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Is the Slovak Economy Doing Well?
A Twin Deficit Growth Approach

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Is the Slovak economy doing well? A twin deficit growth approach*.

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Abstract
Recently, Soukiazis E., Cerqueira P., and Antunes M. (2013) developed a model – hereafter the SCA model - that takes into account the hypotheses that internal and external imbalances can affect economic growth and additionally relative prices are assumed to be not neutral in the pace of economic growth. Although the SCA model is in the spirit of the well known balance of payments constraint hypothesis which became known as Thirlwall’s Law (Thirlwall, 1979) it is more complete in the sense that it considers, along with external imbalances (trade deficits) that internal imbalances (budget deficits or public debt) are additional constraints to economic growth. The recent euro-zone public sovereign debt crisis that started in some peripheral countries shows that when internal imbalances are excessive they can constrain growth and domestic demand, causing severe effects on unemployment rates. The aim of this paper is to apply the more complete SCA model to the Slovak economy (a newly euro-zone member since 2009) and check its accuracy for explaining the growth path in this country. Our empirical analysis shows that Slovakia grew at a higher rate than that allowed by the balance of payments constraint rate and this is consistent with the accumulation of current deficits over the period considered. A scenarios analysis shows that improving trade competitiveness and changing the import and export shares toward current account equilibrium will be the most successful way to achieving higher growth in Slovakia. Financing the economy at a lower cost is also beneficial to growth.

JEL code: C32, E12, H6, O4

Keywords: internal and external imbalances, price and income elasticities of external trade, equilibrium growth rates, 3SLS system regressions, supply constraints.

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1. Introduction

The balance of payments constrained growth hypothesis was first introduced by Thirlwall (1979). Using a simple demand orientated approach he established the so called growth rate consistent with the balance-of-payments equilibrium. This hypothesis defines a simple regularity (known as Thirlwall’s Law) that actual growth can approximately be predicted by the ratio of export growth to the income elasticity of demand for imports or, alternatively, by the ratio of the income elasticity of exports to the income elasticity of imports times the growth rate of foreign income. More specifically, the first regularity is given by \( \dot{y} = \frac{\dot{x}}{\pi} \) and the alternative one by \( \dot{y} = \frac{\varepsilon}{\pi} \dot{y}^* \), where \( \dot{y} \) is the growth of domestic income, \( \dot{y}^* \) the growth of foreign income, \( \dot{x} \) the growth of real exports, \( \pi \) the income elasticity of the demand for imports and \( \varepsilon \) the income elasticity of the demand for exports. To obtain these simple forms, relative prices are assumed to be constant and the balance of payments is in equilibrium (on the current account) \(^1\). The implication of Thirlwall’s Law is that no country can grow faster than its balance of payments equilibrium growth rate, unless it can continuously finance external deficits by capital inflows, which is not always a sustainable solution \(^2\). Growth is constrained by external demand and balance-of-payments disequilibrium on the current account (external imbalance) can be a serious impediment to higher growth when it cannot be financed by the 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. For this reason international relative prices are not playing a significant role (are neutral) in the long term analysis.

A huge number of empirical studies emerged testing the validity of Thirlwall’s Law or criticizing the basic assumptions that it relies on, namely that relative prices are constant in the

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\(^1\) For recent applications of this Law see Soukiazis and Antunes (2012) referred to Portugal and Soukiazis and Muchova (2012) referred to the Slovak Republic.

\(^2\) Financing current account by capital inflows is not a sustainable solution in the long-run and does not have the same dynamic effects on growth as the export-led policy.
long -run and that current account is initially balanced. Among others, McCombie (1989), Moreno-Brid (1998-99), McCombie and Thirlwall (1994) and recently Blecker (2009) have made valuable contributions discussing and criticizing the underlying implications of the Law.

The hypothesis of constant relative prices has been criticized widely in the empirical literature (e.g. McGregor and Swales, 1985; 1991; Alonso and Garcimartín, 1998-99; López and Cruz, 2000). But in most studies in this area, relative prices have shown to be statistically insignificant and when they are significant the price elasticities of imports and exports are very low in size when compared to the income elasticities. This reveals that imports and exports react less to price changes (are inelastic) in comparison to income changes (are elastic). Blecker (2009) stressed that the longer the time period considered the more likely it is that relative prices remain constant. Evidence in the empirical literature seems to support the idea that income is the variable that adjusts to equilibrate external imbalances, implying therefore that growth is indeed balance-of-payments constrained. On the other hand, increasing capital inflows can at most be a temporary way of relaxing the balance-of-payments constraint. But this is not a long-term solution since capital inflows do not allow a country to grow at the export-led cumulative growth rate. What matters in the long-term analysis is the growth of real exports, having higher multiplier effects on domestic growth.

Although Thirlwall’s model has been modified to include capital flows and foreign debt, these studies have not considered the role of public imbalances caused by public deficit and debt as additional constraints to growth. The recent experience of some peripheral euro-zone countries falling into a public debt trap (Greece, Ireland, Portugal, Spain, Italy and recently Cyprus) is the motivation for dealing with this issue. As it is known, the implementation of an expansionary fiscal policy, aiming at strengthening growth rates and reducing unemployment, would not always achieve the desirable objectives (Pelagidis and Desli, 2004). It could be the case that budget deficits, financed either by money printing or by public borrowing, would increase public debt and interest rates, crowd out private investment, aggravate inflation, and harm medium-term growth. The issue of whether budget deficits are always desirable has many
dimensions, including whether government borrowing is used to finance 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 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 and increase of social security benefits. The recent austerity programs implemented in some peripheral countries (Greece and Portugal) confirm this reality.

Our paper aims at contributing to this debate by using a more complete growth model in the spirit of Thirlwall’s Law that takes into account not only external, but also internal imbalances (the twin deficit hypothesis) that emerge from budget deficits and public debt. The model also relaxes the controversial assumption of the neutrality of relative prices by assuming that they can play a significant role in the pace of economic growth. Our model was previously applied to Portugal and Italy revealing that it is very coherent in identifying the most important determinants of growth, mainly associated with external trade competitiveness. It has also been shown that factors related to fiscal policy and public finances (internal imbalances) influence significantly the pace of economic growth in these countries. Our present interest is to test our model to a newly euro-zone member, Slovakia, and provide some assessment on the expected economic performance of this country. Slovakia is a special case study, belonging to the group of the transition economies with sound results on economic improvements and integration in the market economy after its separation from the former Czechoslovakia in 1993.

Taking all these facts into consideration, the paper is organized as follows: in section 2 we briefly present the theoretical growth model that takes into account internal and external imbalances and assumes that relative prices are not neutral; section 3 estimates the structural equations of the model, and section 4 tests the model for the Slovak economy trying to identify the main determinants of growth; a scenario analysis is provided in section 5 focusing on the factors that could foster or harm economic growth in Slovakia. The last section of the paper
presents the main conclusions and policy recommendations that could help the country to improve further its economic performance.

2. Modeling the determinants of Growth.

Soukiazis E., Cerqueira P., and Antunes M. (2013) developed a multi equation model – henceforth the SCA model - where income growth of the domestic economy depends, among other things, on internal and external imbalances and relative prices are assumed to play a non idle role. This approach is in line with the balance of payments constrained growth hypothesis first developed in the pioneering work of Thirlwall (1979) and afterwards became known as the Thirlwall’s Law\(^3\). The SCA model is an extended version of Thirlwall’s Law, having four specific differences: (i) in addition to external imbalances (current account deficits) it also introduces internal imbalances (emerging from public deficit and debt) as determinants of growth; (ii) it takes into account the import contents of the elements of domestic income; (iii) relative prices\(^4\) are introduced explicitly into the growth model; (iv) imports depend on the components of domestic demand and not on aggregate domestic income as in Thirlwall’s Law.

The extended growth model encompasses the following equations which must be estimated simultaneously\(^5\):

\[
\dot{\pi} = \pi_c \dot{c} + \pi_g \dot{g} + \pi_x \dot{x} + \pi_k \dot{i} + \pi_v \dot{v} + \delta_m (\dot{p}^* + \dot{e} - \dot{\pi}) \quad \text{Imports} \quad (1)
\]

\[
\dot{x} = \epsilon_x \dot{y}^* + \delta_x (\dot{p}^* + \dot{e} - \dot{p}) \quad \text{Exports} \quad (2)
\]

\(^3\) For a detailed discussion on the history and new developments of this Law, see Soukiazis and Cerqueira (2012).

\(^4\) The original Thirlwall’s Law assumes that relative prices remain constant in the long-term analysis but this is a debatable assumption, used in some studies for the sake of simplification. Many studies have shown that relative prices are important in international trade and explain a substantial part of economic growth. As an example, Garcimartin et al. (2010-11) attributed the slowdown of economic growth in Portugal to the adoption of a strong currency (loss of price competitiveness) when this country joined the euro- zone.

\(^5\) The time index \(t\) is not attached to the variables for the sake of simplification. Appendix A provides full information on the variables used in the system and the data source.
\[
\dot{c} = \varepsilon_c \dot{y}_d \quad \text{Private consumption (3)}
\]

\[
\dot{\hat{y}v} = \varepsilon_K \dot{y} + \varepsilon_r \dot{r} \quad \text{Private investment (4)}
\]

The first equation of the system explains the growth of imports \( \hat{m} \) depending on the growth of the components of demand, such as the growth rates of private consumption \( \dot{c} \), government expenditures \( \dot{g} \), exports \( \dot{x} \), and investment \( \dot{\hat{y}v} \), respectively. The growth of imports is also assumed to depend on the growth rate of relative prices, given by \( (\dot{p}^* + \dot{e} - \dot{p}) \) where \( \dot{p} \) and \( \dot{p}^* \) are the growth rates of domestic and foreign prices respectively, and \( \dot{e} \) the variation of the exchange rate over time. In the same equation, \( \pi \) represents the elasticity of imports with respect to each of the components of demand which are all expected to be positive since all components of demand have import content. In addition, \( \delta_m < 0 \) is the relative price elasticity of the demand for imports with an expected negative sign, indicating that a currency devaluation is expected to reduce the demand for imports by turning them more expensive in domestic market.

Equation (2) explains the export growth performance \( \dot{x} \) depending mainly on the growth of foreign income \( \dot{y}^* \) (external demand) and the growth of relative prices as has been defined in the import equation. It is therefore explicitly assumed that exports competitiveness is based on price and non-price competitiveness captured by the price and income elasticity of the demand for exports. Specifically, \( \varepsilon_x > 0 \) is the income elasticity of demand for exports capturing the non-price characteristics of the exportable goods associated with quality, design, reliability, varieties, etc. In the same equation \( \delta_x > 0 \) stands for the relative price elasticity of the demand for exports with an expected positive sign, indicating that a currency depreciation reduces the price of exports in international markets increasing therefore their demand.

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\(^6\) Exchange rate is defined as the price of foreign currency in terms of domestic currency units. Therefore when \( e \) increases shows a currency depreciation of the domestic currency.
The aggregate consumption is mainly a function of total disposable income (that includes the returns obtained from holding government bonds) given by Equation (3), where \( \dot{c} \) is the growth of private consumption, \( \dot{y}_d \) the growth of disposable income and \( \varepsilon_c > 0 \) is the income elasticity of consumption.

Private investment is specified according to the conventional accelerator theory\(^7\) stating that the growth of gross investment \( \dot{inv} \) is a function of the growth of domestic income \( \dot{y} \) and real interest rate \( \dot{r} \) as shown in Equation (4). In this equation, \( \varepsilon_k > 0 \) is the accelerator effect and \( \varepsilon_r < 0 \) reflects the impact of real cost in financing gross investment.

Our growth model further includes the government sector assuming that the government budget (in nominal terms) is given by the following identity:

\[
G_n + iB_H + i^*B_F e = tYP + D
\]

where \( G_n \) stands for nominal government expenditures, \( B_H \) is public debt\(^8\) owned by home bond holders, \( B_F \) is public debt owned by foreign bond holders, \( Y \) is domestic income, \( P \) is the domestic price level, \( D \) the public deficit, \( i \) and \( i^* \) are nominal interest rates paid to home and foreign public debt holders, respectively, \( e \) the nominal exchange rate, and \( t \) is the tax rate on nominal income. As a consequence of Equation (5) we can define the alternative expression \( G_n + iB_H + i^*B_F e > tYP \), which shows that public deficit exists when total current expenditures (including interest payments on public debt) exceed the revenues obtained through taxes on domestic money income.

The long term relationship of the growth of real government expenditures \( \dot{g} \) is given by\(^9\):

\(^7\) For more details on the original specification of the investment function see Goodwin (1951) and Chenery (1952).

\(^8\) Public debt is originated by issuing government bonds to finance public deficit.

\(^9\) More details for this derivation can be found in Soukiazis et al. (2012) (see Appendix A, Equation A.5)
\[ \dot{g} = \frac{\dot{y}}{w_G} + (\ddot{d} - \dot{\hat{p}}) w_D + [\Delta i + i(\hat{b}_H - \hat{p})] w_{BLH} - \left[ e \Delta i^* + i^* \Delta e \right] + i^* e \left( \hat{b}_F - \hat{p} \right) w_{BF} \frac{w_G}{w_{BF}} \]

where \( w_D = \frac{D}{YP} \) is the budget deficit ratio, \( w_G = \frac{G}{Y} \) is the government expenditure ratio,

\( w_{BLH} = \frac{B_H}{PY} \) and \( w_{BF} = \frac{B_F}{PY} \) are the shares of public debt owned by home and foreign bond holders (as a percentage of nominal income), respectively, \( \dot{d} \) is the growth of budget deficit and \( \hat{b}_H \) and \( \hat{b}_F \) are the growth rates of the public debt owned by home and foreign bond holders, respectively.

The last relation to complete our growth model is an external equilibrium condition given by the following identity:

\[ XP + D_F e - i^* B_F e = MP^e e \]

The left-hand side of the identity shows the money resources available to finance imports constituted by the export revenues \( XP \) and the amount of public deficit assets hold by foreigners \( D_F e \) less the interest rate payments on foreign bond holders \( i^* B_F e \). As it is shown in Soukiazis et al. (2012) (see Appendix B, Equation (B.6)) the balance of payments final relation can be expressed as:

\[ \dot{x} + \dot{p} + (1 - \xi) \frac{w_D}{w_X} (\ddot{p} + \dot{y} - i^*) - (1 - \xi) \frac{w_B}{w_X} \Delta i^* = \frac{w_M}{w_X} \frac{P^e}{P} \left( \dot{m} + \dot{p}^* + \dot{e} \right) \]

where \( \dot{x}, \dot{m}, \dot{p}, \dot{p}^*, \dot{y}, \) and \( \dot{e} \) are the growth rates of exports, imports, domestic prices, foreign prices, domestic income and nominal exchange rate, respectively. Additionally, \( w_D, w_B, w_M \) and \( w_X \) are the ratios of budget deficit, public debt, imports and exports on income, respectively. Finally \( (1 - \xi) \) represents the percentage of public deficit (or debt) owned by foreign bond holders.
In an explicit manner, Soukiazis et al. (2012) (see Appendix C, Equation (C.4)) show that the growth rate of domestic income can be given by the following relation:

\[
\dot{y} = \frac{A}{B}
\]

where

\[
A = \left( \frac{w_m}{w_x} \left( \frac{P^*e}{P} \right) \pi_s \varepsilon_s \right) \dot{y}^* + \left( \delta_s (1 - \frac{P^*e w_m}{P w_x} \pi_s) - \delta_g w_m \left( \frac{P^*e}{P} \right) (\dot{p}^* + \dot{\varepsilon} - \dot{p}) + \left( \hat{p} - \frac{P^*e w_m}{P w_x} (\hat{p}^* + \dot{\varepsilon}) \right) + (1 - \xi) \frac{w_d}{w_x} (\hat{p} - i^*) - (1 - \xi) \frac{w_g}{w_x} \Delta i^* - \frac{(\Delta i - \Delta \hat{p}) \xi w_b}{(1 - t) + r \xi w_b} (\pi_e \varepsilon_e + \pi_i \varepsilon_i (\Delta i - \Delta \hat{p}) + \pi_g \left[ - \Delta i \xi \frac{w_g}{w_G} - \Delta i^* e(1 - \xi) \frac{w_G}{w_G} \right] \right.\\
+ \left. \pi_g \left[ - \Delta i \xi \frac{w_g}{w_G} - \Delta i^* e(1 - \xi) \frac{w_G}{w_G} \right] \right)
\]

and

\[
B = \frac{w_m}{w_x} \left( \frac{P^*e}{P} \right) \left( \pi_e \varepsilon_e + \pi_i \varepsilon_i + \pi_g \left( \frac{t}{w_G} + \frac{w_d}{w_G} - \frac{i \xi w_b}{w_G} - i^* e(1 - \xi) \frac{w_G}{w_G} \right) \right) - (1 - \xi) \frac{w_d}{w_x}
\]

Equation (9) is a more complete form of a vast number of determinants that can affect economic growth. Among other factors, the growth of domestic income is determined by internal and external imbalances, which was our initial task, but also takes into account the effect of relative prices. In particular the numerator A is decomposed into various parts: the first measures the impact of foreign demand on domestic growth, the second captures the effect of relative prices on growth, the third element is the volume effect of trade, and the rest measures the impact of internal imbalances on domestic growth. The denominator captures basically the effect of the
disaggregated import elasticities of the components of demand on domestic growth. Equation (9) will be used to explain actual growth in Slovakia.

3. Estimation of the structural equations

To implement our extended model to the Slovak economy we first need to estimate simultaneously Equations (1) to (4) to obtain the elasticities which are needed to compute the reduced form of the domestic income growth as defined by Equation (9). Annual data (growth rates) are used for the period 1996-2011 to estimate the system of four equations. The definition of the variables and the data sources are explained in the Appendix A. The method used for estimating the system equations is 3SLS (Three-Stage Least Squares) as it is more efficient to capture the interrelations between equations and the causal and feedback effects between the core variables of the system. Table B.1 in the Appendix B presents the estimation results where simultaneity is controlled by using a set of instrumental variables. The growth of imports, consumption, investment, and exports are assumed to be endogenous as well as the growth of government expenditures, domestic disposable income, domestic product, real exchange rate and real domestic interest rate. All other variables in the system are assumed exogenous, including some lagged variables, as it is explained in Table B.2.

In general the estimation results are quite satisfactory\textsuperscript{10}. In the import equation, export growth is the most statistically significant variable at a 1% level giving evidence that, other things being constant, every 1 percentage point increase in exports is associated with 0.66 percentage point increase in imports. This high dependence of exports on imports can be a drawback for the Slovak economy in terms of the multiplier effect that exports are expected to have on economic growth. The positive effects of exports on growth can be crowded out by the high import content of exports. Investment growth and government spending growth are also statistically significant in the import function at the 5% and 10% levels, respectively, but the import growth effect is smaller.

\textsuperscript{10} It was not possible to use a longer period due to lack of data, given that official series for Slovakia begin in 1993 (the year of the division of the former Czechoslovakia into the Czech Republic and the Slovak Republic). Therefore, the robustness of the estimation results must be interpreted with caution.
sensitivity of these components of demand is lower than that of exports. We were not able to find any significant impact of the growth of consumption on import growth, an unexpected result despite the elasticity carrying the correct sign and being sizable. Relative prices are also displaying a non significant impact on imports confirming the standard evidence in the literature that imports are more sensitive to changes in the elements of demand than to price changes.

In the export function our results confirm the standard findings in the literature that exports are income elastic and price inelastic. The income elasticity of the demand for exports is statistically significant at the 1% level showing that a 1 percentage point increase in foreign income is responsible for a 3.5 percentage point increase in exports. This is a remarkable result for the Slovak economy showing that exports are highly competitive in international markets in terms of the supply characteristics they possess, associated with quality aspects. The price elasticity of the demand for exports is not statically significant but it carries the correct positive sign. Therefore a devaluation of the domestic currency could be beneficial to increase exports, but this policy is no longer feasible for the Slovak economy since the country adopted the euro in 2009.

Consumption growth is income inelastic as expected by the standard consumption theory and investment growth is income elastic confirming the well known accelerator theory. This shows that consumption grows at a lower rate than disposable income but investment grows 2.9 percentage points higher for every 1 percentage point increase in real domestic income. Therefore, the accelerator impact is dominant in the investment equation, showing that investment projects are undertaken only when the perspectives on economic growth are fulfilled. An unexpected result is that investment is elastic with respect to changes in real interest rate, the elasticity carrying an unexpected positive sign and being statistically significant at 5% level.

We also regressed each of the equations individually, by 2SLS (see Table B.2 in Appendix B) using the same set of instruments. 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 this hypothesis is confirmed in all cases. The second is the Pagan-Hall heteroskedasticity test, showing that the hypothesis of homoskedasticity is never rejected. The third test is the Cumby-Huizinga test for autocorrelation and it is confirmed that errors are not first-order autocorrelated in all cases. Finally the normality hypothesis of residuals is also confirmed in all equations.

4. Testing the model for the Slovak economy

Table I, below reports all the values that are necessary to compute the growth of domestic income in Slovakia given by Equation (9). Some values represent the elasticities obtained by estimating the structural equations of the model as explained in section 3, and the remaining figures represent annual averages of the respective components of Equation (9). If we plug in all these values in Equation (9) the growth rate of domestic income in Slovakia can be obtained after controlling for internal and external imbalances and assuming changes in relative prices. The obtained growth is equivalent to $\hat{y}_a = 3.105\%$ which is lower than the actual growth achieved of $\dot{y} = 4.3125\%$ over the whole period (see bottom of Table I). On the other hand, the average growth rate obtained by using the simple Thirlwall Law\(^{11}\) $\hat{y}_b = 3.471\%$ is also less than the growth rate actually achieved in Slovakia. Two main remarks can be made at this point:

(i) Thirlwall’s Law over-predicts the growth rate of Slovakia in comparison to our extended model. Therefore, if internal and external imbalances and relative price movements are ignored in Thirlwall’s growth model the predicted growth rate for the Slovak economy is overestimated.

\(^{11}\) To compute Thirlwall’s Law it was necessary to estimate the import demand function $m = \pi y + \delta_n (\hat{p}^* + \hat{e} - \hat{p})$ by 2SLS to obtain the aggregate income elasticity of the demand for imports, $\pi = 2.55$. The growth rates of consumption, investment, exports and relative prices are used as instruments for $\hat{y}$ which is treated as endogenous. The full estimation results can be provided upon request.
Table I. Computation of the growth rates of domestic income in Slovakia, 1996-2011.

<table>
<thead>
<tr>
<th>( \varepsilon_x )</th>
<th>( \pi_x )</th>
<th>( \varepsilon_c )</th>
<th>( \pi_c )</th>
<th>( \varepsilon_k )</th>
<th>( \pi_k )</th>
<th>( \pi_g )</th>
<th>( \varepsilon_r )</th>
<th>( \delta_m )</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.495</td>
<td>0.663</td>
<td>0.721</td>
<td>0.590</td>
<td>2.907</td>
<td>0.240</td>
<td>0.150</td>
<td>1.761</td>
<td>0.273</td>
</tr>
<tr>
<td>( \delta_x )</td>
<td>( \delta_t )</td>
<td>( \delta_y )</td>
<td>( \delta_i )</td>
<td>( \delta_\pi )</td>
<td>( \delta_m )</td>
<td>( \delta_y )</td>
<td>( \delta_i )</td>
<td>( \delta_m )</td>
</tr>
<tr>
<td>0.373</td>
<td>0.366</td>
<td>0.023</td>
<td>0.039</td>
<td>0.022</td>
<td>0.057</td>
<td>0.401</td>
<td>0.385</td>
<td>0.625</td>
</tr>
<tr>
<td>( \xi_B )</td>
<td>( \xi_* )</td>
<td>( \xi_D )</td>
<td>( \xi_* )</td>
<td>( \xi_D )</td>
<td>( \xi_* )</td>
<td>( \xi_D )</td>
<td>( \xi_* )</td>
<td>( \xi_D )</td>
</tr>
<tr>
<td>0.625</td>
<td>0.773</td>
<td>0.729</td>
<td>0.062</td>
<td>0.042</td>
<td>-0.004</td>
<td>-0.003</td>
<td>1.269</td>
<td>-0.021</td>
</tr>
<tr>
<td>( \frac{p^* e}{p} )</td>
<td>( \dot{p}^* )</td>
<td>( \dot{p} )</td>
<td>( \Delta \ddot{p} )</td>
<td>( \dot{p}^* )</td>
<td>( \dot{p} - \dot{i}^* )</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 1.452 | -0.042 | 0.001 | 0.017 | -0.003 | \n
| \( \dot{y} \) | \( \dot{y}^*_h \) | \( \dot{y}^*_f \) | \( \dot{y}^*_g \) | \( \dot{y}^*_h \) | \( \dot{y}^*_f \) | \( \dot{y}^*_g \) | \( \dot{y}^*_h \) | \( \dot{y}^*_f \) |
| 3.105 | 3.471 | 4.3125 | \n
Internal and external imbalances and relative prices not neutral

Table:  
<table>
<thead>
<tr>
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<th>( \varepsilon_k )</th>
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<td>0.273</td>
</tr>
</tbody>
</table>

Notes:  
\( \varepsilon_x, \pi_x, \varepsilon_c, \pi_c, \varepsilon_k, \pi_k, \pi_g, \varepsilon_r, \delta_m \) and \( \delta_x \) are taken from Table B.1 (see Appendix B).

\( r, t, \omega_D, \omega_G, \omega_B, \omega_X, i, i^*, e, \dot{p} \) and \( \dot{y}^* \) are annual averages over the period 1996-2011.

\( \xi_D \) and \( \xi_B = 0.625 \) , the percentage of public deficit (or debt) owned by national bond holders, is assumed constant over the whole period.

(ii) Both the Thirlwall’s Law and our extended model determine lower growth rates for the Slovak economy in comparison to the actual growth achieved for the whole period.

According to the spirit of Thirlwall’s Law, Slovakia managed to grow faster than was allowed by the balance of payments constraint rate and this should be consistent with the accumulation of current account deficits.

In fact the current account deficit as a percentage of GDP shows an average annual rate of -4.99% for the whole period 1993-2011. As it is shown in Chart 1 (Appendix C) the current
account is always negative except for the years 1994, 1995 and 2011 where a trade surplus is recorded. Despite the average rate being negative in the whole period the current account deficit tends to be lower in the latest years and turns into a surplus in 2011. This is an encouraging result and according to Thirlwall’s Law the Slovak economy will be capable of growing faster without being constrained by the balance-of-payments if this positive tendency on current account continues in the following years. This result is consistent with the good performance of exports relatively to imports as can be seen in Chart 2 (Appendix C). The improvement in the current account could also explain in great part the growth performance of the Slovak economy, which has been relatively higher than the OECD countries, thus allowing the country to catch-up (see Chart 3 in Appendix C).

5. A scenario analysis

Using our extended model from Equation (9), a scenario analysis can be built aiming at detecting the factors that could improve or retard economic growth in Slovakia.

(i) Fiscal policy towards a more friendly taxation policy: if taxation in income falls from 36% (the prevailing average rate for the whole period) to 20% (everything else constant) the growth predicted by our extended model increases from 3.105% to 3.269%. Despite the positive effect on growth due to a more friendly taxation policy, the improvement over domestic income is not very substantial.

(ii) Budget policy towards equilibrium: Public deficit as a percentage of GDP in Slovakia shows an average rate of $w_D = 5.7\%$ for the whole period which is higher than the 3% rate established by the EMU. Policies aimed at reducing this rate can affect positively economic growth in Slovakia. As a matter of fact, if public deficit reduces to 3% the growth rate in Slovakia increases from 3.105% to 3.109% and a further reduction to 2% or 1% leads to 3.117% and 3.114% growth rates in domestic income, respectively. Despite the positive effect on growth coming from the reduction of the deficit ratio the increase in domestic income growth is not very significant. Public debt (as a percentage of GDP) for the whole
period shows an average rate of $w_B=38.5\%$ which is in fact lower than the 60% rate required by the EMU. However, if public debt increases to this rate the obtained growth of domestic income in Slovakia is lower 3.09% than the average rate prevailing in the whole period 3.105%. Although higher growth is obtained with lower public deficit and debt, the improvement in income growth is not very sizeable.

The fact that the Slovak economy still shows a low public debt to GDP ratio should be explained by the revenues coming from the privatization process which is not a sustainable solution in the near future since this process will come to an end. We have to take into account that the high deficit ratio can be translated into higher debt in the future, and in the absence of privatization revenues the economy might faces difficulties in financing the accumulated debt.

(iii) *Reducing financial cost:* It can be shown that growth in Slovakia is more sensitive to changes in foreign interest rates than to domestic ones. As a matter of fact, reducing the foreign interest rate by only 1 percentage point from $i^*=4.3\%$ (the prevailing average rate for the whole period) to 3.3%, the growth rate predicted by our model shifts from 3.105% to 3.118% which is a considerable increase. On the other hand, reducing by 2 percentage points the prevailing domestic interest rate from $i=6.2$ to 4.2%, the domestic income growth changes only slightly, from 3.105% to 3.1004%.

A combination of a ratio of public deficit of 3% (the EMU goal) and a 2% foreign interest rate results into a higher growth, $\dot{y}_a = 3.124$, in comparison to the prevailing average for the whole period, $\dot{y}_a = 3.105$. Therefore, efforts to reduce the budget deficit combined with lower costs in financing the economy and its debt are favorable conditions for achieving higher growth in Slovakia.

(iv) *Relative prices neutral:* Contrary to the original Thirlwall’s Law, our extended growth model, assumes that relative prices are not neutral and that they affect the pace of economic
growth. If we assume that relative prices are constant in the long-run, that is \( \dot{p}^* + \dot{e} - \dot{p} = 0 \), and therefore \( (P^*e/P) = 1 \), \( e = 1 \) and \( \dot{e} = 0 \) and replace these values into Equation (9), the obtained growth rate is \( \dot{y}_a = 3.2767\% \), higher than that found when relative prices are not neutral, \( \dot{y}_a = 3.105\% \) (see Table I). Therefore relative prices make a substantial difference in the growth process, and when they are neglected the model over-predicts the growth rate in Slovakia. On the other hand it shows that the Slovak economy can grow faster in a system with price and exchange rate stability, some of the main EMU goals.

(iv) *External equilibrium and constant relative prices:* An alternative scenario could be to predict the growth rate in Slovakia assuming that trade is balanced and that relative prices remain constant in the long-run. More specifically, the following conditions are assumed: export share equal to import share, \( w_M = w_X = 0.77 \), and therefore, \( w_M / w_X = 1 \); constant relative prices, \( \dot{p}^* + \dot{e} - \dot{p} = 0 \), thus \( (P^*e/P) = 1 \), \( e=1 \) and \( \dot{e} = 0 \). Replacing these values in Equation (9) the obtained growth rate is around 3.80\% which is higher than the prevailing rate for the whole period 3.105\%. Therefore higher competitiveness and stable price and exchange rate conditions are beneficial for achieving higher growth in Slovakia.

(v) *Reducing the import dependence of exports and consumption:* Table B.1 (Appendix B) shows that the elasticities of imports with respect to consumption\(^{12}\) - \( \pi_C = 0.59 \) - and exports - \( \pi_X = 0.663 \) - are quite high, although less than unity. This means that consumption and exports have a high import content which in terms of the balance of payments perspective is not a favorable result. Therefore, developing policies with the aim of reducing the dependence of consumption and exports on imports should benefit domestic growth. For instance, by reducing the elasticity of imports with respect to

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\(^{12}\) However we have to take into account that this elasticity was not statistically significant in the 3SLS regression.
consumption from $\pi_c = 0.59$ to 0.40 and that of imports with respect to exports from
$\pi_x = 0.663$ to 0.50 the predicted growth of domestic income shifts from $\dot{y}_a = 3.105\%$
to 4.39\% which is a substantial increase.

(vi) **External equilibrium and less import content on exports:** the actual share of imports,
$w_M = 0.77$, is substantially higher than the share of exports, $w_X = 0.73$, which indicates
a trade deficit over the whole period. Increasing the share of exports to the level of imports
($w_X = w_M = 0.77$) the growth rate predicted by our model increases significantly from
3.10\% to 3.42\%. If at the same time the sensitivity of exports with respect to imports
reduces from $\pi_x = 0.66$ (the actual rate) to $\pi_x = 0.50$ the growth rate of domestic
income increases even farther, to around 4.22\%. Assuming a trade surplus, for instance
$w_M = 0.77$ and $w_X = 0.80$, and maintaining $\pi_x = 0.50$, the growth rate obtained is
even higher, around 4.41\%. Therefore, developing trade policies with the aim of increasing
export competitiveness and reducing the export dependence on imports is a successful
alternative to stimulate higher growth in Slovakia.

As it can be understood from the scenarios analysis the most successful policies to achieve
higher growth in Slovakia are related to the external sector, namely by turning the economy
more competitive, changing the import and export structure towards trade equilibrium or
reducing the export and consumption dependence on imports. Price and exchange rate stability
are also important conditions for higher growth leading to less uncertainty. All the above
remarks are in line with Thirlwall’s Law and the balance of payments constraint hypothesis.

6. **Summary and concluding remarks**

In this paper we use an extended growth model in line with Thirlwall’s Law to predict the
growth rate of the Slovak economy over the period 1996-2011. Slovakia is an interesting case
study for two main reasons: the country belongs to the group of the so-called transition
economies, peacefully separated from the former Czechoslovakia in 1993; and it is one of the
faster growing countries in Eastern Europe since its independence. The extended model we employ is different from that suggested by Thirlwall’s Law in the sense that it controls for internal and external imbalances (the twin deficit hypothesis) and considers that relative prices are not neutral in the process of economic growth. After defining the structural equations of the model the reduced form of the growth rate of domestic income is obtained, which among other factors depends on the structure of trade, the public deficit and debt, relative price movements, costs of financing the economy and other external factors such as, the external demand. The structural equations are estimated by 3SLS, being the most efficient technique to capture the interrelations and feed-back effects of the core variables of the model and the estimation results are shown to be quite satisfactory despite the short period considered.

After carrying out all the necessary calculations the predicted growth rate of the Slovak economy for the period 1996-2011 is computed, being lower than the rate actually observed. Therefore, the Slovak economy grew at a faster rate than that allowed by the balance of payments constraint hypothesis and this has been done at the cost of accumulating current account deficits. According to Thirlwall’s Law the country is in danger of facing balance of payments constraints in the long-run unless capital flows can finance the current account imbalances, which is neither a sustainable nor a structural solution. Some encouraging results drawn from the current account tendency showing a surplus in the last years and a positive evolution of exports can eliminate the risk of entering into a balance of payments crisis in the immediate future.

The scenarios analysis based on the extended growth model attempts to identify factors and therefore policies that could allow the country to achieve higher growth and thus to catch-up with the advanced European partners. It is shown, that the most effective policy to achieve such a goal is found in the external trade sector, by turning the economy more competitive. Changing the trade structure towards equilibrium, or reducing the dependence of exports and consumption on imports are the most successful policies to achieving higher growth. Price and exchange rate stability are also beneficial to growth, for creating economic conditions with less uncertainty.
Financing the domestic economy and debt at lower cost and a more friendly taxation policy are also advantageous for higher growth but to a lesser extent. Finally, a case of concern is the high deficit ratio which in the long-run would imply higher public debt, creating difficult conditions for financing these liabilities from abroad. The recent debt crisis of the peripheral euro-zone countries can act as an example of loss of sovereignty in case of unsustainable internal imbalances.
Appendix A: Variable definition and data sources

• $\dot{m}_t$ – annual growth rate of real imports - Imports of goods and services at 2005 prices (national currency; annual percentage change).
• $\dot{c}_t$ – annual growth rate of final private consumption - Private final consumption expenditure at 2005 prices (national currency; annual percentage change).
• $\dot{x}_t$ – annual growth rate of real exports - Exports of goods and services at 2005 prices (national currency; annual percentage change).
• $\dot{\text{inv}}_t$ – annual growth rate of investment - Gross fixed capital formation at 2005 prices (national currency; annual percentage change).
• $\dot{y}_t$ – annual growth rate of real GDP - GDP at 2005 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).
• $\dot{p}_{t*}$ – annual growth rate of price deflator GDP at market prices, for the EU-12 (national currency; annual percentage change).
• $w_G$ – share of government’s expenditure on GDP - Total expenditure; general government minus interest including flows on swaps and FRAs (% 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).
• $w_M$ - 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 (%)  
  1993-1999: annual average of the monthly discount rates of the National Bank of Slovakia  
• $i^*$ - nominal long-term interest rates (%) for Germany (Public sector bonds outstanding  
  (over 3 years); from 1993, central government benchmark bond of 10 years.)
Data on $\tilde{m}_t$, $\tilde{c}_t$, $\tilde{x}_t$, $i\tilde{w}_t$, $\tilde{y}_t$, $\tilde{p}_t$, $\tilde{p}^*_t$, $w_G$, $w_D$, $w_{B}$, $w_{M}$, $w_{X}$, $t$, and $i^*$ were taken from European Commission (2012). Data on $i$ were provided by the National Bank of Slovakia (1993-1999) and European Commission (2012) for the period 2000-2011.

- $\dot{g}_t$ – 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)” from Eurostat (extracted on 25th April 2013) and information on $\dot{p}_t$.


- $\dot{y}_d$ - annual growth rate of real disposable income. Computed by the authors as the difference between the nominal annual growth rate of disposable income and the growth of prices. The nominal disposable income was taken from “Disposable income, million €, current prices” (National Bank of Slovakia) and the annual growth rate of prices, from “Price deflator private final consumption expenditure (national currency; annual percentage change)” (European, Commission, 2012).


- $(P*P)$- real effective exchange rate index (2010=100), broad indices (61 countries). Computed by the authors using monthly data, from the Bank for International Settlements(BIS)- [http://www.bis.org/statistics/eer/index.htm](http://www.bis.org/statistics/eer/index.htm)

- $\xi$ - the percentage of public deficit (or debt) owned by national bond holders, is taken by National Bank of Slovakia.
### Table B1. The 3SLS estimation of the structural model, Slovakia 1996-2011.

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<th>Coefficient</th>
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<th>p-value</th>
<th>R²</th>
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Notes to the tables: Endogenous variables: \(m_{t}, c_{t}, k_{t}, x_{t}, g_{t}, \dot{y}_{i,t}, \dot{r}_{t}, (\dot{\rho}_{t} - \hat{\rho}_{t})\) Exogenous variables: \(\dot{y}_{t}^{*}, \dot{y}_{t-1}^{*}, t_{t}, i_{t}, i_{t-1}, t^{*}_{t-1}, \dot{p}^{*}, w_{B,t}, w_{D,t}, w_{G,t}, \dot{\tau}_{t-2}, \dot{\kappa}_{t-2}\) and *, **, *** Coefficient significant at the 10%, 5% and 1% level, respectively
Appendix C

Chart 1. Growth rate of domestic income (\(gy\)) and the current account (\(ca\)) as a percentage of GDP, 1993-2011

Chart 2. Annual growth rate of exports (\(gx\)) and imports (\(gm\)), 1993-2011

Chart 3. Annual growth rate of domestic (\(gy\)) and foreign income (\(gz\)), 1993-2011

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