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Decomposing the Effects of Economic Policies and Technological Changes in Tunisia by the Double Calibration Approach

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Abstract
In this article, we propose to evaluate and dissociate the impacts of the economic policies and the technological changes as well as their intrinsic contribution to the evolution of various Tunisian economic aggregates between 1987 and 2008. For this purpose, we have used the double calibration approach in a multi-sector computable general equilibrium model retracing the functioning of the Tunisian economy. The numerical results show that the direct contribution of policies proved to be very important on the evolution of economic aggregates. Whereas, the technological changes and the indirect impacts of policies on the adoption of the best technological processes could prove to be very important. This allowed us to conclude that Tunisia should invest itself more in technological progress by putting in place policies for innovation and incentives for research and development (R&D).

Keywords: Calibration, CGEM, economic policies, technological changes.

JEL Classifications: C68

1. Introduction

After the proclamation of independence in 1956, the Tunisian economy has been characterized by a strong presence of the public sector in the industrial, agricultural production and services. Indeed, the private sector has been submitted to the tight control of the Tunisian administration mainly through the attribution of authorizations and licenses of importation and exportation and the control of price levels. This interventionist policy has led to an economic crisis in 1986; a crisis which manifested itself by an economic growth below 3%, a current account deficit of 7.8% of GDP and an external debt of 56% of GDP. Despite this crisis, Tunisia has known difficult climatic and economic conditions between 1985 and 1986 such as the

decline of petrol prices, the succession of a range of droughts and the decrease of workers' salary. To face this situation, Tunisia has undertaken a policy of progressive economic liberalization so that it can integrate and adapt itself to the new international context. For this, a structural adjustment plan (SAP) has been established in 1986. It has led to a process of economic reforms and liberalization launched effectively at the end of the year 1987 to disengage the administration gradually from the production sector. The SAP has mainly targeted the prices, the trade, the tax system, the system of incitement to investment, the banking sector, the stock market and the capital market to which should be added the restructuration of public enterprises and the commitment to an important program of privatization and administrative reforms. Indeed, most public enterprises operating in the production sector have been gradually privatized. In addition, the Tunisian economy has known an opening to the world competition through the enforcement of a free exchange agreement concluded with the European Union (UE) in 1995. By adopting these various economic policies undertaken since 1986 with the support of the European Commission, the World Bank and the International Monetary Fund (IMF), Tunisia has managed to obtain good results in terms of GDP growth and the control of inflation and deficit of current account.

The adoption of these reforms has led to the emergence of an important economic literature which has tried to analyze their impacts on the various economic aggregates by using mainly the computable general equilibrium models (CGEM) characterizing the functioning of the Tunisian economy[1]. However, all these works did not take into consideration, in their analysis, the technological change component in their model. In this article, we have tried to evaluate and dissociate the impacts of economic policies and those of technological changes, as well as their intrinsic contribution in the evolution of various economic aggregates in Tunisia, between 1987 and 2008. To reach this goal, we have developed a CGE model compatible with the Tunisian context, which has allowed us to simulate the impacts of the economic policies applied in 1987. Then, the numerical programming of the method of double calibration proposed by Abdelkhalek (2001) allowed us to dissociate and evaluate the effects, which are caused by economic policies from those, which are caused by technological changes. It is worth noticing that there is no economic study, which has dissociated the impact of these two effects for the case of Tunisia despite the fact that it has witnessed a technological progress since its independence. On the other hand, these last few years, the use of the technique of double calibration has proved to be important in the field of decomposition of impacts attributable to certain specific shocks. We can cite, as a reference, Abrego and Whalley (2000), Mujeri and Khondker (2002), Weerahewa (2002) and Christian *et al.* (2008).

In this article, our analysis is based on a totally integrated CGE model with double calibration, taking into account the hypotheses of constant returns to scale and perfect competition on the market of goods and services. In our model, we retain seventeen sectors, which the data are supplied by the National Institute of Statistics (NIS) [2] and by taking 1983 as a basic year. Two social accounting matrices (SAM) specific to the Tunisian economy for both years 1987 and 2008, have been conceived to reply to the requirements of countable coherence of the model.

The description of the model and the countable framework are presented in the second section of this article. Then, the principle of the methodological approach of the double

[1] We can cite as an example, the work of Chaponnière *et al.* (2005), Konan and Assche (2007), Chemingui and Thabet (2009) and Marouani (2009).

[2] NIS National Institute of Statistics ie Institut National des Statistiques (INS).

calibration technique is exposed in the third section. The fourth section presents macroeconomic and sectorial analysis of the effects of economic policies and those of technological changes. The last section presents the conclusion and the recommendations, which we can reach in view of the numerical results.

2. The Model and the Countable Frame

2.1 *The Computable General Equilibrium Model*

The model is built to simulate the impact of economic policies applied in Tunisia between 1987 and 2008, is a static CGE model characterizing an open economy of a small country, with a government. It is a model of exchanges in which money plays a neutral role. The hypotheses of constant returns to scale and perfect competition on the market of goods and services will be considered in our model. This model takes into account the seventeen sectors of activities supplied by the data of Tunisian national accountancy (base 1983) published by the NIS (Table 1). Two production factors are considered: capital and labor, which are perfectly mobile between the different activities with the hypothesis of full employment factors. Each branch produces only one goods in such a way that there exist as many produced goods as sectors of production.

Table 1. List of sectors considered in the model

N°	*Code*	*Title*	*Full title of the sector*
1	00	*APF*	Agricultural products and fishing
2	10	*PFI*	Products of the food Industry
3	20	*CGCM*	Ceramic and glassware Construction Material
4	30	*MME*	Machines and Mechanic and Electric Material
5	40	*ChP*	Chemical Products
6	50	*TGL*	Textiles, Garments and Leather
7	60	*PVMI*	Product of various Manufacturing Industries
8	65	*IM*	Inorganic chemistry and Mine Products
9	66	*PG*	Petrol and Gas
10	67	*Elec*	Electricity
11	68	*Water*	Water
12	69	*BPW*	Buildings and Public Works
13	76	*TT*	Transport and Telecommunications
14	79	*HR*	Hostelry and Restoration
15	82	*FIS*	Financial and Insurance Services
16	85	*OMS*	Other merchant Services
17	94	*NMS*	Non merchant Services

Source: NIS (1983)

The total production of each sector is determined by a function of encased production where the production is a function of Leontief type of the added value and the total intermediate consumption of goods. The intermediary consumptions are also modelized according to the classical diagram of input-output models. With the exception of the non-merchant services, which use only labor as a factor of production, the added value of a sector of production is the composite of primary production factors. It is represented by a CES type function of capital and

labor. For the exporting sectors, their production is aimed at the local market and the world market through a transformation function with constant elasticity of type CET.

At the level of economic agents, in its aggregate version, the model holds three, namely: the households, the government and the rest of the world; which behave in a 'rational' way. The households receive their revenue in the form of sector remunerations of labor and capital. Their savings rate is assumed constant and applies to disposable income. For the repartition of household expenses between the various products, the model retains a utility function of Cobb-Douglas type from which are derived the requests of goods.

As for the government, it collects taxes on importation, indirect duties paid by the companies and direct taxes paid by the households. For the request of composite goods for each category of goods, in order to satisfy the requests of consumption of intermediary goods, the consumption of households and that of the State as well as the investment, it is defined as a function of type CES of imported and domestic products.

Commercial exchanges with the outside world are modeled by specifying the functions of constant elasticity of substitution (Armington's Principle, 1969) or transformation with the hypothesis of a small country for all the products. World prices of goods for importation and exportation are therefore exogenous and fixed. Their equivalent in Dinars is deducted by taking into consideration a nominal exchange rate and eventual taxes, those related to customs duties in particular. The rest of the system of model prices is totally conform to the different functional forms in use.

The various equations of the model and the list of endogenous variables as well as the list of exogenous parameters and variables are presented in the Appendix A.

2.2 The Countable Frame of the Model

The implementation of a CGE model is based primarily on the construction of a single Social Accounting Matrix (SAM). Nevertheless, in order to implement a model with double calibration, two SAM specific to the Tunisian economy are required, with one SAM for each year of calibration. We consider 1987 as the first year of calibration. It is the year of reference for the first SAM, which is in fact, the one that precedes immediately the main economic reforms analyzed in this research. The year 2008[3] is the second year of calibration, corresponding to the second SAM.

In order to construct each of these two MCS, two tables of the national accounts (base 1983), published by the NIS, are compiled: the table of resources and employment (TRE) and the table of integrated economic accounts (TIEA). Their construction has been a research in itself, seen the complexity - implied in the research – of internal and external coherence between TES data and national compatibility. Once both MCS are entirely balanced and respecting all the conditions of aggregated SAM, the second step of the setting into action of a CGE model is based on the calibration principle. And this is achieved with the help of a software GAMS 21.7, for the two years of reference 1987 and 2008. In fact, we had recourse to available studies to approximate the values of elasticity between the factors of production and those of foreign trade in order to calibrate the parameters of Functions CES and CET utilized in our model.

In general, a CGE model for the year of reference (1987) can be represented by a function M in such a way that:

$$Y_0 = M(X_0, \beta_0, \gamma_0)$$

[3] The most recent year for which the data are available for the base 1983 published by NIS

With

Y_0: the vector of dimension m of the endogenous variables of model (m = 568),

M : the usually non linear function,

X_0: the vector of H variables exogenous or of economic policies (H = 39),

β_0: the vector of dimension P of free parameters or *'elasticities'* (P = 51),

γ_0: the vector of K parameters of calibration of the model (K = 477).

The procedure of calibration consists then in determining the vector γ_0 by resolving the following system:

$$\begin{cases} Y_0 = M(X_0, \beta_0, \gamma_0(Y_0, X_0, \beta_0)) \\ \gamma_0 = H(Y_0, X_0, \beta_0) \end{cases}$$

3. The principle of double calibration

The solution proposed by Abdelkhalek (2001) to resolve this problem consists to place a posteriori (in our case 2008) in order to dissociate the effects due to the economic policies from those due to the technological changes. In the traditional approach of CGE model, in order to study the impact of a shock controllable or not, we always consider that the values of the calibrated parameters (γ) and the free parameters (β) do not change during the temporal horizon of the shock. The after-shock balance (Y_1^S) is given then, by the following counterfact situation, where only the vector of exogenous variables has been modified:

$$Y_1^S = M(X_1, \beta_0, \gamma_0)$$

However, this obtained effect is completely different from the effect observed actually at the final period (Y_1), ie in 2008, after applying all economic policies and other technological changes. This is explained indeed by the fact that after a given temporal horizon, the technological parameters and the behavior of an economy can change in such a way that we have:

$$Y_1^S = M(X_1, \beta_0, \gamma_0) \quad \neq \quad Y_1 = M(X_1, \beta_0, \gamma_1)$$

By considering in this work, the case of short term where the values of parameters of elasticity (β_0) do not change in the temporal horizon of the shock.

The specific impact to the simulated policy (*PE*) is then evaluated as the difference between the results of the expected effect of all the economic policies applied in Tunisia between 1987 and 2008 (Y_1^S) and the data observed at the initial period (Y_0), in 1987:

$$PE = Y_1^S - Y_0 = M(X_1, \beta_0, \gamma_0) - Y_0 \qquad (1)$$

And since the *Total Effect* (TE) observed in the Tunisian economy during that period, is calculated by making the difference between the data observed at the ultimate period (Y_1) and those observed at the initial period (Y_0), is decomposed between an economic *Political Effect* (EP) and a technological effect or even an *Effect of Calibration* (EC):

$$TE = PE + EC = Y_1 - Y_0 \qquad (2)$$

Then, we can deduce the effect of calibration as the difference between the total effect and the political effect:

$$EC = TE - PE = (Y_1 - Y_0) - (Y_1^S - Y_0) = Y_1 - Y_1^S$$

$$EC = Y_1 - M(X_1, \beta_0, \gamma_0) \qquad (3)$$

To isolate the effect of calibration determined at the equation (3) by this approach of decomposition presented below, it is essential that the economic effect (PE) as formulated by the

equation (1), take into account all economic policies implemented between periods 0 and 1. In the opposite case where the PE would be only the expression of isolated economic shocks; the equation (3) is not representative of the exclusive effect of technological change, but would also include the effect of other politicies and exogenous non identified (and non simulated) shocks.

4. The Results and Interpretation

All the achieved results are summed up in table 2 below, which represents the criterion of adjustment and performance quality of the model by doing the ration between the political effect (PE) and the total effect (TE). This table allows, indeed, to identify the extent of the effect of economic policies on the different economic aggregates in Tunisia, and to know the proportion of each effect (Technological Effect and Political Effect) in the total effect between 1987 and 2008.

Table 2. Criterion of quality adjustment and performance of the model[4,5]

	Quality of adjustment in % (PE/TE)									
Sectors/Variables	*X*	*Q*	*DCI*	*LD*	*KD*	*C*	*M*	*EX*	*INV*	*DS=DD*
APF	187.6	161.3	114.1	96.2	228.3	223.5	89.1	70.6	298.3	201.6
PFI	90	97.1	61.2	58.8	97.5	117.8	102.8	40.1	-1.8	99.5
MME	47	70.8	70.9	77.2	37.9	45.6	66.2	16.8	89.6	95.9
TGL	80.4	117.6	148.1	22.2	221.4	98.7	71.3	41.4	51.5	294.5
IM	104.2	123	119.3	246.5	46.7	531.8	375.5	100.6	-15.3	105.2
PG	227.1	93.1	99.3	325.4	319.6	59.6	35.9	207.3	-654.6	273.3
Water	201.9	201.9	320.8	149.1	-1226.9	155.5	-	-	-	201.9
HR	24.4	49.7	93.2	7.7	36.7	48.3	90.4	22.6	-	30
Total	98.6	96.7	96.8	81.4	114.5	96.9	71.1	66.6	103	115.2

Endogenous variables	*Political Effect (PE)*	*Total Effect (TE)*	*Quality of adjustment in % (PE/TE)*
C	25 615,3	26 433,4	96.9
YM	39 947,9	39 458,3	101.2
SMH	10 062,9	8 803,1	114.3
YG	6 957,9	7 855,5	88.5
SG	717,8	1 615,4	44.4
TI	12 389,7	12 027,5	103.0
B	2 375,9	1 609	147.6
GDP	42 406,5	43 092	98.4

Source: Authors' computing using *GAMS software*
Unit: Million of dinars

This table shows that the effect of the economic policies applied in Tunisia during that period, on the economic growth is very important. It has contributed by 98.4% of GDP growth, which is explained, indeed, by an important effect on the increase of household consumption by

[4] The results of the other sectors will be available upon request.

[5] The political effect and the total effect of the different variables for each sector are presented in the Appendix B.

96.9%, an increase in the total investment by more than 100% and an augmentation of importations and exportations by 66.6% and 71.1%, respectively. Whereas the technological changes occurred during this period, had a very small effect on GDP growth, which stood at 1.6%. This weak effect is explained, indeed, by a weak impact on the augmentation of household consumption reaching 3.1%, as well as on the exportations and importations around 33.4% and 28.9%, respectively.

We can also notice the importance of the political effect on other aggregates. Indeed, the PE explains the entire increase of household income. Besides, it has a very important impact on the government's revenue increase, contributing by 88.5%. Whereas the technological effect is very weak and it amounts to 11.5%.

This table also highlights the importance of the impact of each effect on the different sectors of production. Indeed, the PE explains the most important part of the total effect on the increase in total production at national level between 1987 and 2008, which rises to 98.6%. Whereas the EC had a weak effect and reaching only 1.4%.

On the sectorial level, both effects differ from one sector to another. For instance, the total effect on the output of the sector of agricultural production (*APF*), is due in totality to the PE. For the textile sector (*TGL*), the PE is very important. It has boosted its output by 80.4%, whereas the technological changes have had a weak impact reaching 19.6%. On the other hand, the EC is more important on the production of the sector of minerals (IM) and the sector of hostelry (HR). Indeed, it has contributed to the increase of their production by 53% and 75.6% respectively. The weak effect of the technological changes on the global production at the national level (1.4%) resulted, in effect, from the fact that the strong positive variations registered in some sectors are confronted to the negative variations registered in other sectors. The decrease in the production of various sectors such as the petrol and gas (127.1%) and water (101.9%), thus counterbalances the increase of the production in all other branches, such as mechanic materials (53%), and food products (10%), etc.

At the level of the market of production factors, the political effect on the global remuneration of production factors is important. It represents 81.4% of the global effect on the remuneration of labor factors and 114.5% on the remuneration of capital factors. Furthermore, the effect of calibration has had a weak impact on salary rates, with an increase of 18.6% while it has decreased the rate of capital return by 14.5%. However, the effect differs from one sector to another.

Finally, we can note that the technological effect has negatively affected the balance of the current account, which decreased by 47.6%. This decrease is explained by the fact that the positive impact of technological change on total imports is lower than the total export.

5. Conclusion

In this article, we have evaluated and dissociated the effects due to the economic policies of those due to technological changes in the Tunisian economy between 1987 and 2008, by using the method of double calibration in a computable general equilibrium (CGE) model characterizing the Tunisian economy. This analysis is concentrated at the level of the magnitude of the economic policies effect on the endogenous variables, and also on the manner with which the effect of technological changes interferes in order to adjust the political effect to the total effect.

The results achieved in this study allow, indeed, to give an indication of the direction and magnitude of economic policies impacts, as well as their intrinsic contribution to the evolution of various economic aggregates in Tunisia, between 1987 and 2008. It turns out as well as these policies pursued during this period, had a very important impact on the economic growth and the evolution of various economic aggregates. Indeed, the political effect contributed of 98.4% to GDP growth in this period.

Beyond the study of the impact of these policies, the double calibration approach reveals the weak contribution of the technological changes occurred during that period. This research suggests that the technological changes and the indirect incidences of policies on the adoption of the best technological processes could be very important. Indeed, the technological effect has positively contributed to the integration of Tunisia in the world economy, and this by contributing to the increase of exportations and importations by 33.4% and 28.9%, respectively. This allowed us to conclude that Tunisia must invest further in technological progress by establishing intensive policies of innovation and incitation to research and development (R&D).

In fact, the important range of hypotheses that the CGE model involve and the degree of liberty allocated to the model designer in the determination of parameters sets up the boundaries of these models. Last but not least, we point out that our presented model postulates the hypotheses of constant returns to scale as well as perfect competition on the market of goods and services. While taking account of imperfect competition and increasing returns, can significantly modified the results. Likewise, taking into account the market of labor and unemployment constitutes also an interesting element for a further prolongation of this research.

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APPENDIX A: Model equations and notation

Table 3. List of the model equations

Equations	*Number of Equations*
Demand for intermediate consumption:	
$CI_{ij} = e_{ij}\mathrm{X_j}$	(289)
$CI_i = \sum_j CI_{ij}$	(17)
Demand of primary factors:	
$L_{Di} = X_i \left[\frac{\alpha_i p_{VAi}}{A_i^{v_i} w}\right]^{\frac{1}{1+v_i}}$	(16)
$K_{Di} = X_i \left[\frac{(1-\alpha_i) p_{VAi}}{A_i^{v_i} r}\right]^{\frac{1}{1+v_i}}$	(16)
$p_{VAi} = \frac{1}{A_i}\left[\alpha_i^{\frac{1}{1+v_i}} w^{\frac{v_i}{1+v_i}} + (1-\alpha_i)^{\frac{1}{1+v_i}} r^{\frac{v_i}{1+v_i}}\right]^{\frac{1+v_i}{v_i}}$	(16)
$p_{VAi} = p_{xi}(1-t_{xi}) - \sum_j p_{Qj} e_{ji}$	(1)
Non merchant Services :	(1)
$X_{SNM} = \frac{LD_{SNM}}{a_{SNM}}$	
$L_{DSNM} = \frac{p_{xSNM}(1-t_{xSNM}) X_{SNM} - \sum_j p_{Qj} e_{jSNM} X_{SNM}}{w}$	
Balance on the market of production factors :	
$\sum_i L_{Di} = \overline{LS}$	(1)
$\sum_i K_{Di} = \overline{KS}$	(1)
Producers supply :	
$EX_i = X_i \left[\frac{p_{Ei}}{B_i^{\varphi_i} \gamma_i p_{xi}}\right]^{\frac{1}{\varphi_i - 1}}$	(13)
$DS_i = X_i \left[\frac{p_{Di}}{B_i^{\varphi_i} (1-\gamma_i) p_{xi}}\right]^{\frac{1}{\varphi_i - 1}}$	(13)
$p_{xi} = \left[\gamma_i^{-\frac{1}{\varphi_i - 1}} p_{Ei}^{\frac{\varphi_i}{\varphi_i - 1}} + (1-\gamma_i)^{-\frac{1}{\varphi_i - 1}} p_{Di}^{\frac{\varphi_i}{\varphi_i - 1}}\right]^{\frac{\varphi_i - 1}{\varphi_i}}$	(13)
Autarchic Sectors :	
$DS_j = X_j$	(4)
$p_{xj} = p_{Dj}$	(4)

Demand of the composite goods : $$C_i = \beta_i \frac{YDM}{P_{Qi}}$$	(17)
Demand for domestic and imported products : $$DD_i = Q_i \left[\frac{\delta_i p_{Qi}}{B_{Mi}^{-\rho_i} p_{Di}} \right]^{\frac{1}{1+\rho_i}}$$	(13)
$$M_i = Q_i \left[\frac{(1-\delta_i) p_{Qi}}{B_{Mi}^{-\rho_i} p_{Mi}} \right]^{\frac{1}{1+\rho_i}}$$	(13)
$$p_{Qi} = \frac{1}{B_{Mi}} \left[\delta_i^{\frac{1}{1+\rho_i}} p_{Di}^{\frac{\rho_i}{1+\rho_i}} + (1+\delta_i)^{\frac{1}{1+\rho_i}} p_{Mi}^{\frac{\rho_i}{1+\rho_i}} \right]^{\frac{1+\rho_i}{\rho_i}}$$	(13)
Autarchic Sectors :	(4)
$$DD_j = Q_j$$	(4)
$$p_{Qj} = p_{Dj}$$	
Export demand from the rest of the world : $$p_{Ei} = p_{WEi} ER$$	(13)
Import supply from the rest of world : $$p_{Mi} = p_{WMi}(1+t_{mi}) ER$$	(13)
Investment demand for each sector : $$INV_i = \mu_i \frac{IT}{p_{Qi}}$$	(17)
Balance on the market of goods and services : $$Q_i = C_i + \sum_i C_{ij} + G_i + INV_i$$	(17)
$$DD_i = DS_i$$	(17)
Formation of the revenue and savings of households and the State : $$YM = w.LS + r.KS$$	(1)
$$Y_G = \sum_i t_{mi} p_{wMi} M_i ER + \sum_i t_{xi} p_{xi} X_i + tyh\,.YM$$	(1)
$$YDM = YM - tyh\,.YM$$	(1)
$$SMH = \psi.YDM$$	(1)
$$SG = Y_G - \sum_i G_i$$	(1)
Balance Investment – Savings : $$IT = SMH + SG + ER.B$$	(1)
Total	**568**

Table 4. List of endogenous variables of the model

Endogenous Variables	*Nomber of variables*
X_i: Raw Production of goods i	(17)
Q_i: Total Consumption of composite goods i	(17)
CI_{ij}: Intermediary consumption of product i by sector j	(289)
CI_i: Total intermediary consumption in product i	(17)
LD_i : Demand for labor by the sector i	(17)
KD_i: Demand for capital by the sector i	(16)
p_{Xi} : Net Price at production in sector i	(17)
p_{VAi}: Price at added value of goods i	(16)
Y_M, Y_G : household income (1) and State income (1)	(2)
C_i: Quantity of composite goods i consumed by households	(17)
M_i, EX_i: Volume of importations (n-4) and exportations (n-4)	(26)
INV_i : Demand of investment in product by branch i	(17)
TI : Total Investment	(1)
SG : State savings	(1)
SMH : Household savings	(1)
YDM : Household disposable income	(1)
DS_i, DD_i: Quantities supplied (n) and demanded (n) of the domestic goods i	(34)
p_{Qi}: Price of composite goods i	(17)
p_{Mi}, p_{Ei}: Price of a unit of importation and exportation of goods i	(26)
p_{Di} : Price of domestic goods i	(17)
w : Rate of nominal salary	(1)
r : Rate of remuneration of the capital	(1)
Total	**568**

Table 5. List of exogenous parameters and variables of the model

e_{ij}: input output Coefficients representing the quantity of goods i consumed by sector j.
a_{SNM} : Fixed technical coefficient representing the quantity of primary labor factors necessary to the production of a unit of goods of sector *SNM*.
A_i, B_{Mi}, B_i: Parameter of scale or dimension in the functions of the Added Value (CES), of Armington (CES) and of transformation (CET).
α_i, δ_i, γ_i: Parameters of proportion in the functions of the Added Value, of Armington and of Transformation.
ν_i, ρ_i, φ_i: Parameters of substitution in the functions of Added Value, of Armington and of Transformation.
σ_i, ϖ_i, ω_i: Elasticity of substitution between capital and labor, imported and domestic goods and elasticity of transformation between exported and domestic goods.
β_i: Part of composite goods i in household consumption.
ψ: Marginal Propensity to spare.
μ_i : Portion of investment of product i in the global investment.
t_{xi}, t_{mi}, *tyh* : Rate of indirect tax, importation tax and direct tax on households.
LS, *KS*: Total offer of labor and capital.
B: Net flows of foreign capital.
G_i: Public spending of goods i.
p_{WMi}, p_{WEi}: World prices of importations and exportations.

APPENDIX B: The Political Effect and the Total Effect

Table 6. The Political Effect and the Total Effect of the different variables for each sector

	Political Effect (PE)										Total Effect (TE)						
Sectors/Variables	*X*	*Q*	*DCI*	*LD*	*KD*	*C*	*M*	*EX*	*INV*	*DS=DD*	*X*	*Q*	*DCI*	*LD*	*KD*	*C*	*M*
APF	9 034,30	10 193,00	4 363,10	751,4	6 907,50	4 818,50	1 577,00	364	1 011,40	8 670,40	4 815,30	6 318,70	3 823,90	780,8	3 025,10	2 155,70	1 769,40
PFI	7 896,60	8 552,90	1 876,70	447,7	1 437,80	6 677,60	1 276,20	566,5	-1,3	7 330,10	8 777,00	8 806,70	3 066,70	761,8	1 475,10	5 666,50	1 241,40
MME	4 690,20	10 822,70	4 956,60	481,7	1 324,80	1 632,60	7 424,90	1 038,30	4 233,50	3 651,90	9 988,20	15 292,80	6 987,00	624,1	3 495,10	3 580,00	11 216,50
TGL	5 337,60	5 551,60	2 879,80	351,4	1 679,70	2 594,60	2 571,20	2 322,90	77,2	3 014,70	6 636,20	4 721,40	1 943,90	1 583,40	758,8	2 627,50	3 608,40
IM	798,1	783,2	773,2	315,3	136,9	8	161,8	173,4	2	624,7	766,3	636,6	647,9	127,9	293	1,5	43,1
PG	11 916,90	5 897,00	5 259,80	480,3	7 459,20	619,5	1 644,50	7 618,20	17,7	4 298,70	5 247,60	6 333,20	5 297,30	147,6	2 334,00	1 038,60	4 585,70
Water	313,8	313,8	139,9	106,8	58,9	173,9	0	0	0	313,8	155,4	155,4	43,6	71,6	-4,8	111,8	0
HR	970,7	697,9	42,2	69,9	514,8	655,7	414,6	687,4	0	283,3	3 980,20	1 403,70	45,3	912,2	1 403,40	1 358,40	458,6
Total	80 324,30	82 089,90	38 884,40	12 857,70	27 090,10	25 615,30	20 995,70	18 619,80	12 389,70	61 704,40	81 496,80	84 864,20	40 163,20	15 793,30	23 665,00	26 433,40	29 548,70

Source: Authors' computing using *GAMS software*
Unit: Million of dinars