Modelling Economic Growth with Internal and External Imbalances: Empirical Evidence from Portugal.

Abstract

Thirlwall's Law considers that growth can be constrained by the balance-of-payments when the current account is in permanent deficit. The Law focuses on external imbalances as impediments to growth and does not consider the case where internal imbalances (budget deficits or public debt) can also constrain growth. The recent European public debt crisis shows that when internal imbalances are out of control they can constrain growth and domestic demand in a severe way. The aim of this paper is to fill this gap by developing a growth model in line with Thirlwall's Law that takes into account both internal and external imbalances. The model is tested for Portugal which recently fell into a public debt crisis with serious negative consequences on growth. The empirical analysis shows that the growth rate in Portugal is in fact balance-of-payments constrained and the main drawback is the high import elasticity of the components of demand and in particular that of exports.

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Keywords: internal and external imbalances, import elasticities of the components of demand, equilibrium growth rates, 3SLS system regressions.

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1. Introduction

Thirlwall (1979) developed a simple model that determines the long run rate of growth of an economy consistent with the balance-of-payments equilibrium. According to this rule, actual growth can be predicted by the ratio of export growth to the income elasticity of demand for imports. There are two main controversial assumptions of the model: balance-of-payments equilibrium (on current account) and relative prices or real exchange rates remain constant in the long term. According to what became known as Thirlwall's Law, no country can grow faster than its balance of payments equilibrium growth rate, unless it can continuously finance external deficits by capital inflows. Growth is constrained by external demand, and balance-of-payments disequilibrium on the current account can be a serious obstacle to higher growth when it cannot be financed by available foreign resources. Another crucial implication of the model is that it is income and not relative prices that adjust to bring the economy back to equilibrium.

Later on Thirlwall and Hussain (1982) revised the model relaxing the assumption that the balance-of-payments is initially in equilibrium. Since countries can run current account deficits, capital inflows can be included in the model to determine the long term growth rate. This model has shown to be more suitable especially for developing countries where external imbalances can be sustained by capital inflows that alleviate the pressure on external payments. A large number of empirical studies emerged testing the validity of Thirlwall's Law or criticising the basic assumptions that it relies on. Among others, Moreno-Brid (1998-99), McCombie and Thirlwall (1994) and recently Blecker (2009) have made valuable contributions discussing and criticising the underlying implications of the Law.

The hypothesis of constant relative prices has been criticized widely in empirical literature (e.g. McGregor and Swales, 1985; 1991; Alonso and Garcimartín, 1998-99; López and Cruz, 2000). But in most studies in this field, relative prices have been shown to be statistically insignificant and even when they are significant the price elasticities, with respect to imports and exports, are very low in magnitude when compared to the income elasticities, showing that imports and exports are less sensitive to price changes than to income changes. Alonso and Garcimartín (1998-99) showed that the assumption that prices do not matter in determining the equilibrium income is

neither a necessary nor a sufficient condition to affirm that growth is constrained by the balance-of-payments. The empirical evidence seems to support that income is the variable that adjusts to equilibrate external imbalances, implying therefore that growth is indeed balance-of-payments constrained. Blecker (2009) also stressed that it is safe to conclude that the longer the time period considered, the more likely it is that relative prices remain constant. On the other hand, increasing capital inflows can at most be a temporary way of relaxing the balance-of-payments constraint, but they do not allow a country to grow at the export-led cumulative growth rate in the long term. What matters in the long-term analysis of growth is the growth of exports.

Moreno-Brid (1998-99) argued that although the Thirlwall and Hussain (1982) model allows for non-zero foreign capital inflows, it imposes no restriction on their trajectory, except for the balance-of-payments accounting principle, which forces the total debit and credit items to cancel out. This accounting restriction is insufficient to guarantee that the evolution of foreign capital inflows generates a pattern of foreign indebtedness that is sustainable in the long term. Moreno-Brid presented an alternative framework aiming to overcome the above limitation by introducing in the model a simple modification ensuring that long-term economic growth is associated with a build-up of foreign liabilities that are not on an explosive path. The Thirlwall-Hussain model is redefined in a way to include a constant ratio of the current account deficit relative to domestic income. The international financial and banking sectors perceive the current account ratio as well as the foreign debt ratio, which ultimately define a country's credibility. Moreno-Brid (2003) presented a version of the balance-of-payments constrained growth model that explicitly takes interest payments into account. By construction this model captures the influence of interest payments and, at the same time, guarantees a sustainable long term trajectory of external debt accumulation. The adequacy of the model was validated by testing it on the Mexican economy.

On the sustainable debt debate, Barbosa-Filho (2002) argued that since the home country does not issue foreign currency, it can only have persistent trade deficits by receiving a continuous inflow of foreign capital. The counterpart of unbalanced trade is a change in the stock of foreign debt and, therefore, it has to be checked under conditions in which the unbalanced trade constraint is consistent with a non-explosive accumulation of foreign debt.

Although Thirlwall's model has been modified to include capital flows and foreign debt, these studies have not considered the role of public imbalances as an additional constraint on growth. The external imbalance considered so far in the literature includes public disequilibrium, but the impact of the latter on overall growth has not been analysed separately. The recent experience of some peripheral European countries falling into public debt crisis is the motivation to deal with this issue. As Pelagidis and Desli (2004) argue, the implementation of an expansionary fiscal policy, aiming at strengthening growth rates and reducing unemployment, would not always achieve the desirable objectives. It could be the case that budget deficits, financed either by money printing or by public borrowing, will increase public debt and interest rates, crowd out private investments, fuel inflation, and damage medium-term growth. The answer of whether budget deficits are always desirable has many dimensions, including whether government borrowing is financing government consumption or investment in infrastructure, whether the deficit is sustainable, and how it is financed. On the other hand, the hesitation of many policy makers – especially in Europe – to rely more aggressively on fiscal policy measures in order to keep their public finances more or less balanced may lead to the possibility of a vicious cycle between low growth and higher deficit formation as a result of the reduction of tax revenues.

Our paper aims at contributing to this debate by developing an alternative growth model, in line with Thirlwall's Law, that takes into account not only external, but also internal imbalances due to budget deficits and public debt. The reduced form of the growth of domestic income is determined, among other things, by factors related to mismanagement of fiscal policy and public finances that could affect economic growth negatively. The theoretical model is tested for the Portuguese economy that recently faced a serious problem of financing its public debt and asked for external intervention. The implemented restrictive measures are expected to have negative repercussions on growth in the following years. Taking all these facts into account, the paper is organized as follows: in section 2 we develop the theoretical growth model; section 3 tests the model for the Portuguese economy analysing some possible scenarios, and the last section concludes.

2. The growth model with internal and external imbalances

We develop a multi equation model to derive the reduced form of income growth which depends, among other things, on internal and external imbalances. Initially, some steady state conditions are assumed for the sake of simplification and later on some of these are relaxed to measure their impact on growth. The model follows the development of Thirlwall's Law with two particular differences: it considers not only external imbalances (current account deficits), but also internal imbalances emerging from public deficit and debt; it considers further the import contents of the components of demand. The *Appendix I* explains some notations, assumptions and definitions used to develop the model.

2.1. Import function

We start developing the model by specifying the demand for import equation. Contrary to the conventional specification that considers real domestic income as the main aggregate determinant of the demand for imports, we use the components of domestic income to explain import flows. We assume that relative prices do not play a significant role and that in the long run they remain constant (the steady state condition)[1]. The import demand equation is specified as follows:

$$M = \alpha C^{\pi_c} G^{\pi_g} X^{\pi_x} K^{\pi_k} \qquad \textbf{(1)}$$

where M is imports, C private consumption, G government expenditures, X exports and K private investment, all expressed at constant prices. In this equation, π represents the elasticity of each of the components of demand in relation to imports. All elasticities are expected to be positive since all components of demand have import content. Taking logs and differentiating through time we can define the same equation in growth rates, where a lower-case letter with a dot denotes the instantaneous growth rate of a given variable:

[1] This is a debatable assumption made for the sake of simplifying the model. As we explained before, there are studies showing that relative prices are important in international trade and explain a substantial part of growth especially in developing countries. Concerning Portugal, Garcimartín et al (2010-11) attribute the slowdown of economic growth in Portugal to the overvaluation of the domestic currency (loss of price competitiveness) when the country joined the Euro zone.

$$\dot{m} = \pi_c \dot{c} + \pi_g \dot{g} + \pi_x \dot{x} + \pi_k \dot{k} \quad \textbf{(2)}$$

In this way, the growth in demand for imports ($\dot{m}$) depends on the growth rates of private consumption ($\dot{c}$), government expenditures ($\dot{g}$), exports ($\dot{x}$) and investment ($\dot{k}$), respectively. The next step is to determine the growth rates of the components of demand.

2.2. Government sector

We consider that the government budget is given by the following identity:

$$G_n + iB = t(YP) + D \quad \textbf{(3)}$$

where G_n is nominal government expenditures, B is public debt [2], Y is domestic income, P is the domestic price level, D the public deficit, i is nominal interest rate paid on public debt and t is the tax rate on nominal income. According to this relation, public deficit exists when total current expenditures (including interest payments on public debt) exceed the receipts obtained through taxes on domestic money income, $G_n+iB>t(YP)$.

As it is shown in *Appendix II*, the long term relationship of the growth of real government expenditures is given by

$$\dot{g} = t\frac{\dot{y}}{w_G} + \dot{d}\frac{w_D}{w_G} - (\dot{p} + i)\dot{b}\frac{w_B}{w_G} + i\dot{p}\frac{w_B}{w_G} \quad \textbf{(4)}$$

where $w_D = \dfrac{D/P}{Y}$ is the public deficit ratio, $\dot{d} = \dfrac{\Delta D}{D}$ the growth rate of public deficit, $w_G = \dfrac{G}{Y}$ denotes the public expenditure share and $w_B = \dfrac{B/P}{Y}$ the public debt share.

We have to note that the public debt (B) is a combination of both domestic (B_H) and foreign (B_F) debt, i.e, government's bonds are held by residents and non-residents, respectively. Likewise, the public deficit (D) can be financed internally (D_H) or from abroad (D_F). Bearing this in mind, the following relations are established:

[2] Public debt is originated by the issue of government bonds to finance public deficit.

$$B = B_H + B_F \quad ; \quad \frac{B_H}{B} + \frac{B_F}{B} = 1 \quad ; \quad \xi_B = \frac{B_H}{B}; \quad 1 - \xi_B = \frac{B_F}{B}$$
$$D = D_H + D_F \quad ; \quad \frac{D_H}{D} + \frac{D_F}{D} = 1 \quad ; \quad \xi_D = \frac{D_H}{D}; \quad 1 - \xi_D = \frac{D_F}{D} \qquad \textbf{(5)}$$

where ξ_B (the percentage of public debt financed internally) and ξ_D (the percentage of public deficit financed internally) are assumed to be constant in the long run, for simplicity. The extreme case ξ_B=1 shows that public debt is uniquely financed by national bond holders. Analogously ξ_D=1 implies that the budget deficit is entirely financed by domestic resources.

2.3. Private final consumption

The final consumption of households is a function of total disposable income and the yields obtained by holding government bonds:

$$C = c\left[(1-t)Y + r\frac{B_H}{P}\right]^{\varepsilon_c} \qquad \textbf{(6)}$$

After some simplifications, as it is shown in *Appendix III*, the growth of consumption ($\dot{c}$) is a function of the growth of domestic income ($\dot{y}$) with ε_c the income elasticity with respect to consumption:

$$\dot{c} = \varepsilon_c \dot{y} \qquad \textbf{(7)}$$

2.4. Private Investment

The main determinants of investment are after tax income and the real interest rate (*r*)[3] on capital loans:

$$K = \varepsilon\left[(1-t)Y + r\frac{B_H}{P}\right]^{\varepsilon_k} e^{\varepsilon_r r} \qquad \textbf{(8)}$$

[3] Real interest rate is the difference between nominal interest rate and domestic inflation, $r = i - \dot{p}$.

where ε_k and ε_r are the income and interest rate elasticities in relation to change in capital stock. Following the same development as in the case of the consumption function, the growth of investment function reduces to:

$$\dot{k} = \varepsilon_k \dot{y} \qquad \textbf{(9)}$$

2.5. Export Demand Function

In this function it is assumed that foreign income Y^* is the main determinant of export demand. It is explicitly assumed that exports competitiveness is based on non-price competitiveness captured by the income elasticity of the demand for exports. Therefore, we assume that relative prices remain constant in the long-term analysis (the steady state assumption). Having this in mind, the export equation is defined as:

$$X = \beta Y^{*\varepsilon_x} \qquad \textbf{(10)}$$

where ε_x is the income elasticity of demand for exports capturing the non-price characteristics of the exported goods associated with quality, design, reliability, varieties, etc[4]. Expressing this equation in growth rates we get:

$$\dot{x} = \varepsilon_x \dot{y}^* \qquad \textbf{(11)}$$

where $\dot{x}$ is the growth of real exports and $\dot{y}^*$ the growth of real foreign income.

2.6. Balance-of-payments condition

The last relation of the model is an external equilibrium condition given by the following identity:

$$XP - iB_F + D_F = MP^* \qquad \textbf{(12)}$$

[4] Although we assume that the income elasticity of demand for exports captures the quality characteristics of the produced goods we do not neglect the fact that changes in relative prices can be related to changes in relative quality as well.

The left hand side of the identity shows the money resources available to finance imports (export revenues minus interest rate payments on foreign bond holders plus the amount of public deficit assets hold by foreigners). *P** is the foreign price level.

It is shown in *Appendix IV* that the external equilibrium relation can be expressed as:

$$\dot{x} + \dot{p} + (1-\xi_B)\frac{w_D}{w_X}\left[\dot{y} + \dot{p} - i\right] = (\dot{m} + \dot{p})\frac{w_M}{w_X} \qquad \textbf{(13)}$$

where w_M and w_X are the shares of imports and exports on income, respectively and the other variables as defined previously.

Substituting the growth of exports and imports by the relations found in **(11)** and **(2)** we derive:

$$\varepsilon_x \dot{y}^* + \dot{p} + (1-\xi_B)\frac{w_D}{w_X}\left[\dot{y} + \dot{p} - i\right] = \left[\pi_c \dot{c} + \pi_g \dot{g} + \pi_k \dot{k} + \pi_x \dot{x} + \dot{p}\right]\frac{w_M}{w_X} \qquad \textbf{(14)}$$

Further substitution of the growth of consumption **(7)**, government expenditure **(4)**, investment **(9)** and exports **(11)** yields:

$$\begin{aligned} &\varepsilon_x \dot{y}^* + \dot{p} + (1-\xi_B)\frac{w_D}{w_X}\left[\dot{y} + \dot{p} - i\right] = \\ &\left[\pi_c \varepsilon_c \dot{y} + \pi_k \varepsilon_k \dot{y} + \pi_x \varepsilon_x \dot{y}^* + \pi_g\left(\frac{t\dot{y}}{w_G} + \dot{d}\frac{w_D}{w_G} - (\dot{p}+i)\dot{b}\frac{w_B}{w_G} + i\dot{p}\frac{w_B}{w_G}\right) + \dot{p}\right]\frac{w_M}{w_X} \end{aligned} \qquad \textbf{(15)}$$

The next step is to define domestic income growth and find its determinants.

2.7. Domestic income growth

Rearranging terms in equation **(15)** we derive the reduced form of the growth of domestic income as it is shown in the *Appendix V*:

$$\dot{y} = \frac{(\varepsilon_x \frac{w_X}{w_M} - \pi_x \varepsilon_x)\dot{y}^* + \frac{w_X}{w_M}\dot{p} - (1-\xi_B)\frac{w_D r}{w_M} - \pi_g\left(\dot{p}\frac{w_D}{w_G} - \dot{p}^2\frac{w_B}{w_G}\right) - \dot{p}}{\pi_c \varepsilon_c + \pi_k \varepsilon_k + \pi_g(\frac{t}{w_G} + \frac{w_D}{w_G} - (\dot{p}+i)\frac{w_B}{w_G}) - (1-\xi_B)\frac{w_D}{w_M}} \qquad \textbf{(16)}$$

Equation **(16)** shows that among other factors the growth of domestic income is determined by internal and external imbalances. Furthermore if we assume internal and external equilibrium (*B=0, D=0* and *X=M)* equation **(16)** reduces to[5]:

$$\dot{y} = \frac{(\varepsilon_x - \pi_x \varepsilon_x)\dot{y}^*}{\pi_c \varepsilon_c + \pi_k \varepsilon_k + \pi_g} \qquad \textbf{(17)}$$

Equation **(17)** is similar to Thirlwall's original Law given by $\dot{y} = \frac{\varepsilon_x \dot{y}^*}{\pi}$. The only difference is that equation **(17)** takes into account the import content of exports in the numerator and the import content of other components of domestic demand in the denominator. It would be interesting to test empirically these alternative versions and check the difference in predicting domestic growth when internal and external imbalances exist or not.

3. Testing the model for the Portuguese economy

Equations **(2)**, **(7)**, **(9)** and **(11)** are estimated simultaneously to obtain the elasticities which are needed to compute the reduced form of domestic income growth as it is expressed in equation **(16)**. The definition of the variables and the data sources are explained in *Appendix VI*. The method used for estimating the system equations is *3SLS (Three-Stage Least Squares)* as it is more efficient to capture the interrelation between equations and the causal and feedback effects between the variables.[6] **Table 1** in the *Appendix VII* provides the estimation results where simultaneity is controlled by using instrumental variables. The growth of imports, consumption, investment and exports are assumed to be endogenous as well as the growth of government expenditures and domestic income. All other variables of the system are assumed exogenous including some lagged variables, as it is explained in **Table 1**.

We also regressed each of the equations individually, by *2SLS*, with the same instruments as before. The intention was to carry out some diagnostic tests to justify the robustness of our results. The first is the Sargan statistic, a test of over-identifying restrictions to check the validity of the instruments used in the regressions and that

[5] We are assuming that prices, real interest rates, the deficit and debt ratios are constant in the long run. Also, $t/w_G=1$.

[6] For more details on the 3SLS method, see for instance, AlDakhil (1998) and Wooldridge (2002).

hypothesis is confirmed in all cases (in equation (2), only at the 10% level). The second is the Pagan-Hall heteroscedasticity test, showing that the hypothesis of homoscedasticity is never rejected. The third test is the Cumby-Huizinga test for autocorrelation. The null hypothesis is that errors are not first-order autocorrelated and this is confirmed in all cases. The last one is a normality test, conceptually similar to the Jarque-Bera skewness and kurtosis test. The null hypothesis is that residuals from a given regression are normally distributed, and this hypothesis is not rejected in all equations.

Table I reports the values which are necessary for computing the growth of domestic income. Some are estimated values taken from **Table 1** (*Appendix VII*) others are annual averages over the period considered (see *Appendix VI* for definition and data sources). Three growth rates are computed: $\dot{y}_a$ obtained from equation **(16)** where internal and external imbalances are considered; $\dot{y}_b$ obtained from equation **(17)** where internal and external equilibrium is assumed, and $\dot{y}_c$ obtained from Thirlwall's original Law, given by $\dot{y} = \frac{\varepsilon_x \dot{y}^*}{\pi}$. In the latter case, it was necessary to estimate the import demand function, $\dot{m} = \pi \dot{y}$, by OLS (with robust standard errors) to obtain the aggregate income elasticity with respect to import growth (π=2.02217)[7].

Table I. Computation of the growth rates of domestic income. Portugal 1985-2008.

ε_x	π_x	ε_c	π_c	ε_k	π_k	π_g	r	t
2.9789	0.5578	0.6597	0.7367	2.2206	0.3513	0.1273	0.0261	0.3668
w_D	w_G	w_B	ξ_D	ξ_B	w_M	w_X	$\dot{p}$	$\dot{y}^*$
0.0472	0.3805	0.5715	0.401	0.401	0.3642	0.2906	0.0690	0.0277
$\dot{y}_a$ **=0.2846%**	$\dot{y}_b$ **=2.6265%**	$\dot{y}_c$ **=2.7508%**	$\dot{y}$ **=2.8375%**					
Internal and external imbalances equation (16)	Internal and external equilíbrium equation (17)	Thirlwall's Law	Actual growth					

Notes: $\varepsilon_x, \pi_x, \varepsilon_c, \pi_c, \varepsilon_k, \pi_k$ and π_g are taken from **Table 1** (*Appendix VII*).

r, t, w_D, w_G, w_B, w_M, w_X, $\dot{p}$ and $\dot{y}^*$ are annual averages over the period 1985-2008.

ξ_D and ξ_B = 0.401 is assumed constant over the whole period.

[7] For more details on testing Thirlwall's Law for the Portuguese economy see Soukiazis and Antunes (2009).

Comparing these different growth rates with the actual average annual growth in Portugal over the period 1985-2008 ($\dot{y}$ =2.8375%) the following remarks can be made:

(i) The growth rate obtained by Thirlwall's original Law ($\dot{y}_c$ =2.7508%) with aggregate income elasticity of imports accurately predicts actual growth rate ($\dot{y}$ =2.8375%) in Portugal. The Portuguese economy grew, on average, 0.08 percentage points (per annum), higher than that allowed by the balance-of-payments equilibrium.

(ii) The growth rate obtained by the modified Thirlwall's Law with the decomposition of the income elasticity of imports ($\dot{y}_b$ =2.6265%) is also close to the actual growth rate. In this case the Portuguese economy grew, on average, 0.21 percentage points (per annum) higher than that consistent with the balance-of-payments equilibrium. However, these two predicted growth rates do not take into account internal and external imbalances.

(iii) The growth rate obtained by the augmented Thirlwall's model which considers internal and external imbalances ($\dot{y}_a$ =0.2846%) underestimates substantially the actual growth in Portugal. This result shows that Portugal should only grow 0.28% (per annum) in order not to aggravate internal and external imbalances. In other words, Portugal grew faster than the rate allowed by the balance-of-payments equilibrium and public financial capability at the cost of accumulating internal and external deficits and this can explain the recent debt crisis of the country. In order to grow faster without deteriorating internal and external imbalances some improvements have to be made to the structural parameters and other values of the model, especially those related with competitiveness.

(iv) The fact that Portugal grew at a higher average growth rate (2.83%) than that predicted by our model in the last two decades can be explained by capital inflows financing this extra growth. The actual higher growth was obtained at the expense of accumulating higher external debt over time corresponding to 233% of GDP in 2009. On the other hand, the low growth rate predicted by our model (0.28%) is due to the fact that internal imbalances imply

capital outflows via debt interest rate payments. Therefore, they play a similar role as imports, restricting growth in the long run.

An important explanation of the low growth performance predicted from our model lies in the high import sensitivity of the components of demand, and especially that of exports, as can be seen by the import elasticity with respect to exports, π_x = 0.56. This elasticity shows that if exports increase by one percent this will induce a 0.56 percent increase in imports (more than half). Therefore the export-led multiplier effects on growth are not substantial in the Portuguese economy as they are counter-balanced by the increase in imports. We have to notice here that what is important in international trade is not importing too much in order to produce exports, but ensuring that the transformation of imported components into exports contains enough value-added. In international markets, most exports embody a substantial share of imported components, but in terms of gains it is important that the value (price) of exports embodying imported components is sufficiently higher than the value (price) of those imported components. Traditionally Portugal produces low value-added exports (due to low productivity) despite the move from low to medium or medium-high technology exports in recent years (OECD, 2008, p.148). The weight of the service sector in the overall economy has risen (corresponding to 75.4% of gross value added against 22.3% in industry and 2.3% in agriculture) but labour productivity gains have been particularly weak and even negative since the beginning of the current decade. The service sector involves mainly a high number of micro enterprises (wholesale, retail, hotels and restaurants) with a substantial proportion of informality (OECD Economic Survey, 2010).

The import sensitivity is also high in consumption (π_c = 0.74), but relatively low for investment (π_k =0.35) and government spending (π_g = 0.13). The high import sensitivity of the components of demand explains the high income elasticity of the demand for imports at the aggregate level π=2.02217 showing that imports grow twice the increase in domestic income. The high penetration of imports can also be seen by the share of imports in income around w_M =36%, with exports representing w_X = 29%.

Some scenarios can be made with the aim to detect the factors that could help the economy to grow faster.

(i) Fiscal policy towards a reduction in income taxation. If taxation on income reduces from t = 37% to 20% (everything else constant) the predicted growth is $\dot{y}_a$ = 0.2974%. It seems that a more friendly taxation policy alone is not efficient to stimulate higher growth.

(ii) Monetary policy towards a reduction in domestic inflation by keeping wage growth low and in line with productivity growth. If inflation reduces from $\dot{p}$ =6.9% to 2% (everything else constant) the predicted growth is $\dot{y}_a$ =0.7445% concluding that lower inflation is not a big stimulus for growth either. Combining both low taxation t = 20% and low inflation $\dot{p}$ =2% the predicted growth is $\dot{y}_a$ = 0.777% per annum. Again this mixed policy is not sufficient to enhance higher growth.

(iii) Budget deficit policy aiming at reducing public deficit and debt. Assuming that public deficit is w_D = 0.09 (9% of GDP, the prevailing rate in recent years) and public debt w_B =0.90 (90% of GDP the prevailing rate in the last years) our model predicts a growth rate around $\dot{y}_a$ = 0.1130%. This shows in fact that high public imbalances force the Portuguese economy to grow at very low rates. But on the other hand if we assume w_D = 0.03 and w_B =0.60 (the values imposed by the Stability Pact) the predicted growth is around $\dot{y}_a$ = 0.3696%. Therefore public budget discipline alone does not help the economy to grow at faster rates.

(iv) Assuming again a mixed policy of low income taxation t = 0.20, low inflation $\dot{p}$ =0.02 and public budget discipline in line with the goals of the Stability Pact, w_D = 0.03 and w_B =0.60, the resulting annual growth rate becomes $\dot{y}_a$ = 0.9408%. This combined policy leads to an income growth around 1% in Portugal which is not high enough for the country to converge to its European partners.

(v) However the previous scenario (iii) does not take into account the link between fiscal policy and external trade and especially the import dependence of the public sector. This link can be seen by reconsidering the balance-of-payments equilibrium condition, equation **(12).** If we divide this equation through nominal income we obtain $w_X = w_M + i\frac{B_F}{YP} - \frac{D_F}{YP}$, or

alternatively, $w_M = w_X - i\frac{B_F}{YP} + \frac{D_F}{YP}$, where w_M and w_X are the shares of import and export relative to income, and *i* is the nominal interest rate paid on public debt. Changes in $\frac{B_F}{YP}$ and $\frac{D_F}{YP}$ affect directly the import share of the whole economy and this in turn affects growth. The share of the public debt financed by foreign investors is given by $\frac{B_F}{YP} = (1-\xi_B)w_B = 0.3423$[8]. Therefore, the share of public debt financed externally on income is around 34%. In the same way, the share of the budget deficit financed from abroad is given by $\frac{D_F}{YP} = (1-\xi_D)w_D = 0.0283$[9]. Substituting these values[10] in the above equation we obtain a new value of the share of imports equal to w_M=0.2864[11]. Plugging this import share value (28.64%) into the augmented form of Thirlwall's Law, equation **(16)**, yields a growth rate around $\dot{y}_a$ = 2.82% per annum. In fact, with this new import share, the exports to imports ratio (w_X/w_M) would be higher than 1, more favorable than the existent ratio of 0.8.

(vi) Reducing the import sensitivity of exports (elasticity) from π_x=0.56 to 0.30 our model predicts a growth rate of $\dot{y}_a$ = 1.9259 % and if π_x = 0.20 the growth rate is even higher, $\dot{y}_a$ = 2.5626 %. In our opinion this is the most important drawback of the Portuguese economy. Having a large import sensitivity of exports is an impediment to growth since the exports' multiplier effects on income are crowded out by higher imports. Reducing the import content of exports is the appropriate policy to achieve higher growth.

(vii) Reducing alternatively the import sensitivity of consumption from π_c=0.74 to 0.50 and that of investment from π_k=0.35 to 0.20 the predicted growth is

[8] From **Table I** we know that ξ_B=0.401 (only 40.1% of the external debt is financed by domestic resources and the rest from abroad, 59.9%) and w_B=0.5715 (the share of total public debt on income).

[9] These values are also taken from **Table I**, where ξ_D=0.401 and w_D=0.0472 (the share of budget deficit on income).

[10] w_X (the share of exports) and *i*(nominal interest rate) are also taken from **Table I**.

[11] The difference of about 6 percentage points between this new value and the value reported in **Table I** can be explained by capital inflows which are not considered in our model.

$\dot{y}_a$ =0.3236% and $\dot{y}_a$ =0.3842%, respectively. Therefore, the stimulus for growth is not significant by reducing individually the import contents of these components of demand. The explanation can rely on the view that imported raw material, machinery and high technology goods are important for investment. On the other hand, some imported consumption goods (especially not produced domestically) contribute to increase the standards of living and productivity.

(viii) Reducing the share of imports by only 4 percentage points (from 36% to 32%) the predicted growth is $\dot{y}_a$ = 1.56%, or alternatively increasing the share of exports by 4 percentage points (from 29% to 33%) the obtained growth is even higher, $\dot{y}_a$ = 3.013%. A combined policy with the aim at reducing the import share to 30% and increasing export share to 35% (having a surplus on trade) yields an even higher growth rate, around $\dot{y}_a$ = 4.6191%. Therefore changing the structure of the shares of imports and exports is the appropriate way to achieve higher growth.

According to these hypothetical scenarios it is clearly shown that the most effective policy to achieve higher growth in Portugal applies to the external sector, towards a balanced external trade or lowering the import share and especially the import sensitivity of exports. This is in line with Thirlwall's Law that affirms that growth is balance-of-payments constrained.

4. Concluding remarks

The aim of this study was to develop an alternative growth model in line with Thirlwall's Law that takes into account both internal and external imbalances. The important contribution of the model is that it discriminates the import content of aggregate demand and introduces public deficit and debt measures as determinants of growth. The reduced form of the model shows that growth rates can be obtained in three alternative ways: assuming internal and external imbalances; assuming that public finances and current account external payments are balanced; and lastly the growth rate predicted by Thirlwall's Law. The growth model is tested for the Portuguese economy to check its accuracy.

The equations constituting the model are estimated by *3SLS* to control the endogeneity of variables and to obtain consistent estimates. The empirical analysis shows that growth rates obtained by Thirlwall's Law accurately predict the average growth rate of the Portuguese economy over the period 1985-2008 when the aggregate income elasticity of imports is used. When income elasticity of imports is decomposed into the main components of demand, the predicted growth rate is also close to the actual one. However, in these two cases external trade is balanced and public finances are at equilibrium. When trade and public imbalances are allowed the predicted growth rate is very different from the actual one and close to zero.

The scenarios implemented to explain the low growth rate predicted by our model point to the fact that policies aiming to equilibrate external deficits or reducing the import sensitivity of exports are more effective for achieving higher growth in comparison to fiscal or monetary policies. In fact if the import elasticity of exports reduces from 0.56 to 0.30 (or 0.20) the predicted growth rate becomes closer to the actual average rate. Our study shows that the high import content of exports is the most important handicap to the Portuguese economy, confirming therefore that growth is balance-of-payments constrained, which is the essence of Thirlwall's Law.

Appendix I

Notations and assumptions:

ΔA is absolute change and $\frac{\Delta A}{A} = \dot{a} = \Delta \ln A$ is relative change of variable A.

We assume that relative prices $\frac{P}{P*} = 1$ are constant in the long run, with P denoting domestic prices and P* foreign prices (the one price law).

i is nominal interest rate given by $i = r + \dot{p}$ where r is the real interest rate and $\dot{p}$ the inflation rate. In the long run all these variables are assumed constant [12] .

B is public debt and $w_B = \frac{B/P}{Y}$ denotes the public debt ratio relative to real income. We note that $\ln B = \ln w_B + \ln P + \ln Y$ and taking relative changes (first differences) we establish the condition $\dot{b} = \dot{p} + \dot{y}$ assuming wB constant in the long run.

We assume that the absolute change in public debt is due to public deficit, D, given by D=ΔB. Alternatively $\frac{D}{\Delta(YP)} = \frac{\Delta B}{\Delta(YP)}$.

Since $w_B = \frac{B}{YP} \Rightarrow B = w_B YP \Rightarrow \Delta B = w_B \Delta(YP)$ we can define analogously:

$D = w_B \Delta(YP) \Rightarrow \frac{D}{YP} = w_B \frac{\Delta(YP)}{YP} \approx w_D = w_B(\dot{y} + \dot{p})$ with $w_D = \frac{D}{YP}$ constant. Therefore

$$\Delta(\frac{D}{PY}) = 0 \Rightarrow \frac{\Delta D(PY) - \Delta(PY)D}{(PY)^2} = 0 \Rightarrow \Delta D(PY) = \Delta(PY)D \Rightarrow \frac{\Delta D}{D} = \frac{\Delta(PY)}{PY}$$

getting $\dot{d} = \dot{p} + \dot{y}$

[12] This is a plausible assumption for the EU countries, since local authorities have no control on interest rates and monetary policy is managed by the European Central Bank.

Appendix II

Government sector

We consider that the government budget is given by the following identity:

$$G_n + iB = tYP + D$$

where G_n is current government expenditures, B is public debt, Y is domestic income, P is the price level, D the public deficit, i is nominal interest rate paid on public debt and t is the tax rate on income. The above relation can be divided by P to define real government expenditures, $G = \frac{G_n}{P}$.

$G = tY + \frac{D}{P} - \frac{B}{P}i$ and taking absolute changes we get

$\Delta G = t\Delta Y + \Delta(\frac{D}{P}) - \Delta(\frac{B}{P})i = t\Delta Y + \frac{P\Delta D - D\Delta P}{P^2} - i(\frac{P\Delta B - B\Delta P}{P^2})$ assuming that the interest rate is fixed. Dividing this new equation by G we get

$$\frac{\Delta G}{G} = t\frac{\Delta Y}{Y}\frac{Y}{G} + \frac{\Delta D}{D}\frac{D}{YP}\frac{Y}{G} - \frac{D}{B}\frac{\Delta P}{P}\frac{B}{YP}\frac{Y}{G} - i\frac{\Delta B}{B}\frac{B}{YP}\frac{Y}{G} + i\frac{\Delta P}{P}\frac{B}{YP}\frac{Y}{G}$$

Making use of the assumption that $D=\Delta B$ (the change in public debt is due to public deficit) and defining $w_G = \frac{G}{Y}$ as the share of government expenditures (as a percentage of real income) we obtain the following long term relationship:

$$\dot{g} = t\frac{\dot{y}}{w_G} + \dot{d}\frac{w_D}{w_G} - (\dot{p} + i)\dot{b}\frac{w_B}{w_G} + i\dot{p}\frac{w_B}{w_G}$$

where $w_D = \frac{D/P}{Y}$ and $w_B = \frac{B/P}{Y}$ are the deficit and debt ratios (as a percentage of nominal income), respectively. Low-case letter with a dot denotes growth rate of the respective variable.

Appendix III

Consumption

The final consumption of households is a function of total disposable income and the yields obtained by holding government bonds:

$C = c\left[(1-t)Y + r\frac{B_H}{P}\right]^{\varepsilon_c}$ or, alternatively,

$$C = c\left[(1-t)Y + r\frac{B_H}{PY}Y\right]^{\varepsilon_c} = c\left[(1-t)Y + rw_{BH}Y\right]^{\varepsilon_c} = \mathrm{c}\left[((1-\mathrm{t}) + \mathrm{rw}_{\mathrm{BH}})Y\right]^{\varepsilon_c}$$

with $w_{BH} = \frac{B_H}{PY}$ representing the share of home bond holders of the public debt.

Taking logs we get

$$\ln C = \ln c + \varepsilon_c\left[\ln Y + \ln\left((1-t) + rw_{BH}\right)\right]$$

Differentiating with respect to time we obtain

$$\dot{c} = \varepsilon_c\left[\dot{y} + \frac{r\Delta w_{BH}}{(1-t) + rw_{BH}}\right]$$

However, $w_{BH} = \frac{B_H}{PY} = \frac{B_H}{B}\frac{B}{YP} = \xi_B w_B$ is constant in the long run (the steady state condition). Therefore, $\Delta w_{BH} = 0$, and the growth of consumption equation reduces to

$$\dot{c} = \varepsilon_c \dot{y}$$

Appendix IV

External imbalances

The external equilibrium condition is given by

$$XP - iB_F + D_F = MP^*$$

Taking absolute changes and dividing by *XM* we get

$$\frac{P\Delta X}{XM} + \frac{X\Delta P}{XM} - \frac{i\Delta B_F}{XM} + \frac{\Delta D_F}{XM} = \frac{P^*\Delta M}{XM} + \frac{M\Delta P^*}{XM}$$

$$\dot{x}\frac{P}{M} + \frac{\Delta P}{M} - i\frac{\Delta B_F}{XM} + \frac{\Delta D_F}{XM} = \dot{m}\frac{P^*}{X} + \frac{\Delta P^*}{X}$$ dividing by P and assuming $P=P^*$ we obtain

$$\dot{x}\frac{1}{M} + \frac{\Delta P}{P}\frac{1}{M} - i\frac{\Delta B_F}{XMP} + \frac{\Delta D_F}{XMP} = \dot{m}\frac{1}{X} + \frac{\Delta P^*}{P}\frac{1}{X}$$ assuming $\Delta P = \Delta P^*$

$$\frac{\dot{x}}{M} + \dot{p}\frac{1}{M} - i\frac{\Delta B_F}{YP}\frac{Y}{XM} + \frac{\Delta D_F}{YP}\frac{Y}{XM} = \frac{\dot{m}}{X} + \frac{1}{X}\dot{p}$$ multiplying by M

$$\dot{x} + \dot{p} - i\frac{\Delta B_F}{YP}\frac{Y}{X} + \frac{\Delta D_F}{YP}\frac{Y}{X} = (\dot{m} + \dot{p})\frac{M/Y}{X/Y}$$ since $\Delta B_F = \Delta B(1-\xi_B)$ and $\Delta D_F = \Delta D(1-\xi_B)$

$$\dot{x} + \dot{p} - i(1-\xi_B)\frac{\Delta B}{YP}\frac{1}{w_X} + \frac{(1-\xi_B)\Delta D}{YP}\frac{1}{w_X} = (\dot{m} + \dot{p})\frac{w_M}{w_X}$$ alternatively

$$\dot{x} + \dot{p} - i(1-\xi_B)\frac{\Delta B}{YP}\frac{1}{w_X} + (1-\xi_B)\frac{\Delta D}{D}\frac{D}{YP}\frac{1}{w_X} = (\dot{m} + \dot{p})\frac{w_M}{w_X}$$ knowing that $\Delta B = D$ and $w_D = D/YP$

$$\dot{x} + \dot{p} - i(1-\xi_B)\frac{w_D}{w_X} + (1-\xi_B)\dot{d}\frac{w_D}{w_X} = (\dot{m} + \dot{p})\frac{w_M}{w_X}$$ substituting $\dot{d} = \dot{y} + \dot{p}$

$$\dot{x} + \dot{p} - i(1-\xi_B)\frac{w_D}{w_X} + (1-\xi_B)(\dot{y} + \dot{p})\frac{w_D}{w_X} = (\dot{m} + \dot{p})\frac{w_M}{w_X}$$

$$\dot{x} + \dot{p} + (1 - \xi_B)\frac{w_D}{w_X}\left[\dot{y} + \dot{p} - i\right] = (\dot{m} + \dot{p})\frac{w_M}{w_X}$$

Appendix V

Growth of domestic income

As explained in *section 2.6*, the balance of payments can be expressed by equation **(13)**

$$\varepsilon_x \dot{y}^* + \dot{p} + (1 - \xi_B)\frac{w_D}{w_X}\left[\dot{y} + \dot{p} - i\right] =$$
$$\left[\pi_c \varepsilon_c \dot{y} + \pi_k \varepsilon_k \dot{y} + \pi_x \varepsilon_x \dot{y}^* + \pi_g\left(\frac{t\dot{y}}{w_G} + \dot{d}\frac{w_D}{w_G} - (\dot{p} + i)\dot{b}\frac{w_B}{w_G} + i\dot{p}\frac{w_B}{w_G}\right) + \dot{p}\right]\frac{w_M}{w_X}$$

Using the steady state conditions established in *Appendix I*, that $\dot{d} = \dot{p} + \dot{y}$ and analogously $\dot{b} = \dot{p} + \dot{y}$, we get

$$\varepsilon_x \dot{y}^* + \dot{p} + (1 - \xi_B)\frac{w_D}{w_X}\left[\dot{y} + \dot{p} - i\right] =$$
$$\left[\pi_c \varepsilon_c \dot{y} + \pi_k \varepsilon_k \dot{y} + \pi_x \varepsilon_x \dot{y}^* + \pi_g\left(\frac{t\dot{y}}{w_G} + (\dot{y} + \dot{p})\frac{w_D}{w_G} - (\dot{p} + i)(\dot{y} + \dot{p})\frac{w_B}{w_G} + i\dot{p}\frac{w_B}{w_G}\right) + \dot{p}\right]\frac{w_M}{w_X}$$

Furthermore

$$\varepsilon_x \dot{y}^* + \dot{p} + (1 - \xi_B)\frac{w_D}{w_X}\left[\dot{p} - i\right] - \left[\pi_x \varepsilon_x \dot{y}^* + \pi_g\left(\dot{p}\frac{w_D}{w_G} - (\dot{p} + i)\dot{p}\frac{w_B}{w_G} + i\dot{p}\frac{w_B}{w_G}\right) + \dot{p}\right]\frac{w_M}{w_X} =$$
$$= -(1 - \xi_B)\frac{w_D}{w_X}\dot{y} + \left[(\pi_c \varepsilon_c + \pi_k \varepsilon_k) + \pi_g\left(\frac{t}{w_G} + \frac{w_D}{w_G} - (\dot{p} + i)\frac{w_B}{w_G}\right)\right]\dot{y}\frac{w_M}{w_X}$$

Gathering terms together we obtain

$$\left(\varepsilon_x - \pi_x \varepsilon_x \frac{w_M}{w_X}\right)\dot{y}^* + \dot{p} + (1 - \xi_B)\frac{w_D}{w_X}\left[\dot{p} - i\right] - \left[\pi_g\left(\dot{p}\frac{w_D}{w_G} - \dot{p}^2\frac{w_B}{w_G}\right) + \dot{p}\right]\frac{w_M}{w_X} =$$
$$= \dot{y}\left\{\left[\pi_c \varepsilon_c + \pi_k \varepsilon_k + \pi_g\left(\frac{t}{w_G} + \frac{w_D}{w_G} - (\dot{p} + i)\frac{w_B}{w_G}\right)\right]\frac{w_M}{w_X} - (1 - \xi_B)\frac{w_D}{w_X}\right\}$$

Multiplying both sides by w_X we get

$$(w_X\varepsilon_x - \pi_x\varepsilon_x w_M)\dot{y}^* + w_X\dot{p} + (1-\xi_B)w_D[\dot{p}-i] - \left[\pi_g\left(\dot{p}\frac{d}{w_G} - \dot{p}^2\frac{w_B}{w_G}\right) + \dot{p}\right]w_M =$$

$$= \dot{y}\left\{\left[\pi_c\varepsilon_c + \pi_k\varepsilon_k + \pi_g\left(\frac{t}{w_G} + \frac{w_D}{w_G} - (\dot{p}+i)\frac{w_B}{w_G}\right)\right]w_M - (1-\xi_B)w_D\right\}$$

Having in mind that $[\dot{p}-i]$=-r with *r* the real interest rate and solving for $\dot{y}$ we obtain

$$\dot{y} = \frac{(w_X\varepsilon_x - \pi_x\varepsilon_x w_M)\dot{y}^* + w_X\dot{p} - (1-\xi_B)w_D r - \left[\pi_g\left(\dot{p}\frac{w_D}{w_G} - \dot{p}^2\frac{w_B}{w_G}\right) + \dot{p}\right]w_M}{\left[\pi_c\varepsilon_c + \pi_k\varepsilon_k + \pi_g\left(\frac{t}{w_G} + \frac{w_D}{w_G} - (\dot{p}+i)\frac{w_B}{w_G}\right)\right]w_M - (1-\xi_B)w_D}$$

Dividing both the numerator and the denominator by w_M we obtain the reduced form of the growth of domestic income, which among other factors is determined by internal and external imbalances.

$$\dot{y} = \frac{(\varepsilon_x\frac{w_X}{w_M} - \pi_x\varepsilon_x)\dot{y}^* + \frac{w_X}{w_M}\dot{p} - (1-\xi_B)\frac{w_D r}{w_M} - \pi_g\left(\dot{p}\frac{w_D}{w_G} - \dot{p}^2\frac{w_B}{w_G}\right) - \dot{p}}{\pi_c\varepsilon_c + \pi_k\varepsilon_k + \pi_g\left(\frac{t}{w_G} + \frac{w_D}{w_G} - (\dot{p}+i)\frac{w_B}{w_G}\right) - (1-\xi_B)\frac{w_D}{w_M}}$$

Appendix VI

Description of the variables and data sources

- $\dot{m}_t$ – annual growth rate of real imports - Imports of goods and services at 2000 prices (national currency; annual percentage change).
- $\dot{c}_t$ – annual growth rate of final private consumption - Private final consumption expenditure at 2000 prices (national currency; annual percentage change).
- $\dot{x}_t$ – annual growth rate of real exports - Exports of goods and services at 2000 prices (national currency; annual percentage change).
- $\dot{k}_t$ – annual growth rate of investment - Gross fixed capital formation at 2000 prices (national currency; annual percentage change).
- $\dot{y}_t$ – annual growth rate of real GDP - GDP at 2000 market prices (national currency; annual percentage change).
- $\dot{p}_t$ – annual growth rate of price deflator GDP at market prices (national currency; annual percentage change).
- w_G – share of government's expenditure on GDP - Total expenditure; general government (% of GDP at market prices; excessive deficit procedure).
- w_D – share of government's deficit on GDP - Net lending (-) or net borrowing (+); general government (% of GDP at market prices; excessive deficit procedure).
- w_B – share of government's debt on GDP - General government consolidated gross debt (% of GDP at market prices; excessive deficit procedure). It excludes interest rate payments on debt.
- w_M - imports of goods and services at current prices (national accounts) - % of GDP at market prices
- w_X-. exports of goods and services at current prices (national accounts) - % of GDP at market prices.
- t – share of government's revenues on GDP - Total current revenue; general government (% of GDP at market prices; excessive deficit procedure).
- i – nominal long-term interest rates (%)

Data on $\dot{m}_t$, $\dot{c}_t$, $\dot{x}_t$, $\dot{k}_t$, $\dot{y}_t$, $\dot{p}_t$, w_G, w_D, w_B,, w_M, w_X, t and i were taken from European Commission (2009).

- $\dot{g}_t$ – annual growth rate of government's expenditure. Computed by the authors from data on general government expenditure (Millions of euro from 1.1.1999/ECU up to 31.12.1998), available on Eurostat - Government Accounts (http://appsso.eurostat.ec.europa.eu/nui/setupModifyTableLayout.do, extracted on 14th January, 2011) and information on $\dot{p}_t$.
- $\dot{y}^*$ - annual growth rate of real foreign income (OECD countries).

1985–1994: GDP at the price levels and exchange rates of 2000 (billions of US dollars) – OECD (2006). Annual growth rates computed by the authors.
1995-2008: Real GDP (% change from previous year) – OECD (2009).

Appendix VII

Table 1. Estimation of the structural growth model: Portugal 1985-2008.

3SLS	Coefficient	Std Error	t-stat	p-value	R^2	F-stat	p-value
Imports growth							
constant	-0.415	1.293	-0.32	0.590			
$\dot{c}_t$	0.737	0.428	1.72	0.089*			
$\dot{g}_t$	0.127	0.078	1.64	0.104	0.8433	28.69	0.000
$\dot{x}_t$	0.558	0.163	3.43	0.001***			
$\dot{k}_t$	0.351	0.171	2.05	0.044**			
Consumption growth							
constant	1.244	0.449	2.77	0.007***	0.4960	29.59	0.000
$\dot{y}_t$	0.660	0.121	5.44	0.000***			
Investment growth							
constant	-2.013	1.125	-1.79	0.077*	0.7138	52.13	0.000
$\dot{y}_t$	2.221	0.308	7.22	0.000***			
Exports growth							
constant	-2.602	1.512	-1.72	0.089*	0.5678	32.84	0.000
$\dot{y}_t$ *	2.979	0.520	5.73	0.000***			

Table 1. Estimation of the structural growth model: Portugal 1985-2008 (continued)

2SLS	Coefficient	Std Error	t-stat	p-value	Sargan test	Het. test	AR(1) test	Norm. test
Imports growth								
constant	-0.545	1.705	-0.32	0.753	χ^2_9=11.896	χ^2_{13}=7.980	χ^2_1=2.364	χ^2_2=0.25
$\dot{c}_t$	1.089	0.595	1.83	0.084*	p-value=0.2192	p-value=0.8449	p-value=0.1241	p-value=0.8820
$\dot{g}_t$	0.053	0.106	0.50	0.623				
$\dot{x}_t$	0.475	0.224	2.12	0.048**				
$\dot{k}_t$	0.386	0.233	1.66	0.115				
Consumption growth								
constant	1.414	0.485	2.92	0.008***	χ^2_{12}=19.897	χ^2_{13}=16.599	χ^2_1=0.0104	χ^2_2=0.45
$\dot{y}_t$	0.600	0.134	4.49	0.000***	p-value=0.0691	p-value=0.2183	p-value=0.9186	p-value=0.7994
Investment growth								
constant	-1.836	1.194	-1.54	0.139	χ^2_{12}=10.426	χ^2_{13}=13.282	χ^2_1=0.7795	χ^2_2=0.46
$\dot{y}_t$	2.158	0.329	6.55	0.000***	p-value=0.5787	p-value=0.4263	p-value=0.3773	p-value=0.7929
Exports growth								
constant	-2.534	1.627	-1.56	0.134	(1)	χ^2_1=0.948 (2)	χ^2_1=0.7252	χ^2_2=2.66
$\dot{y}_t$ *	2.924	0.554	5.27	0.000***		p-value=0.3304	p-value=0.3944	p-value=0.2649

Notes: Endogenous variables: $\dot{m}_t$; $\dot{c}_t$; $\dot{k}_t$; $\dot{x}_t$; $\dot{g}_t$; $\dot{y}_t$. Exogenous variables: $\dot{y}_t$ *, w_G, w_B, t_t, w_D, i_t, t_{t-1}, i_{t-1}, $\dot{p}_t$, $\dot{c}_{t-1}$, $\dot{x}_{t-1}$, $\dot{k}_{t-1}$, $\dot{g}_{t-1}$

*, **, *** Coefficient significant at the 10%, 5% and 1% level, respectively.

(1) The last equation is an OLS regression; there is no Sargan test. (2) The heteroscedasticity test on the last equation is a White/Koenker NR^2 test statistic. The Breusch-Pagan/Godfrey/Cook-Weisberg test points to the same conclusion: χ^2_1= 0.438; p-value = 0.5083.

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