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Understanding the Brazilian Demand Regime: A Kaleckian Approach

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Abstract
The empirical literature on Kaleckian growth and distribution models has almost exclusively investigated developed countries. These studies have used varied econometric techniques and estimation methods, but little attention was given to the developing countries. Onaran and Galanis (2013) provide an extensive review on this literature, and they complement it by estimating models for some developing countries. Nevertheless, due to lack of data, they were unable to estimate the model for Brazil. The contribution of this paper is to expand this empirical literature by adding the results that were found for Brazil. Hence, the Brazilian demand regime is analyzed in the period of 1956-2008, with the functional distribution of income data supplied by Adalmir Marquetti (which was developed in a paper by Marquetti et al., 2010). By applying the single-equation technique in the open economy Bhaduri/Marglin model, as outlined in Hein and Vogel (2008), the results of the estimation show that the demand regime in Brazil is wage-led, both domestically and as an open economy. Therefore, increases in the profit share tend to harm the demand. Finally, based on the estimated results and findings, policy implications are drawn.

Key words: Demand-led accumulation regimes, single equation approach, wage-led, Brazil

JEL code: B50, E12, E25

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1. Introduction

The Kaleckian growth and distribution approach seems to have reached a theoretical consensus in what is sometimes called the neo- or post-Kaleckian model. Nevertheless, empirical studies have not arrived at this stage yet (Lavoie, 2011, p. 24). Particularly, there is a lack of empirical analyses on developing countries and, especially, Brazil. The main reason for this is the lack of data.

The Kaleckian approach to growth and distribution is one of the main strands of Post-Keynesianism (Lavoie, 2011, p. 19). His theory makes a natural liaison between Marx and Keynes, and also between the economists of both strands (Sardoni, 2011, p.118). An essential feature of the Post-Keynesian school of thought is that the economy is demand-led, i.e. supply merely adapts to demand (Lavoie, 2009, p. 15). This is at the core of Kalecki's and Keynes's theories of effective demand, which are very similar. Post-Keynesianism has another key characteristic that is historical and dynamic time, as well as other features belonging to heterodox economics (Lavoie, 2009, p. 15).[1] Kaleckian growth theory accounts for these features and, according to Lavoie (2009, p. 24) goes very well with econometrics, since Kalecki himself was an empirical economist.

The contribution of this paper is to expand the empirical literature on wage- and profit-led demand regimes. Benefited by the data for functional income in Brazil supplied by Marquetti, an empirical analysis was carried out. The results show that the Brazilian demand regime is wage-led, domestically and as an open economy. In an extensive empirical study on economic regimes with Kaleckian growth and distribution models, Onaran and Galanis (2013) augmented the list of developing countries. Still, due to lack of data, they were unable to estimate the model for Brazil.

This paper is structured as follows: After this introduction, a section presenting the theoretical Kaleckian growth and distribution model follows, within an open economy perspective. The third section presents the empirical analysis. Concluding remarks can be found in the final section.

2. Kaleckian distribution and growth models

According to Lavoie (2011, p. 24), there is a consensus on the theoretical framework of Kaleckian growth and distribution models, although not on empirical grounds. This section demonstrates the theoretical model applied in the estimation of the Brazilian demand regime. It is an open economy model, based on Hein and Vogel (2008).

2.1 Open economy model

In this model, the goods market equilibrium incorporates exports and imports (the difference between the former and the latter gives net exports), without the economic activity of the state. Therefore, planned saving (S) is equal to net investment (I) and net exports (NX):

$$S = I + X - M = I + NX. \tag{1}$$

When equation (1) is normalized by the real capital stock (K), it becomes;

$$\sigma = g + b. \tag{2}$$

where the goods market equilibrium is given by the saving rate ($\sigma = S/K$), the accumulation rate ($g = I/K$) and the net export rate ($b = NX/K$). Instead of just saving out of profits (S_{Π}),

[1] See Chapter 1 in Lavoie (2009) for an in-depth explanation.

saving out of wages (S_W) is also included. Equation (3) is obtained when considering: [I] the profit share is related to domestic demand, i.e. profits plus wages $(h = \Pi/(W+\Pi) = \Pi/Y)$, [II] the relation between output and potential output is the rate of capacity utilization ($u = Y/Y^P$), [III] the capital-potential output ratio is the capital stock divided by potential output ($v = K/Y^P$), and [IV] due to the retained earnings of firms, the propensity to save out of profits (s_Π) is higher than the propensity to save out of wages (s_W).

$$\sigma = \frac{S_\Pi + S_W}{K} = \frac{s_\Pi \Pi + s_W (Y - \Pi)}{K} = \left[s_W + (s_\Pi - s_W)h\right]\frac{u}{v}, \quad 0 \le s_W < s_\Pi \le 1. \tag{3}$$

Continuing with the remaining components of equation (1), the investment function is based on Bhaduri and Marglin's paper (1990). One of the main changes set by this seminal paper relies on capital accumulation being a positive function of the profit rate, which is given by the profit share, the capacity utilization and the capital-potential output ratio $(r = hu/v)$. The profit share and capital accumulation affect investment positively, considering technology is constant: [I] by increasing unit profits, i.e. a higher profit share, internal funds for investment finance are higher, causing a positive impact on investment, and [II] the positive effect of capacity utilization on investment is established because there is an improvement in the relation between expected sales and productive capacity as well as in internal funds. The condition for capital accumulation to be positive is that the expected profit rate must exceed a minimum rate (r_{min}), either the interest rate given by the financial markets or the external (foreign) profit rate. These rates are supposed to be exogenous in this model. Therefore, the accumulation equation is given by

$$g = \alpha + \beta u + \tau h, \qquad g > 0 \text{ only if } r > r_{min}. \tag{4}$$

The net export rate is negatively affected by domestic demand and positively influenced by the international competitiveness. The first is given by the relative developments of domestic and foreign demand. Net exports will decline if the rate of growth of domestic demand is higher than the rate of growth of foreign demand. Ceteris paribus, increases of the domestic rate of capacity utilization and the domestic demand will impact net exports negatively. For the international competitiveness, it is assumed that the Marshall-Lerner condition holds and the sum of the price elasticities of exports and imports is larger than unity. In this case, the real exchange rate (e_r) positively impacts the net exports. As Hein and Vogel (2008) show, the real exchange rate may be positively or negatively associated with the profit share.

$$b = \psi e_r(h) - \phi u \tag{5}$$

The saving rate must respond more elastically to changes in capacity utilization, the endogenous variable, than the rate of accumulation and the net export rate together, in order to maintain the stability of the goods market equilibrium. This may be written as

$$\frac{\partial \sigma}{\partial u} - \frac{\partial g}{\partial u} - \frac{\partial b}{\partial u} > 0 \Rightarrow \left[s_W + (s_\Pi - s_W)h\right]\tfrac{1}{v} - \beta + \phi. \tag{6}$$

Equilibrium (*) values for capacity utilization and the growth rate are given, correspondingly,

$$u^{*} = \frac{\alpha + \tau h + \psi e_r(h)}{\left[s_W + (s_\Pi - s_W)h\right]\frac{1}{v} - \beta + \phi}, \tag{7}$$

$$g^{*} = \alpha + \frac{\beta\left[\alpha + \tau h + \psi e_r(h)\right]}{\left[s_W + (s_\Pi - s_W)h\right]\frac{1}{v} - \beta + \phi} + \tau h \tag{8}$$

Accordingly, equilibrium capacity utilization generates the equilibrium activity with the given productive capacities, and equilibrium capital accumulation defines the expansion of potential output or productive capacities. When differentiated with respect to the profit share, both equations (7) and (8) yield, respectively,

$$\frac{\partial u}{\partial h} = \frac{\tau - (s_\Pi - s_W)\frac{u}{v} + \psi\frac{\partial e_r}{\partial h}}{\left[s_W + (s_\Pi - s_W)h\right]\frac{1}{v} - \beta + \phi}, \tag{9}$$

$$\frac{\partial g}{\partial h} = \frac{\tau\left(\frac{s_W}{v} + \phi\right) + (s_\Pi - s_W)\left(\tau\frac{h}{v} - \beta\frac{u}{v}\right) + \beta\psi\frac{\partial e_r}{\partial h}}{\left[s_W + (s_\Pi - s_W)h\right]\frac{1}{v} - \beta + \phi}. \tag{10}$$

Equations (9) and (10) are used to generate the effect of a change in the profit share on equilibrium domestic economic activity, measured by the rates of capacity utilization and capital accumulation in the theoretical model. Correspondingly, these equilibriums are used in empirical analyses to determine if a country has wage- or profit-led demand and wage- or profit-led growth. For equation (9), when profits are privileged by redistribution, the numerator shows three main effects. The first affects it positively via the investment demand (τ), the second is a negative effect by means of the consumption demand [$-(s - s_W)u/v$], and, lastly, the next effect relies on the net exports, but it is unknown in which direction it could take [$\psi(\partial e_r/\partial h)$]. Regarding equation (10), a very similar situation to the one just presented is found. In brief, three effects on its numerator: a positive effect via higher unit profits [$\tau(s_W/v + \phi)$], an indirect negative or positive effect via capacity utilization and consumption demand [$(s - s_W)(\tau h/v - \beta u/v)$] and another indirect positive or negative effect through net exports [$\beta\psi(\partial e_r/\partial h)$].

Table 1 shows a summary regarding the effects of a change in profit share on aggregate demand and economic growth.

Table 1. *Distinct concepts of the effects on aggregate demand (u) and growth rate (g)*

Concept	Verbal definition	Equation
Wage-led aggregate demand (*stagnationism*)	Capacity utilization and profit share are inversely related	$\frac{\partial u}{\partial h} < 0$
Profit-led aggregate demand (*exhilarationism*)	Capacity utilization and profit share are positively related	$\frac{\partial u}{\partial h} > 0$
Wage-led growth	Capital accumulation rate or the growth rate and profit share are inversely related	$\frac{\partial g}{\partial h} < 0$
Profit-led growth	Capital accumulation rate or the growth rate and profit share are positively related	$\frac{\partial g}{\partial h} > 0$

Source: *Adapted from Table 8.1 in Blecker (2002, p. 134).*

This paper aims to estimate the effects of a change in distribution (via profit share) on the components of aggregate demand (consumption, investment and net exports). Before the empirical part, the following section elaborates a literature review on Kaleckian distribution and growth models estimated for Brazil.

3. Literature review on previous empirical results for Brazil

It seems that the first attempt to determine an economic regime using Bhaduri and Marglin's approach (1990) is a paper by Bowles and Boyer (1995), in which they apply the single equation method (Hein and Vogel, 2009). Indeed, since then, there has been an increase in the number of studies testing empirically the existence of different types of demand and growth regimes for many developed countries[2] and only a few developing countries. The most plausible explanation for this discrepancy is data availability. While for developed countries data for this kind of study is widely available, accounting for greater periods of time, which is required for non-spurious time-series econometrics, there is great lack in the amount and also the proportion of data that is official for almost all developing countries. Still, researchers find ways to gather good and reliable data to look for the growth regimes of developing countries. As for Brazil, to my knowledge, there are at least two main papers/studies: Bruno (2003) and Araújo et al. (2011).[3] This literature review consists in examining the results and the econometric structure/method of these studies.

These two papers aim to show the interaction between distribution, aggregate demand and accumulation with econometric tools. All aim to answer the question of whether the demand-led growth regime in Brazil is wage-led or profit-led, and they all use single equation models. The first study examined here, and maybe the first attempt to classify econometrically the growth regime in Brazil, is Bruno (2003). The author proposes an analysis based not only on econometric models, but also other empirical methods, which he elaborates by himself using data supplied by official Brazilian sources. Despite the fact that the paper does not give any information on the econometric method, showing only the final results, it represents a pioneer study. However, it lacks robustness in its results, too, because the author elaborated the regressions with only few observations (less than 20 in one case, in the period from 1991-2001). By dividing its period into three, the main results may be summarized as follows: [I] from 1945 to 1974, wage-led growth (result obtained without any

[2] For a recent literature review for developed economies, using single equation models, check Hein and Vogel (2008).

[3] Oreiro and Araújo (2013) estimate the accumulation regime in Brazil with the Goodwin approach. Their results cannot be confronted here due to the difference in theoretical approache.

econometric estimation), [II] from 1970 to 1990, profit-led growth, and, [III] from 1991 to 2001, wage-led growth. The findings accomplished by the author are summarized in Table 2, jointly with a summary of the main findings by the other two papers.

Bruno (2003) and Araújo et al. (2011) have almost identical theoretical models and estimation strategies. Apparently, the latter show more robustness in their econometric model, that is to say, at least it presents a significant number of observations (the period is 2002-2008, but with quarterly data, instead of annual data as presented by the former). While considering a closed economy, wage-led growth is found for Brazil, however, when the model incorporates open economy features the accumulation regime turns profit-led. This paper also has problems with transparency; it is not possible to identify the method used to estimate the equations, or glean any further information about it.

Table 2. *Overview of empirical studies on distribution and growth in Brazil*

Author	Function		Growth Regime
Bruno (2003)	Savings: Investment: Net exports:	$S = f(\Pi, W)$ $I/K = f(r_{-1}, u_{-1})$ $NX = f(h_{-1}, u_{-1}, e_{-1})$	Profit-led (1970-1990) Wage-led (1991-2001)
Araújo et al. (2011)	Savings: Investment: Net exports:	$S = f(\Pi, W)$ $I/K = f(r_{-1}, u_{-1})$ $NX = f(h_{-1}, u_{-1}, e_{-1})$	Wage-led (closed ec.) Profit-led (open ec.) [2002-2008, quarterly]

Source: Author's own elaboration.

The results for Araújo et al. (2011) differ from Bruno's (2003). However, it is quite difficult to deal with the comparison of these studies without getting into the details of the robustness of their estimations. These studies were only published at conferences and events, to the best of my knowledge. Therefore, they are considered works in progress, but indeed have contributed to expand the debate of different demand-led growth regimes in developing countries. Thus, my research aims to further expand this debate, especially, and almost uniquely, for the Brazilian case. The next section demonstrates the empirical analysis employed for Brazil in this paper.

4. Empirical analysis for Brazil

4.1 Data and trends

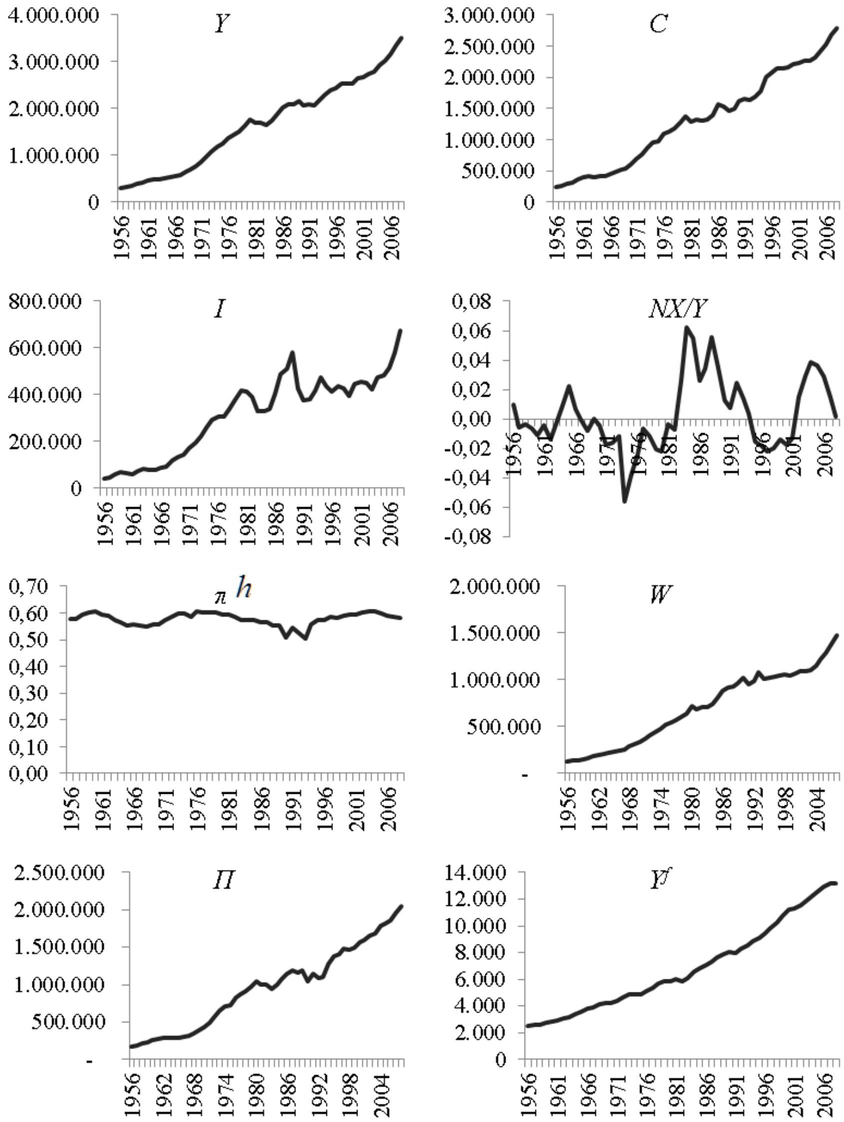
Table 3 displays information about the data gathered for this study, which includes annual data for the period 1956-2008.

Table 3. *Variable notations, descriptions and sources*

Notation	Description	Source
Y	GDP, real	IPEA (2012)
C	Final consumption, real	IPEA (2012)
I	Investment, real	IPEA (2012)
NX	Net exports, real (Exports minus Imports)	IPEA (2012)
h	Profit share	Marquetti (2011)
W	Wages	Marquetti (2011)
Π	Profits	Marquetti (2011)
Y^f	Foreign GDP, real (here: US GDP)	BEA (2012)

Notes: All variables are in Brazilian *real* (R$), except for the profit share (*h*), net exports as a share of domestic GDP, and foreign GDP (Y^f), which are, respectively, ratios and in billions of US dollars (US$).

Figure 1. *Plot of the variables used in the empirical analysis, 1956-2008*



Source: Elaborated by the author using data supplied by the sources described in Table 3.

Some auxiliary information on the calculation of the wage share by Marquetti (2011) needs to be stressed. The data supplied by him is an update of the data found in Marquetti et al. (2010). The focus of this article is the profit rate, however, from its decomposition it is possible to obtain the profit share. Further details on the way they calculated and created this database are in the Appendix of Marquetti et al. (2010). Figure 1 illustrates time-series plots of the variables included in this empirical analysis.

Besides the profit share and the net exports as a share of GDP, all variables show an upward trend from 1956 to 2008. In addition, despite the uniform rising movement of variables Y, C and Y^f, although with some smaller oscillations throughout the period, other variables show more abrupt breaks and deserve further comments. As for investment, there was a boom in investment from the late 1950s until the beginning of the 1980s. This was mostly due to the process of import substitution industrialization (ISI), which first focused on industrial goods and later on intermediate goods, while simultaneously developing the infrastructure in Brazil, e.g. massive public investments in energy production (Marquetti et al., 2010; Baer, 2008, p. 385). High inflation allowed for transferring resources from traditional sectors (agriculture and industry) to services in the 1980s (Baer, 2008, p. 391). The

1980s also accounted for the debt crisis, with substantial drops in the amounts of domestic and foreign saving (Baer, 2008, p. 89), which caused strong impacts on the aggregate demand of the period. The late 1980s and the early 1990s was a period of hyperinflation and increases in consumption spending which fueled investments. It is noteworthy that due to the flow of monetary resources from the productive sector of the economy to the domestic financial system (its share in the GDP more than doubled in the 1980s), a sharp drop in investment occurred in the beginning of the 1990s (Baer, 2008, p. 119).

The period of hyperinflation was associated with stagnating profits (Π) in this same period, as well as with low economic activity. In fact, much of the analysis done for investment is also applicable to the other variables that show breaks in the upward trend. The launch of the Real Plan (*Plano Real*) released a new currency and stopped the hyperinflationary process. In the 1990s, the profit share regained the losses associated with inflation in the previous period, and have so far remained stable, at around 0.55. The halt to high inflation came with a cost. Because of the fully neoliberal agenda adopted, the Brazilian economy failed to regain the dynamism (Marquetti et al., 2010) demonstrated in the middle of the twenty century. In Lula's government (which took office in 2003), investment and wages show a rapid increase. Strong commitment to orthodox policies, which made entrepreneurs happy to continue investing, and income policies contributed to the 'success' of Lula's terms.[4] Nevertheless, his approach of growing the pie to redistribute later was problematic (see Baer, 2008, p. 174) because of the negative effects on distribution of income.

Last but not least, a few words on net exports are required. In the ISI period, Brazil tended to ban imports of any goods, and by doing this, it wanted to supply its domestic market with anything it needed. In this period, exports, and international trade in general, were neglected, putting the country in a risky balance-of-payments position. From the end of the 1960s until the early years of the 1980s, exchange rate problems and an outward-looking policy, aiming at a more open economy, caused massive inflows of imports (primary materials, intermediate and capital goods, that were being forbidden by the ISI program). During the 1980s, in order to ease the effects of the debt crisis, export-oriented policies were put in action; many imports restrictions were also lifted. All over the 1990s, fluctuations and deficits were seen because of the re-opening of the economy (Baer, 2008, pp. 179-182). A boom in commodity prices, mainly driven by China's growth, marked the beginning of the twenty-first century. The surplus started collapsing with an increase in imported goods. These are just a few comments to give a broad idea, without going into the details of the consequences for income distribution and on what happened in the Brazilian economy during these years.[5]

4.2 Method

Basically, the method followed is called the single equation estimation approach. A very clear explanation of the details of this approach can be found in the Appendix of Hein and Vogel (2009), this part of the study follows this paper and also Hein and Vogel (2008). This research follows their explanation to demonstrate how the type of demand regime is derived from a demand-led growth and distribution model. Within this line, each component on the right hand side of equation (11) is estimated separately and generates the partial effects; later they are summed up to reach an answer about the classification of the demand regime. This differs from simulation models that account for possible deficiencies related to the fact that in single equation models the interaction between the demand components are left aside (Hein

[4] President Lula was reelected in 2006 and stayed in power until 2010.
[5] Check Baer (2008) for a very detailed and critical assessment of the economic history of Brazil.

and Vogel, 2009). Nevertheless, the single equation estimation approach is a valid approach and has been widely used in the literature.

$$\frac{\partial Y/Y}{\partial h} = \frac{\partial C/Y}{\partial h} + \frac{\partial I/Y}{\partial h} + \frac{\partial NX/Y}{\partial h}. \tag{11}$$

Following the reasons outlined earlier for the Kaleckian distribution and growth model, the expected signs for each component of this equation are:

$$\frac{\partial C/Y}{\partial h} < 0(-), \frac{\partial I/Y}{\partial h} > 0(+), \frac{\partial NX/Y}{\partial h} = (?) \Rightarrow \frac{\partial Y/Y}{\partial h} = (?) \tag{11a}$$

In the end, there are two possible results for the demand regime, shown as

$$[\text{I}]\ \frac{\partial Y/Y}{\partial h} < 0, \text{wage-led demand, and } [\text{II}]\ \frac{\partial Y/Y}{\partial h} > 0, \text{profit-led demand.} \tag{11b}$$

Before continuing to the final outputs of the model estimations and the computation and explanation of the partial effects for each component, unit roots are computed to check whether the time-series variables are stationary or not. The test applied is the Augmented Dickey-Fuller test, and Table 4 presents the results. Logarithms are used in order to linearize the variables and to obtain percentage changes in the results.

Table 4. *Unit root tests*

	Levels				***Differences***				
Variable	**Specif.**	**Stat.**	**Lags**	**Sig.**	**Specif.**	**Stat.**	**Lags**	**Sig.**	**Order**
log(Y)	c, t	-1.6606	1	-	c	-2.6717	1	*	I(1)
log(C)	c, t	-1.3525	0	-	c	-5.0651	0	***	I(1)
log(I)	c, t	-1.8648	0	-	c	-5.2141	0	***	I(1)
NX/Y	c	-2.8523	0	*	-	-	-	-	I(0)
h	c	-2.2355	0	-	c	-8.1882	0	***	I(1)
log(W)	c, t	-1.3793	0	-	c	-5.0805	0	***	I(1)
log(Π)	c, t	-1.4766	0	-	c	-3.2183	1	**	I(1)
log(Y^f)	c, t	-1.6828	0	-	c	-5.7978	0	***	I(1)

Notes: c and t are notations for constant and trend, respectively. *, **, and *** stand for 10%, 5% and 1% levels of statistical significance, correspondingly. Levels show the test applied to the variable in level, and Differences for variables differentiated one time. The order of integration is displayed in the last column.

The null hypothesis for the unit root tests is that there is the presence of unit roots. Consequently, by not rejecting the null hypothesis, the series is not stationary and it must be differentiated once to become stationary, thus eliminating spurious regressions. The order of integration (I) states how many times the series has to be differentiated in order to become stationary (Brooks, 2008, p. 319 and 326). The only variable that was not differentiated, and is stationary in level, is the profit share. For the remaining variables, the unit root tests say that these variables become stationary in first differences, when the null hypothesis in the unit root test is rejected. With stationary variables, the regressions are not going to present spurious results caused by the presence of unit roots, unless they show a long-run relationship. To solve this problem, Engle and Granger (1987) proposed a test for cointegration, which is the idea behind this long-run movement in harmony between the time-series variables (Baltagi, 2011, pp. 384-386). In order to avoid this problem, this test is computed and, in case, an error-correction model is estimated to deal with it.

4.3 Model estimation

The first equation to be estimated is the consumption function. Consumption is a function of profits (Π) and wages (W); since the variables are in logarithms, elasticities are shown as results:

$$C = f(\Pi, W), \tag{12}$$

$$d[\log(C_t)] = \text{constant} + \alpha_1 d[\log(\Pi_t)] + \alpha_2 d[\log(W_t)] + \varepsilon_t, \tag{13}$$

where ε_t is the residuals of the estimated equation. Since the variables are I(1), a cointegration test was computed to check for a possible long-run relationship. The results are shown in Table 5.

Table 5. *Cointegration test for the equation (13)*

Test	Test statistic (*t*)	Critical value (*c*)	Result
Engle-Granger	-3.1943	-3.4380	No cointegration ($t > c$)

Notes: Critical values for this test are taken from Patterson (2000, p. 332). The null hypothesis (H_0) stands for no cointegration. Then, if t is larger than c, H_0 cannot be rejected.

Without cointegration, the model was estimated in first differences. Table 6 displays the results.

Table 6. *Regression results for the consumption equation*

Variable	Coefficient	Standard error	p-value (sig.)
Constant	0.0018	0.0081	0.8226
α_1	0.4570	0.1336	0.0013 (***)
α_2	0.4780	0.1003	0.0000 (***)
Adjusted-R^2		0.5642	
DW-statistic		2.0233	
		Additional tests	
Test	**Statistic**	**p-value**	**Decision**
Autocorrelation	0.0119	0.9134	No autocorrelation
White's test	24.1913	0.0002	No homoscedasticity
Breusch-Pagan	16.4964	0.0003	No homoscedasticity
ARCH(2)	0.3804	0.8268	No heteroscedasticity
RESET	1.2050	0.3088	Right specification

Notes: The estimation strategy used for consumption follows a stepwise approach. Initially, the model is estimated by OLS (Ordinary Least Squares). The test values for autocorrelation are calculated based on this model and shown in the table. Secondly, heteroscedasticity tests were computed on this model (and results are supplied on the table). If any test shows there is autocorrelation present or absence of homoscedasticity, the model is estimated with robust standard errors for heteroscedasticity correction. The final test is the Ramsey's RESET test, which was calculated specified for squares and cubes and it states if the model is well specified or not. Sig. with *, **, and *** denotes 10%, 5% and 1% levels of statistical significance, correspondingly. A similar approach is used in the investment and net exports function.

All standard tests performed for the regression of the consumption function point to robust results. However, the coefficients are only showing the elasticities. For example, α_1 shows that if profits increase by one percentage point, there is an increase of around 0.46% in consumption. Similarly, the same increase in wages would increase consumption by 0.48%. Since this is just an elasticity, e.g. $\alpha_2 = (\partial C/C)/(\partial W/W)$, the partial effects must be calculated to obtain the contribution of consumption to GDP growth with respect to a change in the profit share. This is done using the equation given as

$$\frac{\partial C/Y}{\partial h} = \alpha_1 \frac{C}{\Pi} - \alpha_2 \frac{C}{W}, \tag{14}$$

where C, Π and W are the mean of the time-series consumption, profits and wages, respectively. Table 7 shows the results.

Table 7. *Calculation of the partial effect for the consumption function*

C/Π	***C/W***	**α_1(*C/Π*)**	**α_2(*C/W*)**	**(∂*C/Y*)/∂*h***
1.3877	1.9013	0.6342	0.9088	-0.2747

When there is a one percentage point rise in the profit share, consumption falls by 0.27% of GDP. This is so because the propensity to consume out of wages is higher than the propensity to consume out of profits, which confirms the assumptions being made in the theoretical Kaleckian and post-Keynesian models. Results found in Bruno (2003) and Araújo et al. (2011) may not be confronted with these results because they do not estimate these partial effects.

The second estimated equation is the investment function. Investment is a function of the log of GDP, as a proxy for capacity utilization (Y), and the profit share (h). In the same way, as represented in Hein and Vogel (2008), the rate of interest would have to be included, but this is not possible for Brazil due to the lack of sufficient data for the time period analyzed. Thus, the attempt here uses the following equations:

$$I = f(Y, h), \tag{15}$$

$$d[\log(I_t)] = \text{constant} + \lambda_1 d[\log(Y_t)] + \lambda_2 d(h_t) + \varepsilon_t. \tag{16}$$

All variables in equation (16) are I(1), and consequently, Table 8 shows the results for the Engle-Granger cointegration test.

Table 8. *Cointegration test for the equation (16)*

Test	**Test statistic (*t*)**	**Critical value (*c*)**	**Result**
Engle-Granger	-2.2345	-3.4380	No cointegration ($t > c$)

Notes: Check Table 5 for the details of this test.

The test result does not yield a result that shows the presence of cointegration, that is to say, variables are not moving together in an upward trend. Results of regressions based on equation (16) did not present any plausible result, even when lags of the independent and dependent variables are added. Therefore, instead of the profit share, we changed it for the profits variable (Π), as it was already put into practice by Hein and Vogel (2008, 2009) and Stockhammer et al. (2009). This approach may be shown as

$$I = f(Y, \Pi), \tag{17}$$

$$d[\log(I_t)] = \text{constant} + \delta_1 d[\log(Y_t)] + \delta_2 d[\log(\Pi_t)] + \varepsilon_t. \tag{18}$$

Same as for the previous investment equation, cointegration tests have to be computed because the variables are not stationary in levels (see results in Table 9).

Table 9. *Cointegration test for the equation (18)*

Test	Test statistic (*t*)	Critical value (*c*)	Result
Engle-Granger	-5.7117	-3.4380	Cointegrated ($t < c$)

Notes: Check Table 5 for the details of this test.

To correct for the presence of cointegration, an error-correction model was estimated, following the explanation in Brooks (2008, pp. 335-343). The outcome of the regression did not show any statistically significant result. Lastly, an alternative model was estimated, using as the dependent variable the investment as a ratio of GDP, (*I/Y*) (Hein and Vogel, 2009). The final estimated equation takes the following form and results are reported in Table 10:

$$\frac{I_t}{Y_t} = \text{constant} + \beta_1 d[\log(Y_t)] + \beta_2 h_t + \beta_3 \frac{I_{t-1}}{Y_{t-1}} + \beta_4 h_{t-1} + \varepsilon_t. \tag{19}$$

Table 10. *Regression results for the final investment equation*

Variable	Coefficient	Standard error	p-value (sig.)
Constant	0.0244	0.0561	0.6657
β_1	0.1160	0.0542	0.0375 (**)
β_2	0.0646	0.1629	0.6936
β_3	0.8682	0.0649	0.0000 (***)
β_4	−0.0720	0.1509	0.6353
Adjusted-R^2		0.7209	
DW-statistic		1.6219	
		Additional tests	
Test	**Statistic**	**p-value**	**Decision**
Autocorrelation	2.6354	0.1113	No autocorrelation
White's test	34.0515	0.0020	No homoscedasticity
Breusch-Pagan	14.4557	0.0060	No homoscedasticity
ARCH(1)	11.9702	0.0005	No homoscedasticity
RESET	2.4806	0.0951	Right specification

Notes: According to the RESET test, the specification of the model is only adequate if a 5% level of statistical significance is considered. Due to the presence of heteroscedasticity, this model was estimated with robust standard errors. *, **, and *** correspond to the levels of statistical significance 10%, 5% and 1%, correspondingly.

It is not possible to calculate the partial effect of a change in the profit share on the GDP growth contribution of investment because the profit share variables are not statistically significant. Normally, increases in the profitability of firms, measured as the profit share or profits, would have a positive effect on investment (Hein and Vogel, 2009). Bruno (2003) and Araújo et al. (2011) find significant results for this equation but their methods are questionable. It seems that due to structural changes in the Brazilian economy, some breaks in the time-series could change the results. Another important determinant that might be lacking to make the regression work is the rate of interest.[6] With one of the highest real interest rates in the world, entrepreneurs would not invest in Brazil without considering these costs. Finally, neither of these suggestions to solve the problem in the investment equation was taken into account here because there was not enough available data to do so.

The net exports function is the last equation to be estimated. As demonstrated in the theoretical model, the main variable (dependent) is the net exports as a ratio of GDP. This variable is stationary in level, but the others variables (independent) in equation 20 need to be differentiated to become stationary. Therefore, any cointegration test is invalidated. As shown in Hein and Vogel (2009), net exports are a function of foreign GDP[7] and the profit share. As outlined in the theoretical model, the partial effect of a change in the profit share on the GDP contribution of net exports has an unknown expected sign.

$$\frac{NX_t}{Y_t} = \text{constant} + \chi_1 d[\log(Y)] + \chi_2 d(h_t) + \chi_3 d[\log(Y^f)] + \varepsilon_t. \qquad (20)$$

This equation represents the one that gave the best and most plausible results of the attempts. Among these, regressions using the net exports as the dependent variable were tried, as well as exports and imports as a ratio of GDP estimated separately as dependent variables. In addition, for the independent variables, lagged variables were added to achieve better results (these maneuvers follow the same sources mentioned earlier). In Table 11, the results for the best fit estimation of the net exports equation are displayed.

Table 11. *Regression results for the final net exports equation*

Variable	Coefficient	Standard error	p-value (sig.)
Constant	0.1421	0.0772	0.0716 (*)
χ_1	−0.1399	0.0821	0.0948 (*)
χ_2	−0.2452	0.1348	0.1015 (approximately. *)
χ_3	0.2800	0.1489	0.0662 (*)
Adjusted-R^2		0.1493	
DW-statistic		0.4683	
		Additional tests	
Test	**Statistic**	**p-value**	**Decision**
Autocorrelation	70.3876	0.0000	Autocorrelation present
White's test	6.3950	0.6998	No heteroscedasticity
Breusch-Pagan	2.6426	0.4501	No heteroscedasticity
ARCH(4)	13.8823	0.0002	No homoscedasticity
RESET	0.2230	0.8010	Right specification

Notes: Due to the presence of autocorrelation, the model was estimated to correct for it (estimation with robust standard errors). *, **, and *** correspond to the levels of statistical significance 10%, 5% and 1%, correspondingly.

The results are as expected: [I] there is a negative relationship between net exports to GDP and domestic GDP (lagged effect), when the latter increases by one percentage point the

[6] See Feijó et al. (2015).

[7] In this paper, this is given by the output (GDP) of the biggest Brazilian trade partner. We also tried other regressions to add the GDP of the European Union and Argentina, both among the top 3 of the biggest trade partners, but none of these attempts showed reasonable results.

former decreases by 0.14%; and [II] net exports to GDP increases by 0.28% when foreign demand rises one percentage point. Regarding the partial effect of the profit share on the net exports as a ratio of GDP, it is given by:

$$\frac{\partial \frac{NX}{Y}}{\partial h} = \chi_2 . \tag{21}$$

According to equation (21), a one percentage point increase in the profit share decreases the net exports to GDP ratio by 0.24 of a percentage point, approximately. In the presented theoretical model, there is only one possible meaning for this result: the indirect effect of net exports in equation (32) is negative (the term is $[\beta\psi(\partial e_r / \partial h)]$). With this result, according to Hein and Vogel (2008), changes in the profit share which affect net exports negatively, seem to be driven by changes in the mark-up and its determinants (degree of price competition, power of trade unions, overhead costs) and not by nominal wages or changes in the nominal exchange rate. There may also be some other explanations for this negative relationship. One explanation for this is that during this period many multinational companies have installed their facilities in Brazil not just to profit from the expanding domestic market, but also to obtain cheap resources for export goods (Amal et al., 2009). Therefore, as an export platform for foreign companies, a negative relation between the domestic profit share and net exports is possible. Exchange rate overvaluation, i.e. the "Dutch disease" (Bresser-Pereira, 2010, p. 148), or rapid financial liberalization (Carvalho, 2008, p. 138), may have had a role to play, too. Hence, a deeper analysis of this would be necessary, however it was not possible to achieve this in this study.

With all equations estimated and the partial effects taken, it is possible to classify the demand regime in Brazil. In Table 12, the partial effects of changes in the profit share on the aggregate demand components (consumption, investment and net exports) are summed to generate the final effect.

Table 12. *Final effect*

Equation	Value
$(\frac{\partial C}{Y})/\partial h$	-0.2747
$(\frac{\partial I}{Y})/\partial h$	/
$(\frac{\partial NX}{Y})/\partial h$	-0.2452
$(\frac{\partial Y}{Y})/\partial h$	**-0.5199**

Notes: No significant result was found for the investment equation.

From both domestic and open economy perspectives, the demand regime for Brazil is characterized as wage-led. It is a quite strong final effect; an increase of one percentage point in the profit share decreases aggregate demand by around 0.52 percentage points of GDP. The domestic effect of an increase of the profit share by 1% reduces GDP by 0.27%. The result obtained by Araújo et al. (2011) for the open economy is thus contradicted. However, for the domestic analysis both studies classify Brazil as wage-led. For the pioneer study of Bruno (2003), the results are partially different, too. On the one hand, according to that study, Brazil is profit-led in the period from 1970 up to 1990. Nevertheless, on the other hand, Brazilian economy is wage-led in a more recent period, from 1991 to 2001. The next section explores the policy implications based on these findings.

5. Conclusions

In this paper a Kaleckian growth and distribution model was estimated for Brazil. The results point to a wage-led demand regime. This result is confirmed for the domestic economy, which accounts for only consumption and investment as aggregate demand components. When net exports are added, giving the aggregate demand function an open economy feature, the Brazilian demand regime continues to be wage-led. This confirms that an increase in the profit share leads to a reduction in aggregate demand, i.e. wage-led demand. In other words, redistribution of income from profits to wages would give the economy a more robust aggregate demand (e.g. more stable, equitable and sustainable). When compared to other empirical studies on Brazil, there is no consensus regarding the Brazilian demand regime. As it was demonstrated in Section 3, results differ when different econometrics methods and time periods are applied. Finally, with respect to economic policies, if the results presented in this study prove to be robust, Brazil could focus on increasing the labor income share without hurting aggregate demand growth. Therefore, so far Brazilian economic policies have been misguided. Instead of trying to tame inflation only, with the inflation-targeting regime, Brazilian policymakers rather need to focus on income distribution, aggregate demand and employment.

References

Amal, M., Raboch, H., Tomio, B.T. (2009). Strategies and Determinants of Foreign Direct Investment (FDI) from Developing Countries: Case Study of Latin America, *Latin American Business Review*, 10 (2 and 3): 73-94.

Araújo, E., Gala, P., Bruno, M. (2011). Economic growth regimes in Brazil: empirical evidence and policy implications, paper presented at *8th International Conference: Developments in Economic Theory and Policy*, Bilbao. http://goo.gl/gJUfL (date of access: 20.11.2011).

Baer, W. (2008). *The Brazilian Economy*: Growth and Development, Sixth edition, London: Lynne Rienner Publishers.

Baltagi, B.H. (2011). *Econometrics*, Springer texts in business and economics, Fifth Edition, Berlin: Springer.

BEA (2012). *Bureau of Economic Analysis* (BEA), January 2012. http://www.bea.gov/national/ (date of access: 03.01.2012).

Bhaduri, M., Marglin, S. (1990). Unemployment and the real wage: the economic basis for contesting political ideologies, *Cambridge Journal of Economics*, 14 (4): 375-393.

Blecker, R.A. (2002). Distribution, demand and growth in neo-Kaleckian macro-models, in: Setterfield, M. (ed.), *The Economics of Demand-Led Growth*, Cheltenham: Edward Elgar.

Bowles, S., Boyer, R. (1995). Wages, aggregate demand, and employment in an open economy: an empirical investigation, in: Epstein, G.A., Gintis, H.M. (eds.), *Macroeconomic Policy after the Conservative Era*, Cambridge, Cambridge University Press.

Bresser-Pereira, L.C. (2010). *Globalization and Competition*: Why Some Emergent Countries Succeed while Others Fall Behind, New York: Cambridge University Press.

Brooks, C. (2008). *Introductory Econometrics for Finance*, Second Edition, Cambridge: Cambridge University Press.

Bruno, M. (2003). Regimes de crescimento, mudanças estruturais e distribuição na economia brasileira (1970-2001), paper presented at Anais do *VIII Encontro Nacional de Economia Política*, Florianópolis. http://goo.gl/crUD0 (date of access: 20.11.2011).

Carvalho, F.C. (2008). Financial Liberalization in Brazil and Argentina, in: Arestis, P. and Paula, L.F. (eds.), *Financial Liberalization and Economic Performance*, New York: Palgrave Macmillan.

Engle, R.F., C.W.J. Granger (1987). Co-integration and error correction: Representation, estimation and testing, *Econometrica*, 55 (2): 251-276.

Feijó, C.A., Lamonica, M.T., Bastos, J.C.A. (2015). Accumulation pattern of the Brazilian economy in the 1990s and 2000s, *International Review of Applied Economics*, 29(1), 15-31.

Hein, E., Vogel, L. (2008). Distribution and growth reconsidered – empirical results for six OECD countries, *Cambridge Journal of Economics*, 32 (3): 479-511.

Hein, E., Vogel, L. (2009). Distribution and growth in France and Germany: Single Equation Estimations and Model Simulations Based on the Bhaduri/Marglin Model, *Review of Political Economy*, 21 (2): 245-272.

IPEA (2012). *IPEAdata macroeconomic database*, January 2012. http://www.ipeadata.gov.br/ (date of access: 03.01.2012).

Lavoie, M. (2009). *Introduction to Post-Keynesian Economics*: with a new Postface on the subprime financial crisis, London: Palgrave Macmillan.

Lavoie, M. (2011). History and methods of post-Keynesian economics, in: E. Hein, E. Stockhammer (eds.), *A Modern Guide to Keynesian Macroeconomics and Economic Policies*, Cheltenham: Edward Elgar.

Marquetti, A.A. (2011). Wage share historical data for Brazil, unpublished data obtained directly from the author by e-mail (aam@pucrs.br). A copy of the exchanged correspondence can be sent upon request (date of exchanged correspondence: 16.08.2011).

Marquetti, A.A., Maldonado Filho, E.A.L, Lautert, V. (2010). The Profit Rate in Brazil, 1953-2003, *Review of Radical Political Economics*, 42 (4): 485-504.

Onaran, Ö., Galanis, G. (2013). Is aggregate demand wage-led or profit-led? A global model, in: M. Lavoie, E. Stockhammer (eds), *Wage-led Growth: An Equitable Strategy for Economic Recovery*, Basingstoke, UK: Palgrave Macmillan.

Oreiro, J.L., Araújo, E. (2013). Exchange rate misalignment, capital accumulation and income distribution: theory and evidence from the case of Brazil, *Panoeconomicus*, 60(3), 381.

Patterson, K. (2000). *An Introduction to Applied Econometrics*: A Time-Series Approach, London: Palgrave.

Sardoni, C. (2011). *Unemployment, Recession and Effective Demand*: The Contributions of Marx, Keynes and Kalecki, Cheltenham: Edward Elgar.s

Stockhammer, E., Onaran, Ö., Ederer, S. (2009). Functional income distribution and aggregate demand in the Euro area, *Cambridge Journal of Economics*, 33 (1): 139-159.

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