1995Q1-2009Q4 in order to investigate both the dynamic relationship among income distribution and capital accumulation, and whether there is a debt-burdened pattern of capital accumulation in the Brazilian economy. The theoretical model utilized by the authors comes from a Kaleckian-Minskian structure, so that beyond the variables profit share and capital accumulation rate (defined as the ratio between gross ﬁxed capital formation and GDP) the authors incorporated, such as in the empirical model of Nishi (2012), the variable debt ratio (defined as the evolution of the supply of loans to private ﬁrms). The empirical analysis was carried out thought accumulated impulse-response functions. These functions were generated from a structural VAR model estimated with all variables in level, but both the definition of the VAR lag order and the stability of the system are not clear in the model. Indeed, besides that the accumulated response on capital accumulation to profit share shocks was not statistically significant and the authors did not provide any robustness test, they concluded that there is a wage-led pattern in the Brazilian economy and, at the same time, it presents a debt-burdened pattern of capital accumulation.

In another work, Feijó et al (2015b) employed the structural approach to investigate the interaction between functional income distribution and growth of aggregate demand in Brazil. In this study, they considered the period before economic opening (1951-89) and performed formal tests of endogenous structural breaks, unit root and cointegration. After estimated linear functions to private consume, investment (total and private) and exports to USA, the authors calculated partial elasticities of aggregate demand components to changes in wage share. The empirical exercise suggested that the Brazilian economy was profit-led, and this profile was strengthened after 1968. According to the authors, two specificities of the Brazilian economy are useful to explain the emergence of a profit-led regime in a relatively open economy with a large share of consumption in GDP: i) the period of high and persistent inflation “inhibited the development of a long-term credit market” and it made firms dependent on internal funds; ii) the industrialization and urbanization processes favored the consumption pattern of the middle class based on demand for durable goods, so that “concentration of income allowed for a low-wage industrialization strategy”.

**4. Econometric Model and Empirical Evidence**

Since Sims’ (1980) seminal paper, VAR models have been used in a range of multivariate macroeconometric analysis. Based on this approach, we estimate the following dynamic system:

 (8).

where is an (n x 1) vector of intercept terms,  is an (n x n) coefficient matrix,is an (n x 1) vector with each variable included in the model and  is an (n x 1) vector of error terms (serially uncorrelated with constant variance). The basic model has three macroeconomic variables related to the canonical Post-Kaleckian macro model of growth and distribution: i) the growth rate of real GDP, ; ii) the rate of capacity utilization,  and the profit-share,  - a proxy to functional income distribution. The real GDP data are available at Brazilian Institute of Geography and Statistics (IBGE) so that we consider The rate of capacity utilization has been calculated by Getúlio Vargas Foundation (FGV) since 1970 and was downloaded from the Institute of Applied Economic Research (IPEA) website. The profit-share data are extracted from Marquetti and Porsse (2014) database. The dataset used in the empirical analysis has annual frequency and covers the period from 1970 to 2008[[7]](#footnote-7). The simple correlations between the variables  and *g*,  and *u*, and *u* and *g* in this period are positive (21.9%, 55.7% and 71.6%, respectively).

The traditional VAR approach assumes that all series in the model are stationary (see Enders, 2014). In this sense, the first step in the econometric analysis is to check whether the series contain a unit root. To this end, the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test is performed. The null hypothesis of the KPSS test is that the series is stationary, and the alternative hypothesis is unit root. The outcome of this test (see Appendix) indicated that the three macroeconomic time series are I(0).

The next step is to determine the appropriate lag length employing the Akaike (AIC), Schwartz (SC) and Hannan-Quinn (HQ) information criteria. All these criteria suggest that VAR(1) is the best model (see Appendix). In this sense, our benchmark specification with three variables, one constant and one lag provides a parsimonious model, so that just twelve parameters need to be estimated. Parsimony is important because if we include more lags and endogenous variables in the model, the degree of freedom largely decreases.

The parameters of the VAR model are estimated by OLS method[[8]](#footnote-8) and two diagnostic tests are performed (see Appendix). The first one indicates that the VAR model with one lag is stable, since the inverse roots of AR characteristic polynomial have modulus less than one and lie inside the unit circle. The second one is performed to check the hypothesis of autocorrelation. Since the p-value of the Lagrange Multiplier test is 0.55 on the first lag, there is no evidence of autocorrelation in the benchmark model specification.

It is well-known that the parameters estimated by VAR models are hard to be interpreted (the t-tests on individual coefficients are not valid because the regressors, in general, are highly collinear). Considering this, we follow the standard literature on time series econometrics and focus only on the impulse-response functions. However, since it is difficult to order the variables rigorously, we utilize the generalized impulse-response functions (see Pesaran and Shin, 1998). This approach is useful because it eliminates potential problems caused by different orderings in the traditional Cholesky decomposition.

The main generalized impulse-responses functions obtained by the VAR model can be seen on figures 1, 2 and 3 (,  and ). Eight periods after shocks are considered in the simulations. Solid lines show the punctual responses and dashed lines represent their two standard error bands. The 95% confidence interval is calculated by the Monte Carlo approach with 10.000 repetitions. The generalized impulse-responses show how an innovation to one variable affect the entire system. Then, through this moving average representation of the VAR model we can test the theoretical hypothesis presented on section two.



**Fig. 1:** Generalized response-impulse function. Response of *u* to *π* shocks.



**Fig. 2:** Generalized response-impulse function. Response of *g* to *π* shocks.



**Fig. 3:** Generalized response-impulse function. Response of *g* to *u* shocks.

Three main results emerge from this aggregative model. First, profit share shocks provoke a positive and significant impact on economic growth at the time that shocks occur. From the second year and after, however, the impact of profit-share shocks on economic growth becomes statistically null. This result suggests that when the income distribution improves (towards wages) the rate of economic growth decrease. In this sense, according to the definition exposed on section two, we conclude that the growth regime of the Brazilian economy can be defined as profit-led. The second result shows a positive response on the rate of capacity utilization to profit share shocks, and this response is statistically significant until the second period. According to the definition presented in the section two, this result provides evidence in favor to a ‘non-stagnationist’ pattern in the Brazilian economy. The third result shows the existence of accelerator effect in the Brazilian economy, so that the effect on output growth due to capacity utilization shocks is positive and statistically significant until the second period. Here is important to note that the effect on output growth due to capacity utilization shocks is twice stronger than that due to profit share shocks.

In order to verify whether the results showed previously are robust, we also have considered nine alternative specifications: ROB1) one bivariate VAR with *π* and *g*; ROB2) one bivariate VAR with *π* and *u*; ROB3) a Bayesian VAR with the Litterman-Minnesota prior[[9]](#footnote-9); ROB4) a model with *π*, *u* and capital accumulation[[10]](#footnote-10) (defined as *I/K*); ROB5) one bivariate VAR with *π* and capital accumulation; ROB6) the standard specification with two lags; ROB7) a model with *π*, *g* and the ratio between actual output and potential output[[11]](#footnote-11); ROB8) the previous model, but with the potential output based on Hodrick-Prescott filter (λ=100); ROB9) the standard specification with the terms of trade[[12]](#footnote-12) as a exogenous variable.

The main results provided by the standard specification can be verified in all alternative models[[13]](#footnote-13), both in terms of punctual responses and in terms of statistical significance. This suggests that our empirical model is robust. Furthermore, three other interesting results can be verified. First, in the ROB4 and ROB5 models we can note that profit share shocks affect the capital accumulation positively, but this impact is not statistically significant in both models. Second, in the ROB7 and ROB8 models we verify that profit share shocks affect positively the ratio between actual output and potential output at the moment that the shock occurs. In the ROB8 model the impact of profit share shock converge to zero faster than in the ROB7 model, but in both models the profit share shock becomes statistically null in the third period and after that. Third, in the models that we considered the variable *u* it is possible to note that capacity utilization shock affect positively both the output growth and the capital accumulation (validating the accelerator effect).

**5. Concluding Remarks**

The aim of this paper was to empirically test for the Brazilian economy, the Post-Kaleckian growth model that have been widely used to assess the impact of different patterns of income distribution on economic performance. Starting from the Bhaduri-Marglin framework we estimated a VAR model to investigate whether the Brazilian economy was profit-led or wage-led during the period 1970-2008. In this perspective, we follow some empirical works that used a Post-Kaleckian structure that have been provided some insights about the Brazilian growth experience [Araújo and Gala (2012), Oreiro and Araujo (2013), Morrone (2015) and Feijó et al (2015a) and (2015b)].

The standard VAR model specification provided strong evidence to conclude that both the growth regime and the demand regime of the Brazilian economy have been profit-led in the considered period, so that a positive profit-share innovations affect, in the same direction, both economic growth and rate of capacity utilization. Furthermore, in the alternative specifications, these results did not change and we could observe that i) profit share shocks affect positively both the ratio between actual output and potential output (regardless the estimates to potential output we use) and capital accumulation and ii) a capacity utilization shock is shown to positively affect both the output growth and the capital accumulation through accelerator effect.

In future empirical investigations on income distribution and long-run growth regime in the Brazilian economy, one should consider financial variables (such as credit to GDP ratio, corporate and household debt, financial and housing wealth) and personal income distribution (such as Gini coefficient, top 10% versus bottom 10%) in the model. We also think that is important to distinguish the effects of change in the functional income distribution on aggregate demand components, including with disaggregate data.

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**Appendix**

**Table A1.** KPSS test

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Series | Band | Test | Specification | Result |
| *π* | 5 | 0.1273 | Constant | I(0) |
| *g* | 4 | 0.4218 | Constant | I(0) |
| *u* | 4 | 0.2420 | Constant | I(0) |

Notes: In this test is used Barlett kernel and Newey-West bandwidth.

The critical value (5% level) is 0.463.

**Table A2.** VAR lag order selection criteria

|  |  |  |  |
| --- | --- | --- | --- |
| Lags | AIC | SC | HQ |
| 0 | -12.70755 | -12.57424 | -12.66153 |
| 1 | -14.96855\* | -14.43528\* | -14.78446\* |
| 2 | -14.63514 | -13.70193 | -14.31299 |
| 3 | -14.67012 | -13.33697 | -14.20992 |
| 4 | -14.76003 | -13.02693 | -14.16177 |

\* Indicates lag order selected by the criterion.

**Fig A1.** Inverse root of AR characteristic polynomial



**Table A3.** VAR residual serial correlation LM test

|  |  |  |
| --- | --- | --- |
| Lags | LM-Stat | Prob |
| 1 | 7.855255 | 0.5488 |
| 2 | 12.99147 | 0.1630 |
| 3 | 8.155983 | 0.5185 |
| 4 | 11.81306 | 0.2241 |

**Fig. A2:** Response of *g* and *g* to *π* shocks.

**Fig. A3:** Response of *u* to *π* shocks.

**Fig. A4:** Response of *I/K* to *π* shocks.

**Fig. A5:** Response of *Y/Y\** to *π* shocks.

**Fig. A6:** Response of *g to u* shocks.

1. Economic inequality for instance, has become a prominent topic after the publication of Piketty’s (2014) book *Capital in the Twenty-First Century*. [↑](#footnote-ref-1)
2. In the light of what was reported by Blecker (2016) due to the relative closeness of the Brazilian economy we would expect a wage-led regime. However, the VAR approach is essentially a short-run methodology and, according to Blecker’s rationale it is more prone to yield profit-led results. So we cannot say beforehand the growth regime for the Brazilian economy. [↑](#footnote-ref-2)
3. In fact these authors have adopted a structural VAR approach (SVAR) in which they impose contemporaneous restrictions on the interaction of the variables. [↑](#footnote-ref-3)
4. We are using the nomenclature Post-Kaleckian growth models in reference to the third generation of KGM. In this generation, that follow the Bhaduri-Marglin’s approach, both profit-led and wage-led outcomes are possible. In the Neo-Kaleckian growth models, however, just the wage-led outcome is possible. [↑](#footnote-ref-4)
5. From the structural approach, many different papers, such as Naastepad (2006), Naastepad and Storm (2007), Ederer and Stockhammer (2007), Hein and Vogel (2008) and Stockhammer, Onaran and Ederer (2009), employed this empirical strategy. Hein and Vogel (2008) and Stockhammer (2016) provide comparative boxes of results. [↑](#footnote-ref-5)
6. Baer reports that “there is also considerable evidence that the real wages declined at first in the second half of the 1960’s and then rose at a rate substantially smaller than the rate of productivity increases.” [↑](#footnote-ref-6)
7. The estimates are performed using data up to 2008 because, to the best of our knowledge, there is no series of functional income distribution that start at least in 1970 and cover a more recent period. [↑](#footnote-ref-7)
8. According to Enders (2014, p. 290) the OLS estimates are consistent and asymptotically efficient. [↑](#footnote-ref-8)
9. The results remained virtually unchanged when we used the Normal-Wishart prior. [↑](#footnote-ref-9)
10. Capital accumulation estimates can be found in Marquetti and Porsse (2014). [↑](#footnote-ref-10)
11. Estimates to potential output were based on Shaikh-Moudud methodology, available in Bruno (2015). [↑](#footnote-ref-11)
12. This series was obtained from Institute of Applied Economic Research (IPEA) database. [↑](#footnote-ref-12)
13. The main impulse-response functions of these alternative models are available in the Appendix. [↑](#footnote-ref-13)