The Economics of Demand Led-Growth

Theory and Evidence for Brazil[♣]

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Abstract: The objective of the present article is to present the theory of demand-led growth and some econometric evidence of the existence of a demand-led growth regime for the Brazilian economy. Initially, we will do a brief review of the theory of demand-led growth, based on Kaldor's (1988) contribution for the theme. According to Kaldor, long-run growth is determined by the sum of the growth rate of government consumption spending and the growth rate of exports. Based on the methodology developed by Atesoglu (2002), we run some econometric tests for the hypothesis of a demand-led growth regime for the Brazilian economy. The results of the tests show that almost 95% of the growth rate of real GDP in the period 1990-2005 is explained by variables at the demand side of the economy. The econometric tests also show that natural growth rate of the Brazilian economy is endogenous, being determined by the growth rate of aggregate demand.

Key-words: Economic growth, Aggregate demand, Exports.

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1 – Introduction.

In the last 25 years, the Brazilian economy is growing at an average rate of 2.6% per year, a rate considerably lower than the average growth rate in the period 1950-1980 and lower than the average growth rate observed in other emergent economies like Russia, China and India. Considering that the rate of growth of population is near by 1.5% per year, GDP per-capita growth rate is near by 1% per year. At this speed, it will take almost 70 years for Brazilian GDP per-capita to reach the current levels of GDP per-capita observed in Spain or Portugal. So we can conclude that Brazilian economy is now in a situation of *near-stagnation*.

In the end of 1980 and beginning of 1990, this situation of *near-stagnation* was considered to be the result of the persistent high inflation observed in the Brazilian economy. For instance, in March of 1990, in the last month of President Sarney term, the inflation rate was 72% per month, defining a situation of hyper-inflation (cf. Bresser-Pereira, 2004, p.282). The end of hyper-inflation and the reduction of inflation levels to less than 10% per year were obtained after the successful implementation of Plano Real during President Fernando Henrique Cardoso first term. This process, however, was the result of the adoption of an exchange-rate anchor for inflation, namely a crawling-peg exchange rate regime from 1995 to 1998.

Stabilization was not followed by a persistent acceleration of growth. The growth acceleration observed in the first two years of Plano Real – when the average growth rate goes up to almost 5% per year – came to an end due to the effects of the external crisis in Mexico, East Asia and Russia.

In the beginning of 1999, after a huge loss of international reserves caused by a *sudden stop* in capital flows to the Brazilian economy caused by a lack of confidence in the sustainability of the Brazilian exchange rate regime, Monetary authorities in Brazil adopted a flexible exchange rate regime.

The new macroeconomic model was completed in 1999 with the adoption of an *Inflation Targeting* regime enhanced with a fiscal policy orientated for the generation of substantial primary surpluses in order to avoid the explosion of public debt as a ratio to GDP.

The new macroeconomic model allowed a significant reduction of real interest rates – from a level of almost 25% per year in the period 1994-1998 to near 10% per year in the period 1999-2005 – and a devaluation of real exchange rate which was of fundamental importance for the elimination of current account deficits observed in the period 1994-1998, that reach a level of almost 4% of GDP. Besides that, the fiscal policy oriented for the generation of significant primary surpluses allowed that public debt as a ratio to GDP to be reduced to a current level of near by 50%, after have reached a maximum value of 63% in 2002.

Despite the reduction in real interest rates, the reduction of external fragility and the stabilization of public debt; the growth performance of the Brazilian economy is still very weak. The average growth rate in the period 1999-2005 was only 2.3% per year compared to an average of 3.22% per year in the period 1994-1998.

These reasoning allowed us to take two important conclusions. First of all, a low inflation level is not a sufficient condition for a high growth performance. Second, the Brazilian experience shows us that the simple adoption of a consistent macroeconomic model – that is, a model for the governance of macroeconomic policy that produced a low

and stable inflation rate, the stability of public debt as a ratio to GDP and the reduction of external fragility – is neither a sufficient condition for growth acceleration in a persistent way. In this setting, the relevant question to be asked is: what should be done in order to produce a persistent increase in the growth rate if the Brazilian economy?

There are two answers for this question. The first one, based in neoclassical growth models and in the methodology of growth accounting, defines that the reason for the low growth performance of the Brazilian economy in the last 25 years must be found in the supply side of the economy. More specifically, the sources of the low growth rate of GDP were a low level of domestic savings – due to the negative contribution of the public sector and the weak incentives for private savings – and a low technological dynamism expressed in a very low growth rate of total factor productivity. According to this view, a persistent increase in the growth rate would demand a reform in the social security system in order to increase the government saving and an increase in the degree of openness of the Brazilian economy in order to stimulate the increase in the productivity of the Brazilian firms.

The second answer for the question at hand was based on the idea that the macroeconomic model adopted in Brazil on the last decade caused a contraction of aggregate demand and hampers the growth rate of real GDP. This occurs because the combination of still high real interest rates with the generation of significant (and, in the last years, increasing) primary surpluses has the effect of depress aggregate demand. According to this view, the solution for the near-stagnation of the Brazilian economy would be the end of the current macroeconomic model based on inflation targeting-flexible exchange rates and generation of primary surpluses.

In our opinion, both views about the problem at hand are wrong. In the present article, we adopted a Keynesian point of view according to which the determinants of long-

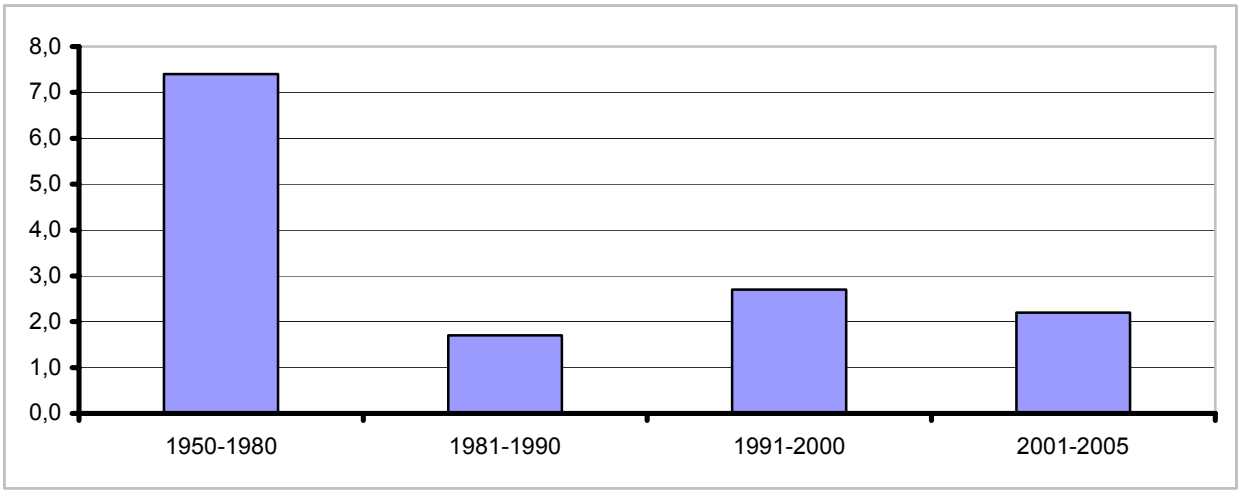
run growth must be found in the demand side, not in the supply side of the economy. However, we rejected the naïve Keynesian view according to which growth must me stimulated by whatever policy that increases aggregate demand. The Fiscal Crisis of Brazil sets clear and tight limits for growth policies based on increase in government consumption expenditures. According to our view a persistent increase in the growth rate of the Brazilian economy demands the adoption of a new growth model, in which exports are the dynamic element of aggregate demand and, for this reason, the engine of long-run growth. The adoption of this growth model, however, requires an special care with the level of real exchange rate.

The present article is organized in five sections, including the present introduction. In section 2, we will preset a brief review of the growth performance of the Brazilian economy in the last two decades. In section 3 we will present the theory of demand-led growth according to which the long-run growth rate of real GDP is a weighted average of growth rates of government consumption expenditures and exports. In section 4, based on the methodology developed by Atesoglu (2002), we will do some econometric tests for the hypothesis of a demand-led growth regime for the Brazilian economy. The results of the tests showed that almost 95% of GDP growth in the period 1990-2005 is explained by demand-side variables. Besides that, based on the methodology developed by Ledesma and Thirwall (2002), we showed that the natural growth rate of the Brazilian economy is endogenous, increasing considerably in boom times. Taken for granted these results, there are no restrictions from the supply side of the economy to a permanent increase in the growth rate of the Brazilian economy. Section 5 summarizes the conclusions of the article.

2 – The Growth Performance of the Brazilian Economy in the Last Decades.

In the two last decades, the Brazilian economy had experienced a strong slowdown in the growth rate of real GDP. In fact, as we can see in Figure 2.1, the average growth rate of the Brazilian economy was superior to 7% per year in the period 1950-1980. In the 1980's, however, the average growth rate slowdown. In the period 1981-1990, the so-called "lost decade", the average growth rate of the Brazilian economy was inferior to 2% per year. Between 1991 and 2000, the average growth rate increases a little further to 2.7% per year, staying behind the average of the period 1950-1980. Finally, in the period between 1991 and 2000, the average growth rate of real GDP slowdown again to 2.2% per year.

Figure 2.1: Growth Performance of the Brazilian Economy: 1950-2005.



Source: IPEADATA.

The fundamental question to be asked is: what factors explained the strong slowdown in growth rates of the Brazilian economy after 1980? During the 1980's the slowdown in economic growth was believed to be the result of the cumulative effects of the external debt crisis and the near hyper-inflation observed in Brazil during the decade.

During the 1990's, the external debt problem was solved by means of the Brady Plan and inflation was finally defeated by Plano Real. But the growth performance of the Brazilian economy did not come back to the same level of the period 1950-1980.

The conventional explanation for growth slowdown of the Brazilian economy is based in the growth accounting exercises. According to this methodology, the growth rate of the Brazilian economy slowdown due to a substantial reduction of the growth rate of the supply of factors of production (basically, capital) and to a reduction of the growth rate of total factor productivity after the second oil shock (cf. Barbosa, 2006). This reduction in the growth rate of total factor productivity is considered to be the result of a lot of inefficiencies that came from the import substitution model adopted in Brazil until the end of the 1970's (cf. Franco, 1999). Also according to this methodology, the Brazilian economy should, in current conditions, grow at a rate no superior than 3.5% per year, if the commitment with price stability is to be kept alive.

An alternative explanation for the slowdown in growth rates is based in demand conditions, instead of supply conditions. According to this line of reasoning, long-run growth is demand-led, instead of supply driven; so it is of fundamental importance the analysis of the factors that driven the growth of aggregate demand. According to this framework, the growth model of the Brazilian economy was based in the expansion of consumption expenditures in luxury goods, being this expansion induced by an active policy of income concentration in upper classes (cf. Bresser-Pereira, 2003, p.181).

This growth model came to an end in the 1980's due to the transition to a democratic government in Brazil. In effect, democracy put income distribution and reduction of inequality as the most important political issues for the Brazilian society. In this way, there will be no longer possible to driven aggregate demand growth by means of

increases in consumption expenditures in luxury goods permitted by continuous increases in income concentration.

According to this view, the growth problem of the Brazilian economy is that, since the beginning of the 1980's, there is no alternative source of aggregate demand expansion that could allow a high growth rate of real GDP.

3 – The Theory of Demand-Led Growth: the Keynesian view.

3.1 Long-run endogenity of the supply of factors of production.

Neoclassical growth models take for granted that the fundamental limit to long-run growth is the supply of factors of production. Aggregate demand is relevant only to determine the degree of capacity utilization, but have no direct influence over the rate of expansion of productive capacity. In the long-run, Say's law is supposed to hold; i.e, supply creates its own demand.

But it will be true that supply of factors of production is independent of demand? This question is originally raised by Kaldor (1988), originating the theory of demand-led growth. The starting point of demand-led growth theory is that means of production used in a modern capitalist economy are themselves goods produced within the system. The "supply" of means of productions should never be taken as given and independent from the demand for them. In this theoretical framework, the fundamental economic problem is not the allocation of a given amount of resources between alternative uses; but the determination of the rate of creation of these resources. In the words of Setterfield:

> "*The use of produced means of production implies that the ´scarcity of resources´ in processing activities cannot be thought of as being independent of the level of activity*

in the economy. What is chiefly important in processing activities is the dynamic propensity of the economy to create resources (that is, to deepen and/or widen its stock of capital) rather than the static problem of resource allocation" (1997, p.50).

In order to understand the long-run endogenity of factors of production, we will start with the supply of capital. The quantity of capital that exists in a point of time – or, in other words, the productive capacity that exists in the economy – is the result of past investment decisions. From this line of argument, we can conclude that the stock of capital is not a given quantity determined by "nature", but is dependent of the rate at which entrepreneurs want to increase the stock of capital.

So the fundamental determinant of the "capital stock" is investment decision. Investment, in turn, is determined by two set of variables: i) the opportunity cost of capital (mainly determined by the level of short-term interest rate set by the Central Bank); ii) the expectations about the future growth of sales and production. In this setting, if entrepreneurs expect a strong and sustainable increase in demand for the goods that they produce – as it would be expected in an economy that shows a persistent high growth rate – then they will make large investment expenditures.

In other words, investment is an endogenous variable that came in line with the expected growth of aggregate demand, since one fundamental restriction is met: the expected rate of return of capital has to be bigger than the cost of capital. If this condition is met, the "supply of capital" should not be considered a limit to long-run growth.

It is true that in the short and in the middle run, production should not increase beyond the maximum productive capacity of the economy. In the long-run, however, the

productive capacity must be increased – by means of investment expenditures – in order to met the increase in aggregate demand. In the words of Kaldor:

> "*Since under the stimulus of growing demand capacity of all sectors will be expanded through additional investment, there are no long-run limits to growth on account of supply constraints; such constraints, whether due to capacity shortage or to local labor shortage, are essentially short-run phenomena – at any one time, they are a heritage of the past*" (1988, p.157).

A very common objection to this reasoning is the idea that investment needs "previous" saving in order to be realized; that is, any increase in investment expenditure requires a previous increase in the saving rate of the economy. According to this line of reasoning, the "supply of capital" is limited by the share of real income that society does not want to consume. Saving defined this way is determined by private sector saving, government saving and foreign saving.

It is not true that investment requires "previous" saving in order to be realized. In fact, investment expenditures require only the creation of liquidity by commercial banks. If commercial banks are ready to increase their credit operations in favorable terms[i], then it will be possible for firms to start their investment projects, buying new machines and equipment from the capital goods producers. Once the investment expenditure is done, it will be generated an extra income of such magnitude that, at the end of the process, aggregate saving will adjust to the new value of aggregate investment. The extra saving generated in this way should now be used for funding short-term debts with commercial banks in long-term debts in capital markets. More specifically, firms could sell shares or long-term bonds in capital markets in order to raise the required funds to pay all their debs

to commercial banks. These operations will not necessarily decrease the price of bonds or shares since families will be looking for new assets to store their extra saving.

There are, however, financial limits to the increase in the productive capacity. In fact, firms must be ready to adjust their productive capacity to the expected growth of demand for their products if and only if the expected rate of return of the new investment projects is higher than the opportunity cost of capital. In a first approximation we can define the cost of capital as the average interest rate that firms must pay for the required funding for their investment projects. There are three sources of funds to finance the investment project of firms: retained earnings, debts and equity. So, the cost of capital is the weighted average of the cost of each of these sources of finance. If the cost of capital is too high – for instance, due a very tight monetary policy that increase the short-term interest rate, increasing the cost of borrowing – than new investment projects may not be profitable, and investment expenditure will not adjust to the level required by the expected growth of aggregate demand.

We will now turn our attention to the "supply of labor". According to our view, the "supply of labor" should not be considered a limit to the growth of production in the long-run.

First of all, the number of work hours could be increased easily in order to increase the level of production.[ii].

Second, the participation rate – defined as the ratio between the labor force and total population in work age – could increase in response to a strong increase in demand for labor (cf. Thirlwall, 2002, p.86). In fact, during boom times, the opportunity cost of leisure increases, stimulating a strong increase in the participation rate. So we can conclude that

the growth rate of labor force could accelerate during boom times due to the fact that some people may decide to enter in the labor force as a response to the incentives created by a booming labor market.

Finally, we have to state that population and labor force are not a datum from the view point of the economy as a whole. A shortage of labor – even of qualified workers – can se solved by immigration from other countries. For example, countries as Germany and France could sustain high growth rates during the 1950's and 1960' due to immigration of workers from the countries of the periphery of Europe (Spain, Portugal, Greece, Turkey and south of Italy).

A last element to be considered is technological progress. Is it possible to consider the rate of technological progress a restriction to long-run growth? If the rate of technological progress is exogenous to the economic system then growth will be limited by the pace at which technological knowledge is increased. However, technological progress is not exogenous to the economic system.

First of all, the pace at which firms introduce innovations is largely determined by the rate of capital accumulation; since a large part of technological innovations are embodied in new machines and equipment.[iii]

Second, even that small part of technical progress that is disembodied is determined by *dynamic economies of scale* such as *learning-by-doing*. So we can establish the existence of a structural relationship between the growth rate of labor productivity and the growth rate of output known as "Kaldor-Verdoon law"[iv v]. In this setting, an increase in aggregate demand will cause an increase in the growth rate of labor productivity since the growth rate of output will be increased as a consequence of a greater demand growth.

Based on his reasoning we can say that there is no such a thing as potential or full-employment output for the long-run, since the supply of factors of production and the rate of technological progress is demand determined. "Full-employment" is essentially a short-run concept that ignores that endogenity of "natural growth rate" in the long-run. In the words of Kaldor:

> "*Full employment of an industrial region or a country is therefore essentially a short-run concept, which ignores the long-run mobility of labor and the possibility of an increase in training which responds to demand in much the same way as capital investment*" (1988, p.157).

3.2 Determinants of long-run growth.

If supply of factors of production should not be considered a limit to long-run growth, what are the determinants of economic growth in the long-run? According to the Keynesian view, the ultimate determinant of economic growth is aggregate demand. Firms will increase their production levels as a response to an increase in aggregate demand two conditions are satisfied: i) profit margins are high enough to give to entrepreneurs the rate of profit desired by then; ii) realized profit rate must be bigger than the cost of capital. If these two conditions are met, then the rate of growth of real output will be determined by the rate of growth of *autonomous demand*; i.e. the growth of that part off aggregate demand that is independent of the level and/or variations of the level of output and income.

For open economies there are two components of autonomous demand: exports and government consumption expenditures (cf. Park, 2000). Investment expenditures are not a component of autonomous demand since investment decision in capital assets is basically determined by entrepreneurs' expectations about future growth of production and sales,

according to the so-called *principle of acceleration* of investment theory (cf. Harrod, 1939). In other words, investment is not an exogenous variable from the view point of growth process; since it is driven by output growth. So, long-run growth rate of real output is a weighted average of the rate of exports growth and the rate of government consumption expenditures.

For a small open economy that do not have a convertible currency, exports growth is the exogenous variable in growth process. If the rate of growth of government consumption expenditures is bigger than the rate of exports growth than real output and income will increase faster than exports. Supposing an income-elasticity of imports bigger than one (as it is usual in open economies) than the rate of imports growth will be bigger than the rate of exports growth, generating a growing trade deficit (assuming constant terms of trade), which will be unsustainable in the long-run[vi].

The growth rate of exports is equal to the product between income-elasticity of exports (ε) and the growth rate of world income (z). So we can establish that the long-run growth rate of real output (g^*) according to the theory of demand-led growth is given by:

$$g^* = \varepsilon z \quad (3.1)$$

4 – Demand-Led Growth in Brazil? Some econometric evidence.

In this section we are going to estimate some regression equations to test the hypothesis that Brazilian economic growth is demand determined. First of all, we are going to analyze the role of a few demand side variables on the Brazilian economy performance in the 1990-2005 period of time.

Particularly, we are going to provide some evidence that exports and government consumption are exogenous variables in the long-run growth process, thus corroborating to the theory of demand led growth presented in section 3. Afterward, we are going to provide a few evidences supporting the view that the Brazilian natural rate of economic growth is endogenous. If it is true, the Brazilian economic performance is not bounded by supply side aspects. Our estimates for the 1980-2002 period show some evidence that the annual natural rate of economic growth can vary from 5,2% to 8% in good times. Therefore, there is no reason to believe that the Brazilian economy is fated to grow at an annual rate of 3.5% because of supply side restrictions, as it is said by Brazilian neoclassical economists.

4.1 Testing the demand-led growth hypothesis.

Following Atesoglu (2002), in the present section we are going to assess the impact of real exports (X), real investments (I), real government consumption (G), and real money supply (M3) on real GDP (Y) for the Brazilian economy.

The data source for real GDP, real government consumption, real exports, and real investments is the System of National Accounts provided by the Brazilian Statistical Bureau (IBGE/SCN). The real money supply is from the Brazilian Central Bank and it is divided by the General Price Index (IGP-DI) from Getúlio Vargas Foundation (FGV). All variables were transformed in a way that their values in 1990 are equal to 100 (1990 = 100), and they are stated in natural logarithms; as a result the estimated coefficients give the elasticity between the left and right hand side variable. The time period under study is from the first quarter of 1991 to the fourth quarter of 2005, so the data is quarterly (N = 60). The

statistical packages used to estimate the regressions, to perform statistical tests, and to generate graphics are Stata 8.1 and EViews 4.0.

All variables have an upward trend through time and a stochastic trend[vii]. Therefore, it is likely that these variables have a spurious correlation. If this is true, Ordinary Least Square (OLS) regressions will probably lead to erroneous conclusions. Moreover, OLS estimates are not consistent and statistical inference tests are not appropriate.

To check this out, we have performed Augmented Dickey Fuller (ADF) tests. To set the number of lags in the ADF tests, we started with a relatively large number of them (8 lags) and checked if the last one was statistically significant different from zero. If it was not significant, we would proceed and perform the test with 7 lags. This procedure was carried out to the point in which the last lag was found to be significant. Then, we used Schwarz and Akaike Information Criterion to decide if an intercept and trend should be included in the test, and we have tested their level of significance.

The results are reported in Table 4.1 and the ADF tests point out that all variables are integrated of order one, thus they are not stationary:

Table 4.1 – Series Stationary Tests

Variable	*Specification*	*Levels*	*Differences*
Y	5 Lags – Constant + Trend	-2.306	
	4 Lags – Constant		-5.119**
X	2 Lags – Constant	0.428	
	2 Lags – Constant		-15.680**
I	2 Lags	0.951	
	2 Lags		-9.252**
G	6 Lags	4.063	
	5 Lags – Constant		-6.952**
M3	No Lags – Constant + Trend	-1.891	
	No Lags – Constant		-7.933**

Notes: Rejection of the unit root hypothesis is indicated with one asterisk (5%) and two asterisk (1%).

Therefore, by the ADF tests results, we can not run OLS regressions to appraise the relation among the macroeconomic variables listed above. One way to deal with spurious

regression problems due to nonstationary time series is to take the variables first differences and check if they are stationary. Because all series are integrated of order one I(1) via ADF tests, that is, their first differences are stationary (see Table 4.1), we can run OLS regression using the variables first difference. The results are illustrated below:

Regression equation 1 – OLS estimates employing the variables first difference

$\Delta Y =$	0.0009	+ 0.1542ΔX	+ 0.2527ΔI	+ 0.3730ΔG	– 0.0233$\Delta M3$	
	(0.00285)	(0.02520)	(0.05348)	(0.06431)	(0.04741)	standard deviation
	(0.31)	(6.12)	(4.72)	(5.80)	(-0.49)	t – test
	Adj R-squared = 0.7987					
	N = 59		F(4, 54) = 58.53			

All variables on the right hand side of regression equation (1) have the expected signs and they are significant at 5% or 1% significance level, except M3. Tests to check for problems of heteroscedasticity (Breusch-Pagan/Cook-Weisberg), autocorrelation (Durbin-Watson), multicollinearity (Variance Inflation Factor), and nonnormality of residuals (Stata test based on D'Agostine, Belanger and D'Agostine Jr., 1990 cited by Park, 2003) did not show any of the above cited problems[viii]. Consequently, the inference statistics are reliable. The right hand side variables explain 80% of income variation, a considerable amount. Government consumption has the major impact on income, a 1% increase in the former raises the later by 0.37%.

The main problem in the first difference variables OLS regression is that valuable long-run information can be lost if the variables are cointegrated. The condition for this is that the error term of the estimated regression must be stationary.

The results of Johansen Cointegration test to verify the cointegration among the above cited variables support this conclusion (that the estimated error term series is stationary). The same procedures of the ADF tests were followed to establish the number of lags that should be included and to decide the inclusion of a constant and a trend in the

Johansen Cointegration Test (Table 4.2). This procedure to stipulate the model to be tested was also used to specify the Error Correction Model (Table 4.3). The variables have at least two cointegration vectors as we can see in Table 4.2:

Table 4.2 – Johansen Cointegration Test

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.554093	120.0439	87.31	96.58	None **
0.474361	74.81585	62.99	70.05	At most 1 **
0.309218	38.80000	42.44	48.45	At most 2
0.194227	18.08383	25.32	30.45	At most 3
0.101450	5.990469	12.25	16.26	At most 4

Notes: Lag interval of ΔY, ΔX, ΔI, ΔG, ΔM3 included to perform the test = 1 to 3. It is also included an intercept and a deterministic trend in the test.

The evidences suggest that OLS residuals are stationary, so there is a long run relationship among the variables. Accordingly, by the ADF tests results we conclude that the variables are I(1), but they are cointegrated. This result points out that OLS regression making use of level variables provides better estimates since it captures the above mentioned long run relationship. In such regression, the residuals statistical tests provide evidences of autocorrelation[ix]. To correct this problem, we have performed the Cochrane-Orcutt AR1 regression. The results are presented below:

Regression Equation 2 – Cochrane-Orcutt AR(1) regression (iterated estimates)

Y =	0.8971	+ 0.1539X	+ 0.2719I	+ 0.3690G	+ 0.0135M3	
	(0.23039)	(0.01681)	(0.03678)	(0.06391)	(0.01628)	standard deviation
	(3.89)	(9.16)	(7.39)	(5.77)	(0.83)	T – test

Adj R-squared = 0.9524 DW Original = 1.296
N = 59 F(4, 54) = 291.23 DW Transformed = 1.761

The conclusions are nearly the same as in the prior regression. The coefficients have the same signs and their magnitude have slightly changed, with the exception of real money supply. Nevertheless, its coefficient remains not significantly different from zero. The

similar results in both regressions are additional evidence that OLS regression results using level variables are robust. As expected, adjusted R square and t-statistics have increased.

To check for variables endogeneity, we have employed the vector error correction model estimated by Johansen method. The results are reported in Table 4.3. The error correction term indicates which variable adjusts to the long run equilibrium between the dependent (real GDP) and the explanatory variables.

Table 4.3 – Results from estimation of vector error correction model

	ΔY	ΔX	ΔI	ΔG	ΔM3
Error correction term	1.1001	-0.9457	3.6575	-0.3047	-1.4779
(t-statistic)	(3.93178)	(-0.8077)	(5.5471)	(-0.8834)	(-1.3251)
(standard deviation)	(0.27980)	(1.1709)	(0.6594)	(0.3449)	(1.1153)
Adj. R-squared	0.871	0.702	0.609	0.833	-0.092
S.E. (equation)	0.0139	0.0583	0.0328	0.0172	0.0555

Notes: Lag interval of ΔY, ΔX, ΔI, ΔG, ΔM3 included in error correction model = 1 to 3. In the vector error correction model it is also included an intercept and a deterministic trend.

The results of Table 4.3 indicate that Y and I adjust to deviations in long run equilibrium. Therefore, there are evidences of a **bidirectional causality** between GDP and investments, and **unidirectional causality** running from exports and government consumption to GDP and investments. Money supply does not adjust to long run equilibrium, but since it were not found to be significant, it is not possible to say that this variable have an influence on GDP and investment.

However, it must be stressed that, on the basis of the regression equation estimated coefficients, for a 1% increase on government real consumption, the increase of real GDP is about 0.36%. Assuming that the government revenue at Central, States and City level is approximately 40% of GDP, a government current consumption increase of 1% would raise government revenue by 0.15%, thus amplifying the public deficit.

Taking into consideration that tax burden in the Brazilian economy (about 40%) is close to its limit and that there is a large public debt as a ratio of GDP (about 51% in liquid terms), it is evident the impossibility to pull the growth of Brazilian economy by means of increasing government consumption expenditure, The only autonomous source of demand capable to induce acceleration of Brazilian economic growth is the demand for exports. In other words, the Brazilian economy growth model must be an *export-led growth* type.

The money supply does not adjust to long run disequilibria, but because its coefficient is not statistically significant, it is not possible to state that this variable has some influence on Y and I. As a result, it seems unlikely that monetary policy has a persistent effect on the Brazilian economic growth. That is, the pace of real money supply growth does not seem to have a statistically significant influence over the performance of real GDP and/or real investment.

Apart from money supply, this section's findings are very similar to the Atesoglu (2002) ones. The causal relations support the Keynesian approach that exports and government spending can be an important source to stimulate demand and economic growth. Though, it must be stressed that, in face of the Brazilian fiscal crisis, it does not seem to be possible to pull the country's economic growth through the expansion of government consumption expenditures.

4.2 Is the Brazilian natural rate of economic growth endogenous?

In this sub-section we are going to test endogeneity of the natural rate of growth in the Brazilian economy. This section is based on a study carried out by Ledesma and Thirlwall (2002). By means of Okun's concept (1962 cited for Ledesma and Thirlwall 2002), the natural rate of growth (g_n) is the one that keeps constant the unemployment rate.

Okun (1962 cited by Ledesma and Thirlwall 2002) makes use of the following specification for the percentage variation of the unemployment level:

$$\Delta\%U = a - b(g) \quad (4.1)$$

Where U stands for unemployment level, g is the rate of GDP growth, and *a* and *b* are both constants. By equation (4.1), when Δ%U = 0, the *natural rate of growth* is defined by *a/b*.

Because some people give up looking for work when the rate of economic growth is low, it is possible that *a* coefficient is underestimated. In this case, the natural rate of economic growth would also be underestimated. On the other hand, in periods of high economic growth, some part of the additional labor force that is necessary to raise production comes from idle labor force and from extra working hours. Thus, *b* coefficient turns to be underestimated, what leads to an overestimation of the natural rate of economic growth. Thus, the natural rate of economic growth can be under or overestimated depending on which of the two effects prevail.

Another approach to estimate the natural rate of economic growth in the attempt to avoid such problems was developed by Thirlwall (1969):

$$g = a_1 - b_1(\Delta\%U) \quad (4.2)$$

In equation (4.2), when the unemployment rate variation is zero, we have the following equation:

(4.3) $g = a_1$

Thus, the natural rate of economic growth is defined by the estimated value of regression equation intercept. The problem of using equation (4.2) is that the natural rate of economic growth is endogenous, so the estimated coefficients will be biased.

Once the natural rate of economic growth is estimated, we can create a dummy variable that assumes the value 1 (one) when the economy rate of economic growth is superior to the natural one estimated by equations (4.1) or (4.2), and 0 (zero) when the opposite happens. With the introduction of this dummy variable, we have the following regression equation specification:

(4.4) $g = a_2 + b_2 D + c_2 (\Delta\%U)$

Where: D represents the dummy variable. In the specification of equation (4.4), two potentially different natural rates of economic growth are estimated. The first one is estimated for the periods in which the rate of economic growth is higher than the natural rate of economic growth given by equation (4.2). In this in case, the natural rate of economic growth is given by $a_2 + b_2$. The second one is estimated taking into consideration the periods where the rate of economic growth is lower than the natural one given by equation (4.2). In this case, the natural rate is represented by a_2.

Because it is a natural rate, it would not be expected to change with variations in the rate of economic growth. If this statement is accurate, the dummy variable coefficient

should not be significant. On the contrary, the natural rate of economic growth (g_n) is endogenous and it responds to changes in the rate of economic growth (g).

The database used to carry out the empirical analysis is unemployment level from the Brazilian Statistical Bureau (Instituto Brasileiro de Geografia e Estatística - IBGE) Unemployment Monthly Research (Pesquisa Mensal do Emprego - PME). This series is monthly available, but they were transformed into quarterly data by taking an arithmetic mean of the three months of each trimester. The GDP Chained Index series is from IBGE National Accounts System (IBGE/SCN). The empirical analysis covers the period from the first trimester of 1980 to the fourth trimester of 2002. Both variables were transformed into rates of growth, so the first observation of each series was lost. Thus, the sample is composed by 91 observations.

In view of the quarterly data series, the estimated natural rate of economic growth (NREG) via equations (4.1) and (4.2) are given in Table 4.4:

TABELA 4.4 – ESTIMATED NATURAL RATE OF ECONOMIC GROWTH VIA OKUN AND THIRLWALL EQUATIONS

	Estimation Method	*Intercept*	*Slope*	*DW*	*Ad. R^2.*	*NREG*
Equation (1)	RR	1,61 (0,99)	-2,70*** (3,49)	2,32	0,11	0,60
Equation (2)	OLS	0,59*** (2,99)	-0,053*** (4,12)	1,89	0,15	0,59

Notes: *** it is significant at the 1% level; ** it is significant at the 5% level; * it is significant at the 10% level. OLS stands for Method of Ordinary Least Squares; RR is the Robust Regression Method to correct problems of residuals non-normality heteroskedasticity. DW is the Durbin-Watson test value for first order autocorrelation process; Ad. R^2 is the Adjusted R^2; and NREG means Natural Rate of Economic Growth.

The rate of economic growth estimated from both equations are quite similar, giving support to these results, despite the potential problems previously mentioned.

With the estimated natural rate of economic growth around 0.60% per trimester, the annualized natural rate is close to 2.50%. Thus, according to the Table 4.4 results it is

possible to state that between 1980 and 2002 the rate of economic growth that maintains unemployment rate constant in the Brazilian economy is near to 2.50%.

In Table 4.5 is shown the estimation results of the regression equation (4.4). In the third column, MA means that the rate of economic growth is a Moving Average Variable composed by three trimesters.

TABLE 4.5 – ESTIMATED NATURAL RATE OF ECONOMIC GROWTH VIA OKUN AND THIRLWALL EQUATIONS INCLUDING A *DUMMY* VARIABLE

	Estimation Method	*Intercept*	*Dummy Coefficient*	*Slope*	*DW*	*Ad. R^2.*	*NREG ($g<g_n$)*	*NREG ($g>g_n$)*
Equation (4)	MQO	-0,84*** (-4,40)	2,85*** (10,40)	0,03*** (-3,35)	2,28	0,61	-0,84	2,01
Equation (4) MA	PWER	-0,26* (-1,66)	1,56*** (10,26)	0,011** (-2,14)	1,82	0,54	-0,26	1,3

Notes: *** it is significant at the 1% level; ** it is significant at the 5% level; * it is significant at the 10% level. OLS stands for Method of Ordinary Least Squares; PWER is the Prais-Wisten Method with robust standard errors to correct for problems of autocorrelation and heteroskedasticity. DW is the Durbin-Watson test value for first order autocorrelation process; Ad. R^2 is the Adjusted R^2; NREG means Natural Rate of Economic Growth; and MA is the regression equation using a three month Moving Average data.

The results of regression equation (4.4) indicate that the *natural rate of economic* growth responds to *effective rate of growth*. To be precise, the natural rate of growth is endogenous. The results of Table 4.5 (second line) indicate that in the periods of high economic growth, the annual natural rate is around 8%, while in periods of weak economic growth or recession, the annual natural rate is negative, about to -3,5%.

It is good to remember that the data period is quarterly, so there it has a great deal of variation. Therefore, employing moving average data reduces the oscillation from one trimester to another. The changes on the estimation results of regression equation (4.4) are clear as we can see in Table 4.5's third line. In this case, the annual natural rate of economic growth is close to 5.2%, while in bad times it is near to -1%.

The tests indicate that the *natural rate of growth in Brazil is an endogenous variable*. Therefore, it can be affected by the conditions of demand in the Brazilian economy. Moreover, we verify that the estimated annual natural rate of economic growth in good times vary from 5.2% to 8%. Therefore, the empirical results indicate that the Brazilian economy performance can be superior to 3.5% without generating inflationary pressures. The conclusion is that the recent Brazilian economic growth is not bounded by the supply side, but by the demand side.

5 – Final Remarks

Through out this article we have presented the theory of demand-led growth in order to answer to fundamental questions: i) For what reason Brazilian economy have experienced a growth slowdown in the last two decades relative to the period 1950-1980; ii) What kind of economic policy should be adopted in order to restore a robust economic growth?

Concerning the first question, we rejected the first answer based in the methodology on growth accounting, according to which Brazilian economy can only grow at a rate no bigger than 3.5% per year in the long-run in the absence of structural reforms in the supply side of the economy.

Our empirical research had shown the existence of a demand-led growth regime in Brazil. In fact, our econometric tests shown that almost 95% of real GDP growth in period 1990-2005 is explained by variables of the demand-side of the economy. Based on this results, we can affirm that growth slowdown in the last decades was due to the end of the model of aggregate demand expansion adopted after 1964, which was based in the

expansion of consumption expenditures in luxury goods driven by increasing income concentration in upper and middle classes. The current situation of near-stagnation of the Brazilian economy is the result of the inexistence of an alternative model of aggregate demand expansion.

The econometric tests also shown that government consumption expenditure multiplier is near by 0.37, so that a 1% increase in government consumption expenditure will result in an increase in 0.37% of real GDP. Considering a tax burden of 40% of real GDP, we can conclude that a 1% increase in government consumption expenditures will increase tax receipts in just 0.15% of GDP. Since Brazil is in a very serious fiscal crisis, expressed by the combination of a high tax burden, a high public debt as a ratio to GDP (at least for emergent economies) and a very (almost inexistent) government investment expenditures; it is no longer possible to driven economic growth in Brazil by means of an expansionary fiscal policy. The only alternative at hand is the adoption of an *export-led growth model*.

The adoption of this growth model will require the adoption of policies designed to increase the income elasticity of exports, increasing the long-run growth rate of the Brazilian economy.

Finally, we have to stress that, based on the methodology developed by Ledesma and Thirwall (2002), we have shown that the natural growth rate of the Brazilian economy is endogenous, being a function of actual growth rate. So it seems that there are no limits from the supply side of the economy for a robust growth of the Brazilian economy.

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[i] See Davidson (2002, Chapters 6 and 7).

[ii] In the case of Brazil, industrial production could increase near by 44% - according to IEDI estimates (Valor Econômico, 24/03/2006) – compared to the current level of production by means of increasing the number of work hours. If we consider the adoption of additional work turns, production could increase almost 57% compared to the current level of production.

[iii] This idea was originally presented in Kaldor (1957) by means of the "Technical Progress Function", which establishes the existence of a structural relationship between the growth rate of output per-worker and the growth rate of capital per-worker. According to Kaldor is not possible to isolate the growth of labor productivity due to introduction of new technologies from the growth of labor productivity due to an increase in capital per-worker. That is so because almost all technological innovations that increase labor productivity require the use of a biggest level of capital per-worker, since these innovations are embodied in new machines and equipment.

[iv] Some econometric evidence about the validity of "Kaldor-Verdoon's Law" for United States can be found in McCombie and De rider (1984).

[v] Ledesma (2002) estimates a demand-led growth model for 17 OECD countries (Germany, Australia, Austria, Belgium, Canada, Denamark, United States, Spain, Finland, France, Italy, Holland, Japan, Norway , Portugal, Sweden and United Kingdon) in the period 1965-1994. Based on his econometric evidences, we can establish the existence of a structural relationship between the growth rate of labor productivity and a set of other variables, in particular the growth rate of output. The estimated structural equation is:

$$r = -0.015 + 0.642y + 0.0002(I/O) + 0.617K + 0.021GAP,$$

Where: r is the growth rate of labor productivity, y is the growth rate of real output, (I/O) is investment as a share of real GDP, K is a index of technological innovation and GAP is an estimate of the technological gap.

[vi] It is important to notice that a growth rate of exports bigger than the growth rate of government consumption expenditures is not a sufficient condition for a sustainable growth process in the long-run. In fact, it is also necessary to be a balance of payments equilibrium. For open economies with zero-capital mobility this means that long-run growth rate will be equal to the ratio between the income elasticity of exports and the income elasticity of imports, being this ratio multiplied by the growth rate of world income, what is known as "Thirwall's Law" (cf. Thirwall, 1997). The introduction of capital flows does not alter significantly the long-run equilibrium growth rate (cf. McCombie and Roberts, 2002, pp.95-96). In the present article, however, we are not interested in balance of payments restrictions of growth of Brazilian economy, but to shown the existence of a demand-led growth regime in Brazil. For this reason, we will not use "Thirwall's Law" in our econometric tests.

[vii] The series graphs are available by request.

[viii] The results are available by request with the authors.

[ix] The results are available by request with the authors.