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International Competitiveness: is the reduction of wages a solution? An evaluation for the Portuguese case[1,2]

Elsa Cristina Vaz – Economics Department of University of Évora and CEFAGE

Maria Paula Fontoura - ISEG - School of Economics and Management / Technical University of Lisbon, and UECE – Research Unit on Complexity and Economics

Abstract

The purpose of this paper is to analyse, in the case of Portugal, the effectiveness of a wage reduction - a current proposal since 2011 to help the country to reverse the high public and external debts - in promoting the efficiency and the international competitiveness of the economy. A static multi-sectoral and single-country general equilibrium model will be used with data from GTAP7 Data Base. The model allows to measure changes by sector. The simulations performed show that extending the reduction of wages already deployed by the government in the public sector to the private one leads to a positive impact on employment (both skilled and unskilled labour), production and volume of exports in all sectors except those that are R&D intensive, characterized by a low weight in the Portuguese economy. However it is possible that the positive results in terms of external competitiveness are not sustainable as the impact on productivity is negative, albeit small, for most sectors. There is also reason for concern regarding the observed deterioration of the trade balance of most sectors, the exception being the traditional labour intensive sectors that show good prospects in this respect.

KEYWORDS: Competitiveness, wages, Stability and Growth Pact; General Equilibrium Model, Portugal.

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1. Introduction

To address huge macroeconomic imbalances, in the aftermath of the late-2000s financial crisis, several EU economies had to implement Stability and Growth Programs (SGP) using very restrictive options of fiscal and other policies aiming macroeconomic stability, usually designated by austerity plans.

Portugal is one of the EU countries that suffered such a severe economic disruption and unsustainable fiscal and external debts that needed to sign a bail-out agreement with the European Union and International Monetary Fund to reduce the excess debt levels. In April 2011, Portugal, following Greece and the Republic of Ireland, began receiving a financial support from the European Union (totalling 78 billion-euro) through the European Financial Stability Mechanism (EFSM) and the European Financial Stability Facility (EFSF). As a consequence, the country had to implement, in the context of the Memorandum of Economic and Financial Policies signed with Troika (European Commission, International Monetary Fund and European Central Bank), very restrictive SGP policies. Since then the government faces tough choices in its attempts to stimulate the economy, while struggling to reduce its public deficit to around the EU average.

One of the most important discussions in countries involved in similar SGP programs is how to increase production in order to allow the economy to resume a path of economic growth in a context of harsh austerity measures. In the case of Portugal, which displays accentuated decreasing levels of consumption and investment, both domestic and foreign, hopes are focused in the growth of exports through gains in international competitiveness.

It is generaly acknowledged that promotion of international competitiveness can be done through three distinct pathways. The first is to reduce the costs of productive factors, including labour costs, generating a decrease in the unit cost per unit of the final product. The second is based on increasing production without changing the resources used, which is an effective increase of productivity. The third is to increase product differentiation in order to reduce the market share of the international competitors.

The two latter alternatives to increase competitiveness imply, respectively, a scale effect of the investment with increased motivation of the workers and the reorganization of business structures, and the diversification of the varieties produced, either keeping the quality or introducing changes in the production and the management structures allowing to up-grade quality; in any case, they are not easy to implement in an economy facing a serious economic recession. Therefore, these paths of promoting efficiency have been in practice disregarded in the short term by the majority of the Portuguese political and economic actors.

The easiest solution, if viable, is naturally to reduce wages. Indeed, between 2009 and 2013, the cumulative reduction will reach a predicted value of more than 12.3 per cent. Contributing to this drop in earnings was cutting Christmas and holiday subsidies for civil servants in the end of 2011 and mid-2012 , corresponding to the 13th and 14th months, i.e. approximately -14 per cent of the annual salary, and the wage adjustment that has been happening in the private sector, particularly due to the increase in unemployment (estimated to be over 15 per cent in 2012), in part fostered by a policy of promoting labour flexibility that forces workers to accept lower wages.

The purpose of this study is to analyse the impact of a wage reduction across all sectors in promoting positive impacts on production, employment, productivity and international trade. For that purpose we use a static multi-sectoral and single-country general equilibrium model, using the data from GTAP7 Data Base for the base year of 2004.[3] Labour will be disaggregated at two levels of qualification. Section 2 presents the model while the results of the simulations are shown in section 3. Section 4 concludes.

2. The model

In this model the productive sector is characterised by the existence of six profit maximiser sectors that produce six types of goods and supply, in accordance with a nested production function, with capital, labour (skilled and unskilled) and

[3] Note that this type of model is static as it takes into account the effect of the investment in the adjustment of the economy in a very rudimentary way, by considering the investment goods and a bank that makes the allocation by sectors. In future developments of this analysis we intend to introduce dynamics in the model.

intermediate goods (also a composite good). At the first level, a Leontief technology is employed, with the value added and intermediate goods as factors of production. At the second level, we have, on the one hand, the value added as a constant elasticity of substitution (CES) function with constant returns to scale, along with capital and labour as factors of production, and on the other hand, the intermediate goods as a Leontief technology function.

A representative family is used as a proxy for all consumers, owning all production factors.

The consumer's optimal choice is determined by maximising the LES utility function, which is subject to the budgetary constraint that relates the income available for consumption with the value of expenses.

The unemployment is endogenised using a wage curve type of relationship between the rate of change in the real gross wage rate and the rate of change in the unemployment rate.

The demand for investment is included in the model very simply by considering investment as investment goods valued at market prices (including taxes). An entity allocates savings across investment goods, in all sectors, in accordance with the Cobb-Douglas utility function that is maximised, subject to the constraint of total savings.

Finally, the model is closed considering that public expenses are constant and revenues result from different fixed tax rates, assuming the small country condition applied to Portugal and supposing that flexible capital formation exists because all savings are valued in national currency and that the investment corresponds to the sectorial allocation of savings using fixed proportions.

The hypothesis to simulate with GTAP database, version 7, will be the administrative reduction of costs corresponding to the value of two salaries, as implemented by the government in the public sector.

We disentangle between skilled and unskilled labour. For skilled and unskilled labour, respectively, we have:

$$PLQ \rightarrow PLQ \times \Phi q_{r,s}$$

$$PLU \rightarrow PLU \times \Phi u_{r,s}$$

where PLQ and PLU are, respectively, wages for skilled and unskilled labour and $\Phi q_{r,s}$ and $\Phi u_{r,s}$ are the parameters to discriminate the reduction of wages by sectors.

The equations of our model and the description of the variables [4] are in tables I and II in the Appendix 1, respectively. Table III in the Appendix 1 presents the sectoral aggregation and Table IV shows the structure of production and exports presented according to the sectoral aggregation used. Finally, the numerical results of the simulations are shown in tables V to VIII in the Appendix 2.

3. A simulation for the Portuguese economy

As a preliminary essay, we have cut wages in all sectors and type of labour in the amount implemented by the Portuguese government in the case of the civil servants by the end of 2011 and mid-2012: the cancellation of two months salary, corresponding to the 13th and 14th months, i.e. approximately -14% of the annual salary.

Table 1 shows the impacts on employment by type of labour (skilled and unskilled) and on production.

Table 1 – Impacts on employment and production (%)

	LQ	LU	VAB
Res	+	+	+
Lab	+	+	+
Spe	+	+	+
Sca	+	+	+
Rd	-	-	-
Non	+	+	+

Note: results in Table V in Appendix 2.

[4] For more details about the model, see Vaz, E. (2012).

We observe that this cost reduction would improve the value added as well as the use of both types of labour, reducing the unemployment, in all sectors except in the R&D intensive sector, i.e. in a sector which represents a small weight in the Portuguese economy (table IV in Appendix 1). Note that the model precludes rigidity of labour market since the proportion assumed for the wages cut is the same in all sectors.

An interesting result of the simulations is that in a longer term the market adjustment will produce a (small) positive variation in the wages of both types of labour, skilled and unskilled, as a result of the positive impact of cutting wages on production, while the price of capital declines as a consequence of the substitution of capital for labour due to the reduction of labour costs (Table VI in Appendix 2).

Turning now to the impacts on trade, Table 2 shows the results of the simulations for exports, imports and the trade balance by sector. Note that while exports and imports are measured in volume, the trade balance is measured in value[5].

Table 2 – Impacts on trade

	Exports	Imports	Trade Balance
Res	+	-	-
Lab	+	-	+
Spe	+	+	-
Sca	+	+	-
Rd	-	-	+
Non	+	-	-

Note: results in Table VII in Appendix 2.

We observe that in all sectors but one, and once more the exception is the small R&D intensive sector, wages cut produce a positive variation in the volume of exports. However, in some sectors (namely in the "Spe" sector, which includes

[5] In the Armington condition the international price of exports ($pwe_{r,rr,s}$) does not vary however the export price at the national currency varies according to the expression: $pe_{r,rr,s} = er_{r,rr} * pwe_{r,rr,s} * \left(1 - te_{r,rr,s}\right) + p_{r,"non"} * emg_{r,s}$. This explains why there may be an increase in the volume of exports and a decrease in the volume of imports and simultaneously a negative trend in the trade balance.

electronic equipment and some machinery, and the "Sca" sector, which includes scale and capital intensive sectors, such as chemical products and motor vehicles) imports also record a positive variation, contributing to a negative impact on the trade balance of these sectors. Indeed, the only sector with relevance in production and exports of Portugal that depicts a positive trend on its trade balance is "Lab", which includes the labour intensive industries.

Finally, table 3 displays the results for the indices of productivity. Increasing productivity has been incessantly advocated as the best solution to increase international competitiveness of the Portuguese economy to the extent that it is the way of consistently reducing the high unit costs (see, for instance, IMF, 2010). However, the results of the simulations show negative impacts on productivity of both skilled and unskilled labour except in the sector "Non". Moreover if we consider also the capital factor (in the multifactor column of Table 3), even the "Non" sector shows a negative productivity trend[6].

Table 3 – Impacts on Productivity

	Productivity Skilled Labour	Productivity Unskilled Labour	Productivity Multifactor
Res	-	-	-
Lab	-	-	-
Spe	-	-	-
Sca	-	-	-
Rd	-	-	-
Non	+	+	-

Note: results in Table VIII in Appendix 2.

A major contribution of this study is thus to show that reducing wages may decrease productivity, putting into question the sustainability of the external competitiveness that apparently is promoted using this (controversial) economic policy measure.

[6] Note that we use a Leontief production function for the primary inputs and therefore the factors are used in fixed proportions. If productivity increases for labor but decreases when we add the capital factor, the reason is that the capital employed increased at a higher rate than the production.

4. Concluding remarks

The simulations performed show that a wage reduction in the Portuguese case may induce a positive variation in employment (both of skilled and unskilled labour), production and exports volumes. The exception to these trends occurs in a sector that is not representative of the Portuguese economy.

However, there are reasons to suspect that the positive result for exports do not lead to a sustainable increase in trade competitiveness as the simulated impacts on productivity are negative (albeit small) for most sectors, with both types of labour. Besides, simulations point to a negative effect (albeit small) on the trade balance of most sectors, due in part to a positive variation in the value of import (especially due to the price increase). In fact, only approximately one fourth of Portuguese exports record a positive trend for the trade balance, especially the labour-intensive sectors ("Lab").

This exercise allows concluding how important it is to ponder all the effects of a measure of economic policy. This is especially true in a context of a deep crisis as it happens in the present time.

A possible additional step of this analysis could be to test whether the reduction of price / cost of goods in the non-tradable sector (easier to implement in the short term and achieved especially by administrative means) improves the performance of the tradable sector. The main drawback in this type of exercise is to properly disentangle between both types of sectors.

References

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Appendix 1 – Equations of the model and Sectorial Aggregation

Table I: Equations of the model

Production and trade:

$$K_{r,s} = \left[\frac{XD_{r,s}}{aF_{r,s}}\right] * \left[\frac{\gamma Fk_{r,s}}{(1+tk_{r.s}) * pk_r + pi_r * d_{r,s}}\right]^{\sigma F_{r,s}} * \left\{\left[(1+tk_{r.s}) * pk_r + pi_r * d_{r,s}\right]^{1-\sigma F_{r,s}} * \gamma Fk_{r,s}^{\sigma F_{r,s}} + \right.$$

$$\left. + \left[(1+tlq_{r.s}) * plq_r * \Phi q_{r,s}\right]^{1-\sigma F_{r,s}} * \gamma Fq_{r,s}^{\sigma F_{r,s}} + \left[(1+tlu_{r.s}) * plu_r * \Phi u_{r,s}\right]^{1-\sigma F_{r,s}} * \gamma Fu_{r,s}^{\sigma F_{r,s}}\right\}^{\frac{\sigma F_{r,s}}{1-\sigma F_{r,s}}}$$

$$LQ_{r,s} = \left[\frac{XD_{r,s}}{aF_{r,s}}\right] * \left[\frac{\gamma Fq_{r,s}}{(1+tlq_{r.s}) * plq_r * \Phi q_{r,s}}\right]^{\sigma F_{r,s}} * \left\{\left[(1+tk_{r.s}) * pk_r + pi_r * d_{r,s}\right]^{1-\sigma F_{r,s}} * \gamma Fk_{r,s}^{\sigma F_{r,s}} + \right.$$

$$\left. + \left[(1+tlq_{r.s}) * plq_r * \Phi q_{r,s}\right]^{1-\sigma F_{r,s}} * \gamma Fq_{r,s}^{\sigma F_{r,s}} + \left[(1+tlu_{r.s}) * plu_r * \Phi u_{r,s}\right]^{1-\sigma F_{r,s}} * \gamma Fu_{r,s}^{\sigma F_{r,s}}\right\}^{\frac{\sigma F_{r,s}}{1-\sigma F_{r,s}}}$$

$$LU_{r,s} = \left[\frac{XD_{r,s}}{aF_{r,s}}\right] * \left[\frac{\gamma Fu_{r,s}}{(1+tlu_{r.s}) * plu_r * \Phi u_{r,s}}\right]^{\sigma F_{r,s}} * \left\{\left[(1+tk_{r.s}) * pk_r + pi_r * d_{r,s}\right]^{1-\sigma F_{r,s}} * \gamma Fk_{r,s}^{\sigma F_{r,s}} + \right.$$

$$\left. + \left[(1+tlq_{r.s}) * plq_r * \Phi q_{r,s}\right]^{1-\sigma F_{r,s}} * \gamma Fq_{r,s}^{\sigma F_{r,s}} + \left[(1+tlu_{r.s}) * plu_r * \Phi u_{r,s}\right]^{1-\sigma F_{r,s}} * \gamma Fu_{r,s}^{\sigma F_{r,s}}\right\}^{\frac{\sigma F_{r,s}}{1-\sigma F_{r,s}}}$$

$$(1-txd_{r,s}) * pd_{r,s} * XD_{r,s} = \left[(1+tk_{r,s}) * pk_r + pi_r * d_{r,s}\right] * K_{r,s} + \left[(1+tlq_{r,s}) * plq_r * \Phi q_{r,s}\right] * LQ_{r,s} +$$
$$+ \left[(1+tlu_{r,s}) * plu_r * \Phi u_{r,s}\right] * LU_{r,s} + \sum_{ss}\left[io_{r,ss,s} * XD_{r,s} * p_{r,ss} * (1+tcf_{r,ss,s})\right]$$

$$XDD_{r,s} = \frac{XD_{r,s}}{aT_{r,s}} * \left(\frac{1-\sum_{rr}\gamma T_{r,rr,s}}{pdd_{r,s}}\right)^{\sigma T_{r,s}} * \left[\sum_{rr}\left(\gamma T_{r,rr,s}^{\sigma T_{r,s}} * pe_{r,rr,s}^{1-\sigma T_{r,s}}\right) + \left(1-\sum_{rr}\gamma T_{r,rr,s}\right)^{\sigma T_{r,s}} * pdd_{r,s}^{1-\sigma T_{r,s}}\right]^{\frac{\sigma T_{r,s}}{1-\sigma T_{r,s}}}$$

$$E_{r,rr,s} = \frac{XD_{r,s}}{aT_{r,s}} * \left(\frac{\gamma T_{r,rr,s}}{pe_{r,rr,s}}\right)^{\sigma T_{r,s}} * \left[\sum_{rr}\left(\gamma T_{r,rr,s}^{\sigma T_{r,s}} * pe_{r,rr,s}^{1-\sigma T_{r,s}}\right) + \left(1-\sum_{rr}\gamma T_{r,rr,s}\right)^{\sigma T_{r,s}} * pdd_{r,s}^{1-\sigma T_{r,s}}\right]^{\frac{\sigma T_{r,s}}{1-\sigma T_{r,s}}}$$

$$pd_{r,s} * XD_{r,s} = pdd_{r,s} * XDD_{r,s} + \sum_{rr}\left(pe_{r,rr,s} * E_{r,rr,s}\right)$$

$$XDD_{r,s} = \frac{X_{r,s}}{aA_{r,s}} * \left(\frac{1-\sum_{rr}\gamma A_{r,rr,s}}{pdd_{r,s}}\right)^{\sigma A_{r,s}} * \left[\sum_{rr}\left(\gamma A_{r,rr,s}^{\sigma A_{r,s}} * pm_{r,rr,s}^{1-\sigma A_{r,s}}\right) + \left(1-\sum_{rr}\gamma A_{r,rr,s}\right)^{\sigma A_{r,s}} * pdd_{r,rr,s}^{1-\sigma A_{r,s}}\right]^{\frac{\sigma A_{r,s}}{1-\sigma A_{r,s}}}$$

$$M_{r,s} = \frac{X_{r,s}}{aA_{r,s}} * \left(\frac{\gamma A_{r,rr,s}}{pm_{r,rr,s}}\right)^{\sigma A_{r,s}} * \left[\sum_{rr}\left(\gamma A_{r,rr,s}^{\sigma A_{r,s}} * pm_{r,rr,s}^{1-\sigma A_{r,s}}\right) + \left(1-\sum_{rr}\gamma A_{r,rr,s}\right)^{\sigma A_{r,s}} * pdd_{r,rr,s}^{1-\sigma A_{r,s}}\right]^{\frac{\sigma A_{r,s}}{1-\sigma A_{r,s}}}$$

$$p_{r,s} * X_{r,s} = pdd_{r,s} * XDD_{r,s} + \sum_{rr} \left(pm_{r,rr,s} * M_{r,rr,s} \right)$$

$$M_{r,rr,s} = E_{rr,r,s}$$

$$pe_{r,rr,s} = er_{r,rr} * pwe_{r,rr,s} * \left(1 - te_{r,rr,s}\right) + p_{r,"non"} * emg_{r,s}$$

$$pm_{r,rr,s} = \left(1 + tm_{r,rr,s}\right) * er_{r,rr} * pwe_{rr,r,s} + p_{r,"non"} * mg_{r,rr,s}$$

$$SF_{r,rr} = \sum_{s} \left(pwe_{rr,r,s} * M_{r,rr,s} - pwe_{r,rr,s} * M_{r,rr,s} \right)$$

$$MARGB_{r} = \sum_{rr} \sum_{s} \left(mg_{r,rr,s} * M_{r,rr,s} - emg_{r,s} * E_{r,rr,s} \right)$$

Representative Household:

$$YH_r = pk_r * \overline{KS_r} + plq_r * \left(\overline{LQS_r} - UNEMPQ_r \right) + plu_r * \left(\overline{LUS_r} - UNEMPU_r \right) +$$
$$+ TRF_r + \sum_{s} \left[plq_{r,s} * \left(\Phi q_{r,s} - 1 \right) * LQ_{r,s} \right] + \sum_{s} \left[plu_{r,s} * \left(\Phi u_{r,s} - 1 \right) * LU_{r,s} \right]$$

$$SH_r = mps_r * \left[YH_r - ty_r * \left(YH_r - TRF_r \right) \right]$$

$$CBUD_r = YH_r - ty_r * \left(YH_r - TRF_r \right) - SH_r$$

$$\left(1 + tc_{r,s}\right) * p_{r,s} * C_{r,s} = \left(1 + tc_{r,s}\right) * p_{r,s} * \mu H_{r,s} +$$
$$+ \alpha H_{r,s} * \left\{ CBUD_r - \sum_{ss} \left[\left(1 + tc_{r,ss}\right) * p_{r,ss} * \mu H_{r,ss} \right] \right\}$$

Unemployment:

$$\left(\frac{plq_r^t / pcindex_r^t}{plq_r^0 / pcindex_r^0} - 1 \right) = elasU_r * \left(\frac{UNEMPQ_r^t / LQS_r^t}{UNEMPQ_r^0 / LQS_r^0} - 1 \right)$$

$$\left(\frac{plu_r^t / pcindex_r^t}{plu_r^0 / pcindex_r^0} - 1 \right) = elasU_r * \left(\frac{UNEMPU_r^t / LUS_r^t}{UNEMPU_r^0 / LUS_r^0} - 1 \right)$$

Government:

$$TAXR_r = ty_r * \left(YH_r - TRF_r \right) + \sum_{s} \left[p_{r,s} * \left(tc_{r,s} * C_{r,s} + tcg_{r,s} * \overline{CG}_{r,s} + tci_{r,s} * I_{r,s} \right) + \right.$$
$$+ \sum_{ss} \left(tcf_{r,ss,s} * io_{r,ss,s} * p_{r,ss} * XD_{r,s} \right) + tk_{r,s} * pk_r * K_{r,s} +$$
$$+ tlq_{r,s} * plq_r * \Phi q_{r,s} * LQ_{r,s} + tlu_{r,s} * plu_r * \Phi u_{r,s} * LU_{r,s} +$$
$$+ \sum_{rr} \left(tm_{r,rr,s} * er_{r,rr} * pwe_{rr,r,s} * M_{r,rr,s} + te_{r,rr,s} * er_{r,rr} * pwe_{r,rr,s} * E_{r,rr,s} \right)$$
$$\left. + txd_{r,s} * pd_{r,s} * XD_{r,s} \right]$$

$$pcindex_r = \sum_s \left(\frac{\left(1+tc^t_{r,s}\right) * p^t_{r,s} * C^0_{r,s}}{\left(1+tc^0_{r,s}\right) * p^0_{r,s} * C^0_{r,s}} \right)$$

$$TRF_r = trep_r * \left(plq_r * UNEMPQ_r + plu_r * UNEMPU_r \right) + \overline{TRO}_r * pcindex_r$$

$$SG_r * GDPDEF_r = TAXR_r - \sum_s \left[\left(1+tcg_{r,s}\right) * \overline{CG}_{r,s} * p_{r,s} \right] - TRF_r$$

$$GDPC_r = \sum \left\{ p_{r,s} * \left(1+tc_{r,s}\right) * C_{r,s} + p_{r,s} * \left(1+tcg_{r,s}\right) * \overline{CG}_{r,s} + p_{r,s} * \left(1+tci_{r,s}\right) * I_{r,s} + \right.$$

$$\left. + \sum_{rr} \left(er_{r,rr} * pwe_{r,rr,s} * E_{r,rr,s} - er_{r,rr} * pwe_{rr,r,s} * M_{r,rr,s} \right) \right\}$$

$$GDP^t_r = \sum_s \left\{ p^0_{r,s} * \left(1+tc^0_{r,s}\right) * C^t_{r,s} + p^0_{r,s} * \left(1+tcg^0_{r,s}\right) * \overline{CG}_{r,s} + p^0_{r,s} * \left(1+tci^0_{r,s}\right) * I^0_{r,s} + \right.$$

$$\left. + \sum_{rr} \left(er^0_{r,rr} * pwe^0_{r,rr,s} * E^t_{r,rr,s} - er^0_{r,rr} * pwe^0_{rr,r,s} * M^t_{r,rr,s} \right) \right\}$$

$$GDPDEF_r = \frac{GDPC_r}{GDP_r}$$

Investment:

$$S_r = SH_r + GDPDEF_r * SG_r + \sum_{rr} \left(er_{r,rr} * SF_{r,rr} \right) + \sum_s \left(d_{r,s} * pi_r * K_{r,s} \right) + MARGB_r * p_{r,"non"}$$

$$pi_r = \prod_s \left\{ \left[\frac{\left(1+tci_{r,s}\right) * p_{r,s}}{\alpha I_{r,s}} \right]^{\alpha I_{r,s}} \right\}$$

$$I_{r,s} = \alpha I_{r,s} * S_r * \left[\left(1+tci_{r,s}\right) * p_{r,s} \right]^{-1}$$

General Equilibrium:

$$\sum_s LQ_{r,s} = \overline{LQS}_r - UNEMPQ_r$$

$$\sum_s LU_{r,s} = \overline{LUS}_r - UNEMPU_r$$

$$\sum_s K_{r,s} = \overline{KS}_r$$

$$X_{r,s} = C_{r,s} + I_{r,s} + \sum_{ss} \left(io_{r,s,ss} * XD_{r,ss} \right) + \overline{CD}_{r,s}$$

Table II – Description of the variables and the parameters

Endogenous variables:	
pk_r	Capital price
plq_r	Skilled labour price
plu_r	Unskilled labour price
pi_r	User cost of capital (investment function)
$p_{r,s}$	Composite price of good sold in the domestic market
$pd_{r,s}$	Price of domestic production
$pdd_{r,s}$	Price of domestic production for domestic market
$pe_{r,rr,s}$	Price of exports in domestic market
$pm_{r,rr,s}$	Price of impost in domestic market
$pwe_{r,rr,s}$	FOB price of exports
$er_{r,rr}$	Exchange rate
$pcindex_r$	Laspeyres price index
$X_{r,s}$	Total supply in domestic market
$XD_{r,s}$	Domestic production
$XDD_{r,s}$	Domestic production for domestic market
$E_{r,rr,s}$	Exports
$M_{r,s}$	Imports
$K_{r,s}$	Capital demand
$LQ_{r,s}$	Skilled labour demand
$LU_{r,s}$	Unskilled labour demand
$C_{r,s}$	Consumption of goods and services
$CBUD_r$	Income available for consumption
YH_r	Household income
GDP_r	Gross domestic product at market prices
$GDPC_r$	Gross domestic product at constant prices
$GDPDEF_r$	Gross domestic product at market prices deflator
SH_r	House hold savings
SG_r	Government savings
S_r	Total savings
$SF_{r,rr}$	Balance on goods and services
$MARGB_r$	Balance on transport margins related to international trade
$I_{r,s}$	Investment goods demand

$UNEMPQ_r$	Skilled labour unemployment
$UNEMPU_r$	Unskilled labour unemployment
$TAXR_r$	Total tax revenues
TRF_r	Total transfers of Government
Exogenous variables:	
$\overline{KS_r}$	Capital supply
$\overline{LQS_r}$	Skilled labour supply
$\overline{LUS_r}$	Unskilled labour supply
$\overline{TRO}_r$	Other transfers of Government
$\overline{CG}_{r,s}$	Government demand for goods and services
Parameters:	
ty_r	Taxes on income
$txd_{r,s}$	Taxes on production
$tc_{r,s}$	Taxes on household consumption
$tcf_{r,ss,s}$	Taxes on intermediate consumption
$tci_{r,s}$	Taxes on investment consumption
$tcg_{r,s}$	Taxes on government consumption
$tk_{r.s}$	Taxes on the use of capital
$tlq_{r.s}$	Taxes on the use of skilled Labour
$tlu_{r.s}$	Taxes on the use of unskilled Labour
$tm_{r,rr,s}$	Customs taxes
$te_{r,rr,s}$	Taxes on exports
$mg_{r,rr,s}$	Transport margins on imports
$emg_{r,s}$	Transport margins on exports
$d_{r,s}$	Depreciation rate of capital
$aF_{r,s}$	Parameter efficiency of the production function
$\gamma Fk_{r,s}$	Distribution parameter of capital
$\gamma Fq_{r,s}$	Parameter distribution of skilled labor
$\gamma Fu_{r,s}$	Parameter distribution of unskilled labor
$\sigma F_{r,s}$	Elasticity of substitution between production factors
$aT_{r,s}$	Efficiency parameter of CET function
$\gamma T_{r,rr,s}$	Distribution parameter of exports
$\sigma T_{r,s}$	Transformation elasticity
$aA_{r,s}$	Efficiency parameter of the Armington function
$\gamma A_{r,rr,s}$	Distribution parameter of total imports
$\sigma A_{r,s}$	Elasticity of substitution between domestic and imported goods

$\alpha H_{r,s}$	Exponent of the Household utility function (LES)
$\alpha I_{r,s}$	Income elasticity of demand for goods and services for investment
$\mu H_{r,s}$	Minimum consumption
mps_r	Marginal propensity to save
$io_{r,ss,s}$	Technical coefficients
$trep_r$	Weight of unemployment benefits in average salary
$\Phi u_{r,s}$	parameters to discriminate the reduction of unskilled labour wages
$\Phi q_{r,s}$	parameters to discriminate the reduction of skilled labour wages
$elasU_r$	Unemployment elasticity

Table III– Description of the Sectorial Aggregation

Sectorial Aggregation	Number	Code	Description
Resource intensive (res)	19	cmt	Meat: cattle, sheep, goats, horse
	20	omt	Meat products nec
	21	vol	Vegetable oils and fats
	22	mil	Dairy products
	23	pcr	Processed rice
	24	sgr	Sugar
	25	ofd	Food products nec
	26	b_t	Beverages and tobacco products
	30	lum	Wood products
	32	p_c	Petroleum, coal products
	34	nmm	Mineral products nec
	36	nfm	Metals nec
Labour intensive (lab)	27	tex	Textiles
	28	wap	Wearing apparel
	29	lea	Leather products
	37	fmp	Metal products
	42	omf	Manufactures nec
Specialised suppliers (spe)	40	ele	Electronic equipment
	41	ome	Machinery and equipment nec
Scale and Capital intensive (sca)	31	ppp	Paper products, publishing
	33	crp	Chemical, rubber, plastic prods
	35	i_s	Ferrous metals
	38	mvh	Motor vehicles and parts
	48	otp	Transport nec
R&D intensive (rd)	39	otn	Transport equipment nec

Non industrial &non classified (non)	1	pdr	Paddy rice
	2	wht	Wheat
	3	gro	Cereal grains nec
	4	v_f	Vegetables, fruit, nuts
	5	osd	Oil seeds
	6	c_b	Sugar cane, sugar beet
	7	pfb	Plant-based fibers
	8	ocr	Crops nec
	9	ctl	Cattle, sheep, goats, horses
	10	oap	Animal products nec
	11	rmk	Raw milk
	12	wol	Wool, silk-worm cocoons
	13	frs	Forestry
	14	fsh	Fishing
	15	coa	Coal
	16	oil	Oil
	17	gas	Gas
	18	omn	Minerals nec
	43	ely	Electricity
	44	gdt	Gas manufacture, distribution
	45	wtr	Water
	46	cns	Construction
	47	trd	Trade
	49	wtp	Sea transport
	50	atp	Air transport
	51	cmn	Communication
	52	ofi	Financial services nec
	53	isr	Insurance
	54	obs	Business services nec
	55	ros	Recreation and other services
	56	osg	Public Admin / Defence /Health / Education
	57	dwe	Dwellings

Table IV – Sectoral structure of production and exports (2004)

	Production	Exports
Res	12.12	13.79
Lab	8.19	22.86
Spe	5.14	17.07
Sca	8.77	20.89
Rd	0.18	1.25
Non	65.60	24.14
Total	100.00	100.00

Appendix 2 – Numerical results of the simulations

Table V – Impacts on employment and production (%)

	LQ	LU	VAB
Res	7.31E-09	7.05E-09	3.81E-09
Lab	2.75E-08	2.78E-08	1.00E-08
Spe	3.42E-08	3.41E-08	3.29E-08
Sca	1.90E-08	1.88E-08	1.21E-08
Rd	-3.33E-06	-3.35E-06	-3.43E-06
Non	2.39E-09	1.97E-09	5.28E-09

Table VI: Impacts on prices (%)

Price of skilled Labour:	7.21E-09
Price of unskilled labour:	7.24E-09
Price of capital:	-8.58E-10

Table VII – Impacts on trade (%)

	Exports	Imports	Trade Balance
Res	2.52E-08	-4.57E-09	-5.25E-08
Lab	4.27E-08	-7.05E-09	1.78E-07
Spe	5.51E-08	1.94E-09	-5.53E-08
Sca	3.39E-08	1.43E-10	-3.93E-08
Rd	-3.29E-06	-1.05E-07	3.09E-06
Non	2.33E-08	-5.33E-09	-1.46E-07

Table VIII - Impacts on productivity (%)

	Productivity Skilled Labour	Productivity Unskilled Labour	Productivity Multifactor
Res	-3.20E-09	-2.94E-09	-8.96E-09
Lab	-1.26E-08	-1.29E-08	-3.01E-08
Spe	-1.53E-09	-1.42E-09	-7.91E-09
Sca	-5.71E-09	-5.60E-09	-1.46E-08
Rd	-3.94E-08	-1.82E-08	-3.32E-07
Non	1.83E-09	2.25E-09	-4.42E-10