Impacts of the Euro-Tunisian agreements of free exchange: evaluation by a Computable General Equilibrium Model in 1996

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Abstract

Until nowadays, the South-Mediterranean countries have focused on their strategic choice which consists in the creation of a Euro-Mediterranean Free Trade Area (FTA). In the context of globalisation, this choice appears to be the best means which facilitates the integration of the south countries with the north countries of the Mediterranean. This FTA is going to be established progressively during a period of transition of 12 years. Among the first participants in the constitution of this zone, is Tunisia, which signed an agreement of association with the European Union (EU). This agreement is based on free exchange and on financial, economic and technical cooperation and it contains a social and cultural chapter and a political dialogue. Since the signature of this agreement, Tunisia has been interested in improving its internal economic situation through internal reforms (plan of structural adaptation, upgrading, fiscal reform …) to facilitate the application of external reforms.

With the coming into force of this agreement, the free Euro-Tunisian exchange concerns exclusively industrial products, while the other products (farm produce) are going to be examined in the coming days.

The object of this communication is to compare the effects of the free total exchange and the effects of the free industrial exchange between Tunisia and the EU in the Tunisian economy. This problem was estimated by means of a Computable General Equilibrium Model (CGEM). This document will be divided in two blocks of simulations. The first concerns total commercial liberalization (for all the products (agricultural and industrial) and all services (traders and non-traders) and for all the partners), while the second block consists in a partial commercial liberalization (only for manufactured goods, for all the partners). Each of these two blocks is subdivided into four simulations:

1°) A decline of 1/12 of the rate of import customs duty
2°) A decline of 1/6 of the rate of import customs duty
3°) A decline of 50% of the rate of import customs duty
4°) A total abolition of the rate of import customs duty

In these two blocks, the EU constitutes the totality of the account of the Rest of the World, because it is considered as the main partner of Tunisia.

In the light of the comparison of these eight simulations, we notice that a progressive commercial liberalization applied during a reasonable period remains an effective economic reform for a developing country.

Moreover, such a liberalization is considered as preferable when it is applied to one or to a certain category of product. In other words, free progressive industrial exchange between Tunisia and the EU is considered as a good strategy for the constitution of a Euro-Mediterranean FTA by 2010.

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1. Introduction

Over the last few years, most of the developing countries have been getting ready for access to the international scene which groups traditional and new rivals. In the face of this new phenomenon, the countries concerned took internal precautions in the form of accompanying, adaptation (plan of structural adaptation) and reorganization (upgrading) of domestic reforms policies under the aegis of the international institutions to facilitate the application of external reforms. These reforms were studied by certain economists whose purpose is to estimate their impacts in savings for development. In this context, we will study the evaluation of the impacts of two types of commercial liberalization between Tunisia and the European Union on the Tunisian economy. This empirical comparison is made through a Computable General Equilibrium Model (CGEM). This document illustrates results found from the GAMS software and it is distributed in two paragraphs in the form of two blocks of simulations:

1st Block: total commercial Liberalization (for all the products(0), for all the partners).

2nd Block: partial commercial Liberalization (only for manufactured goods, for all the partners).

The choice of the 1st Block consists in giving advantages and drawbacks of a commercial liberalization which concerns all the products from all the partners together. This block contains four scenarios which show a progressive tariff decline until a total elimination. These simulations do not correspond, in fact, to current policies adopted by Tunisia. But they are chosen to be compared with commercial policies of Tunisia within the framework of a Euro-Tunisian partnership. They consist in a tariff decline which first of all concerns manufactured goods following a calendar fixed by the two parties (namely Tunisia and EU).

This means that the 2nd block roughly reflects the contents of the Euro-Tunisian agreement of association. The main point of this agreement is the phasing in a free trade area during a period of 12 years. This free exchange exclusively concerns manufactured goods and more particularly industrial products. Farm produce, fishing and services are excluded from the first agreement (these products are going to be revised in the coming years). For that reason, partial commercial liberalization focuses only on all manufactured goods. We divide our second block in four scenarios: the first consists in a decline of 1/12 of the rate of import customs duty of manufactured goods (it means that tariff decline is made every year during a period of 12 years). The second scenario consists in a decline of 1/6 of the same rate (which means that this decline is made every year during a period of 6 years).

(0) s1: agriculture produce and fishing , s2: industrial products, s3 : tradable services and s4 : non tradable services

The third scenario contains the decline of 50% of the rate of customs duty. In other words, we expect that this commercial liberalization would take two years. Finally, we eliminate the rate of customs duty only for the import of manufactured goods which will be the object of the 4th scenario. We worked out these four simulations to show the advantages and disadvantages of the choice of the period of 12 years by two parties (EU and Tunisia).

The choice of two blocks is made to try to answer certain questions put by certain economists, for example:

• What is the impact of the Euro-Tunisian agreement on the Tunisian economy, when commercial liberalization concerns the totality of products instead of concerning only manufactured goods?

• What is the duration of commercial liberalization which is considered as satisfactory and adequate to achieve at the completion of reforms expected by Tunisia? (Whether it is a total or partial liberalization).

• What are the impacts of a progressive liberalization on the one hand and on the other hand an immediate liberalization (that is, an abolition of customs duties) within the framework of a Euro-Tunisian partnership?

After answering these three questions, we expose conclusions in the last paragraph.

2. Total commercial liberalization

This block contains four simulations:

Simulation 1: tariff decline of 1/12

Simulation 2: tariff decline of 1/6

Simulation 3: tariff decline of 50%

Simulation 4: eliminating of import customs duties

The results of this block are given in detail in table n°1 (annex1).

Simulation 1 (sim1) consists of a reduction of 1/12 of the rate of customs duty in the import of all the products.

Because of this reduction of tariffs, receipts of the State in value fall from D 1,328 millions to D 1,225 millions, or 7.756%. The decline of the rate of customs duty entails not only a decline of the internal prices for the manufactured and agricultural goods, but the weak increase in prices of services as well (0.2%). We notice, from table n°1, that this decline is higher for the prices for farm produce (1.68%) than for those of manufactured goods (0.74%). These prices keep the same evolutions in the other three simulations (that is a decline for the prices for the farm produce and industrial products and an increase of trade services).

This tariff decline (sim1) entails an increase expected from the imports of two products (agricultural and industrial of 2.21% and 0.56% respectively), which makes the total volume of purchases abroad increase (0.61%). Moreover, we can notice that this increase, imports of farm produce as well as manufactured goods, persists when the application of liberalization lasts a short time (6 years (sim2), 2 years (sim3)) or an abolition of customs duties (sim4). For each short duration, we observe that there is a fast increase of imports (table n°1). This is confirmed only for the primary and secondary sectors. As far as services are concerned, we observe a decline of imports in the last three simulations, in terms of volume. It is due to the increase of their market price.

In our CGEM, we maintain the equilibrium of the deficit of the foreign current account of the initial situation. In other words, any evolution of Tunisian imports can be financed only by an evolution in exports knowing that the capital returns of the Rest Of the World (ROW) are null. Our four simulations are about an increase in the imports of the farm and industrial products. For the present case, the exports of manufactured goods as well as agricultural products went up, respectively, 1.03% and 0.78%. We notice that there is an improvement of the balance of trade of manufactured goods (a decline of the deficit) but a widening of the trade gap for farm produce (even for the other three simulations). The improvement of the trade gap also concerns the service sector and it is verified in four simulations.

The general index of prices (the weighted price for value added, *pindex*) decreases in four simulations (sim1: by 0.4%, sim2: by 0.9%, sim3: by 2.7% and sim4: by 5.6%). So the shorter the period, the more this index decreases. It involves stronger and stronger increase of the real exchange rate ($e_r = (e_n / pindex)$) from 1 to 1.059 (in sim4) [1.004 (in sim1); 1.009 (in sim2); 1.028 (in sim3)].

In these four simulations, we conclude that the real depreciation of the Tunisian dinar (DT) (by 0.4% in sim1; by 0.9% in sim2; by 2.8% in sim3 and by 5.9% in sim4) is incentive enough so that the Tunisian production bound for the EU (its main partner) reaches the level required by the greater necessities of financing imports.

The increase of Tunisian exports is made to the detriment of a decline of sales on the Tunisian local market.

We can notice this phenomenon essentially for manufactured goods, in all the simulations, while we notice it only from the second simulation in the case of farm produce. It explains the fact that certain member countries of the EU, direct agricultural competitors of Tunisia, benefit from the advantages of a CAP (Common Agricultural Policy), and that during a large decline of customs duties, Tunisian agricultural exports increased in the European market. It means that the application of a total liberalization, during short period, leads to an increase of agricultural exports, but not to a decline of the agricultural trade gap. So a specific commercial liberalization in every sector seems more beneficial than one that concerns all the sectors within a small economy.

In the second simulation, we notice that the exports of the industrial farm products and the services increased, respectively by 2.06%, by 1.58% and by 0.43%; while sales on the Tunisian market of these three products decreased by 0.09%, by 0.84% and by 0.02%. This relationship is discovered from the function of the domestic demand for a product given by type CET (Constant Elasticity of Transformation). In other words, the transformation of the internal offer to an external offer (the export) is due to a decline of the price received by the producers on the Tunisian market (pl (s_i), respectively 0.7%, 0.6% and 0.4% (see sim1), with i=1,2,3). This price also falls in relative terms, because the price paid for the export of three products is maintained fixed (pe (s_i) =1, with i=1,2,3).

In the last three simulations, we notice that the process of transformation of the local sales into the export is greater in the case of industry than in the other two cases (agriculture and services), while the decrease of the local price for industrial production was weaker than the local price for the production of the other sectors. This is essentially explained by the value of the elasticity of commercial transformation of industry (which is equal to 2), superior on the one hand to that of agriculture (equal to 1.2) and on the other hand to that of services (equal to 0.5).

Similarly to the last three simulations, we notice in the first one that the reorientation of three products towards foreign markets (in particular towards the European market) is also accompanied by a decline of the total production in agricultural and industrial sectors and by an increase of the total production in the service sector. We now focus on the decline of the agricultural and industrial output. It is less when the period of the application of the commercial liberalization is short (for example: sim1). We can also explain this decline from the result of the domestic demand. This demand is subdivided into three constituents: household consumption, investment and intermediate demand. First, we notice that household consumption is not responsible for an internal fall in demand, because it grows in volume for farm produce and industrial products with competition, respectively by 0.05% and 0.04% in sim1. This increase is noticed every time for a short period (for example an increase of 1.02% and 0.06%, respectively, in sim2). On the other hand, in the case of the service sector, we notice a deep decrease during a short period (sim2, sim3 and sim4). Then, total investment keeps falling in value (sim1: 0.38%, sim2: 0.75 %, sim3: 2.28% and sim4: 4.49%). This decline is caused mainly by the reduction of the total income of the government resulting from import taxes, which was 7.76% (in sim1), and not by public saving. Indeed, this increased by 4.6% (sim1). Furthermore, in our CGEM, we fixed foreign saving. This explains simply that the balance between investment and saving is maintained by a decrease in the level of the investment and the savings of households and companies and by an increase of public saving (see table n°1).

We underline that investment is built upon three products (agricultural, industrial and services), in our case it implies that a large decline of the sales of agricultural and manufacturers products in the Tunisian market directly affects a decrease of their production. This decrease provokes a fall in the intermediate demand, in the case of farm produce and industrial products (in terms of volume and in terms of value) while that of services increases in terms of volume but decreases in terms of value.

Now, we are going to focus on the process of the decline of the production in the first two sectors and in the process of the increase of the production in the tradable service sector.

In the agricultural sector, the decline of the internal price for imported agricultural produce (pm (s1)) is greater in absolute value than the increase of the market price of the local product sold on the domestic market (pd (s1)). It means the consumer is more likely to buy the imported product than local one. This commercial substitution favours the imports which entail a fall in the agricultural investment. As regards manufactured goods, we also notice a decline of the internal price for the imported product (pm (s2)) being greater in absolute value than that of the market price of the local product sold on the domestic market (pd (s2)). It also encouraged local consumers to stock up more with imported products. This then accelerates the fall of industrial investment. While for tradable service sectors, we notice that it is different from those of the other two sectors. At first, this sector welcomes a part of the labour freed from the other two sectors (in sim1: the increase of the labour demand by the activity "s3" in terms of volume is 0.23%). This reception is also noticed in the other three simulations. Then, investment of tradable services remains unchanged in terms of volume in four simulations.

So this sector has no influence in the fall of the investment in volume, but it has a weak influence in terms of value in the other two sectors. Finally, the internal price for imported services (pm (s3)) increases 0.2% contrary to the internal prices for the other two products. The shorter the period concerning the application of the commercial liberalization, the greater the increase. Furthermore, we notice that there is a large decline of the market price of local services sold on the domestic market up to 0.3% (in sim1). So this favours the local production of trade services to the detriment of imported services. It explains the improvement of this sector locally and its satisfaction for the local and the foreign users, namely the neighbouring (Libya and Algeria)) although it is more developed within the EU. So it is no surprise to see the increase of the production of tradable services which is not oriented to the domestic market (because there is a weak decrease of the local demand for services) but oriented to the foreign market, because there is an increase of the exports of these services of 0.24% (in sim1).

This increase becomes greater when it takes a short period (in sim2, sim3 and sim4).

We can also interpret the production of each of these three sectors from the prices for value added in every activity. Decaluwé B., Martens. A and Savard L. (2001) assert that the variations of this price express changes in the degree of actual protection which is measured by the Effective Protection Rate (EPR =TPE). It measures the relative variation of the internal value added of the branch j (va_j) and international value added (vai_j))[(1)] :

$$TPE_j = \frac{va_j - vai_j}{vai_j} * 100$$

With:

Vai_j is the added value of the reference situation because international prices are equal to 1.

From table n°1 (Annex 1), we see that the price for the value added of the agricultural sector falls by 0.70%, that of the branch of industry by 0.50%, while that of tradable services decreases only by 0.30% (in sim1).

This explains the last sector which stays relatively the least unprotected (because - 100 < TPE_{s1} < TPE_{s2} < TPE_{s3} < 0)[(2)]. It means that the last sector attracts the labour left by the other two sectors (namely agricultural and industrial) which obviously explains the increase of their productions.

In the case of non-tradable services, the value of their production is, by definition, equal to the public consumption. In our CGEM applied in Tunisia, we fixed the volume of services offered by the State (x (s4) = D 3,420.9 millions). It is the decline of the price of production of these services (px (s4)) which automatically engenders a decline of their production in terms of value (g). This decline is noticed in four simulations.

Furthermore, we notice that the shorter the period the more the price of production falls and provokes a continual large decrease of the public consumption (i.e. non tradable services). The production of these services requires only the working labour, this demand in terms of volume remains constant in four scenarios. It is due to the stability of the offer of these services.

Within the framework of the payments for the factors of production, we notice that the decline of the market prices of the local production of three products (farm, industrial products and tradable services) decreases the marginal productivity of the labour in terms of value (that is the wage rate). For the Tunisian economy, we notice that there are less and less big intensities of use of working labour, which causes a decrease of the wage (w) by 0.4% (in sim1). This decrease of the wage is weak with regard to the

(1) see Decaluwé B., Martens A. and Savard L.(2001)," la politique économique de développement et les modèles d'équilibre général calculable", les Press d'Université de Montréal.

(2) Effective Protection Rate : TPE(s1) = -0.74%, TPE(s2) = -0.54%, TPE(s3) = -0.25% (calculated from sim1 of table n°1).

decrease noticed in the capital return on the agricultural (r(s1)) and manufacturing (r(s2)) sectors (respectively by 0.70% and by 0.50% in sim1) while it is higher with regard to that noticed for the return on the capital of tradable services (0.30% in sim1). These results increased in the other three simulations, while keeping the same relations (see sim2 , sim3 and sim4). Because in our model, capital is specific in every sector so it cannot be reallocated (according to Decaluwé B., Martens. A and Savard L.(2001)). We add that these decreases of the production costs of primary factors inevitably explain the almost equal decrease of the household income and their savings by 0.31% (in sim1). This quasi-equality is almost verified in the other three simulations. Considering the decline of the prices for two composite products (pq (s1) and pq (s2)), we notice that there is an increase in volume of the household consumption, only for the farm produce and industrial products. Whence a reorientation of domestic purchases towards these two composites products, the price of which decreases more than that of tradable services.

Most economists suggest reforms and economic policies, for developing countries, which lasted an averagely long period. Their objective consists in preparing the ground for the resistance of the small economies in development for these exogenous shocks and to be able to adapt to the consequences of these short-term reforms. It can be confirmed by the comparison of Equivalent Variations (EV)[3] and Compensating Variations (CV) [4] between four simulations.

We notice from the table below that there is an increase of the well-being in the simulation 1 and 2 while there is a decrease of the well-being in the last two simulations.

Table 1.1 : the numeric value of Equivalent Variations (EV) and Compensating Variations (CV)

	simulation 1		*simulation 2*		*simulation 3*		*simulation 4*	
	CV 1	**EV 1**	**CV 2**	**EV 2**	**CV 3**	**EV 3**	**CV 4**	**EV 4**
Households	-1.332	1.336	-1.819	1.831	5.386	-5.492	46.483	-48.4
Interpretation	We have : CV < 0 et EV > 0 There is an increase of well-being		We have : CV < 0 et EV > 0 There is an increase of well-being		We have : CV > 0 et EV < 0 There is an decrease of well-being		We have : CV > 0 et EV < 0 There is an decrease of well-being	

* Calculated by the author

These last results confirm the preference of the application of a commercial liberalization during a reasonable period and not during a short period (sim3) or the immediate abolition of customs duties.

From these four simulations which form the 1st block, we notice that commercial liberalization concerning all the products brings certain inconveniences. The weak points of this type of liberalization consist in the divergence of results (as the case appears on the one hand for farm produce and industrial products and on the other hand for tradable services), in other words this liberalization favours certain products.

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[3] See the Annex 3.
[4] See the Annex 3.

However we applied the same shocks for the set of products. And if we analyse in detail the particular case of the tradable service sector, we will observe that there is a dissociation between the reality and the theory. The decrease of the price on the market of the composite product concerned (pq (s3)) should automatically entail the increase of the household consumption of these services (ch (s3)), but it is not the case in our results. We can notice that when it concerns general reforms which concern the set of activities, it is difficult to dissociate effects of every sector and especially as it is a study in a computable general equilibrium model of which sectors are interdependent. For that reason, certain economists opt for reforms touching a sector or a category of sector. It is in this way that they can manage to analyse these shocks on the set of sectors easily.

3. Partial commercial liberalization

This block consists in the commercial liberalization only in manufactured goods and it also contains four simulations:

Simulation 5 (sim5): tariff decline of 1/12

Simulation 6 (sim6): tariff decline of 1/6

Simulation 7 (sim7): tariff decline of 50 %

Simulation 8 (sim8): abolishing customs duties

The results of this block are presented in detail in table n°2 (Annex 2).

In simulation 5 (sim5), outside shock consists in the decline of the rate of customs duty of 1/12 only for manufactured goods. These are the first products which were concerned with the calendar of the dismantling fixed by the Euro-Tunisian Agreement of Association. Firstly, it is about the total dismantling from the coming into force of the agreement of the non-competitive capital goods. Secondly, it treats dismantling over five years (that is by 1/5 a year) for raw materials and for non competitive half-finished products. Thirdly it corresponds to the dismantling of the competitive products (made locally) and more competitive than the European products over a period of 12 years at the rate of 1/12 a year, and fourthly it concerns the dismantling of the remaining products (made locally but not competitive) during a period of 8 years at the rate of 1/8 a year.

Furthermore, the two signatories (Tunisia, EU) awarded a grace period of four years for these last types of products from the coming into force of the agreement whose object consists in the bringing of the Tunisian companies up to the required level. In our study, we focused on the aggregated manufactured good which gather the competitive manufactured goods representing a large quantity in Tunisian imports.

The reduction by 1/12 of the rate of customs duty in the import of manufactured goods lowered, in terms of value, the tariff receipts of the State from D 1,328 millions to D 1,231 millions (-7.3%). The decline of the rate entailed on the one hand a decline of internal prices (of the market) for farm produce

and industrial products and on the other hand the increase of internal prices for tradable services. But we notice that the decline of prices is greater for manufactured goods (by 0.74% in sim5, by 1.47% in sim6) than for farm produce (0.08% in sim6 and almost stable in sim5).

In the other simulations (sim7 and sim8), we observe the same signs of variations. For example, we notice that the shorter the period for the application of the liberalisation, the more the internal prices (of the market) for manufactured products decrease (sim7: 4.49%, sim8: 8.82 %).

In simulation 5, as well as in the other simulations, we notice that this liberalization involved an increase expected of the imports of manufactured goods (sim5: 0.61%, sim6: 1.23%, sim7: 3.78% and sim8: 7.91%), whereas for farm produce and tradable services, we observe large decline during a long period of application (see all four simulations). This explains that the increase of the volumes of purchases abroad, which focus essentially on the increase of the volumes of the purchases of manufactured goods. From these results, we deduce that commercial liberalization favours the import of manufactured goods to the detriment of the other products. And this is verified during every period (short or long).

In our CGEM applied in Tunisia, we suppose that the foreign current deficit is exogenous. So any variation of the imports of Tunisia can be financed only by a variation of its exports because the capital returns in the ROW are very low, even nil. We notice that Tunisia's imports and exports evolve in the same way for four simulations. The increase of exports is noticed especially by manufactured goods (0.67% in sim5) and by tradable services (0.24%). Furthermore, the exports of farm produce increased slowly in four simulations.

Concerning the trade balance, we have a deficit for farm produce and for manufactured goods. On the contrary we have an excess for the trade balance of tradable services.

In four simulations, we notice that there is an improvement of the trade balance of three products.

General index of prices (*pindex*) decreases in four simulations (sim5: by 0.40%; sim6: by 0.80%; sim7: by 2.30% and sim8: by 4.90%). It engenders a larger and larger increase of the real exchange rate ($e_r = (e_n / pindex)$) from 1 to 1.0515 (in sim8) [1.004 (in sim5); 1.008 (in sim6); 1.0235 (in sim7)] knowing that international prices are constant. Furthermore, we add that the real depression of the Tunisian dinar (by 0.40 % in sim5, by 0.80 % in sim6, by 2.35% in sim7 and by 5.15 % in sim8) is incentive enough so that Tunisian production for export, and more exactly for the EU, reaches a level required by the greater necessities of financing of imports.

The increase of the Tunisian exports of manufactured goods is made to the detriment of a decline of the sales of the same products on the Tunisian local market. That confirms the focalisation of the economic policy of the government to be more and more directed to the world market (in terms of competition, price and quantity).

During these four simulations, we notice that the output of the industrial activity decreases proportionally with the duration of the application period. On the other hand the output of the other two activities remain constant and\or increase slowly. It shows that to boost local industrial production, it is better to apply for one type of product a progressive liberalization, as is the case for manufactured goods.

In simulation 5, as in the other three simulations, we notice that the exports of manufactured goods increase more and more, while the sales of the same products on the Tunisian market decrease. This relation is organized in the CET function of the domestic demand for the manufactured good. It means that the transformation of the domestic offer of the manufactured goods into export is due to a decline of the price received by the producers on the Tunisian market (respectively by 0.60% (sim5); 1.10% (sim6); 3.40% (sim7) and 6.90% (sim8)). While the process of transformation of the local sales into exports was lower in the case of the other two activities. In other words, this liberalization favours reorientation only of manufactured goods towards external markets and in particular towards the European market. The domestic demand for farm produce and tradable services increases slowly over the shorter period. We can also explain the decline of the production of manufactured goods by the domestic demand for the same product, which consists of household consumption, investment and intermediate demand. First of all, we notice that the household consumption of manufactured goods is not the cause of the fall in internal demand, because the demand of households for this product grows in volume by 0.10% in sim5 (by 0.21% in sim6; 0.54% in sim7 and 0.70% in sim8). We see a weak increase, even stagnation, in the demand of the household for the other two products, which partially explains the increase of their domestic demand. Then, we evoke the large decline of the total investment in terms of value which is due largely to the fall in demand of total investment of the manufactured goods (in terms of value) and as well as to the decline of the market price of the manufactured composite product. This block consists in a decline of customs duties for manufactured goods, which implies a reduction of the total receipts of the State, which results from import taxes (by 7.30% in sim5; by 14.68% in sim6; by 45.03% in sim7 and by 93.52% in sim8). This tariff loss is compensated automatically with an increase of total receipts resulting from the indirect tax received by the State.

In our CGEM, we supposed that foreign saving is fixed. Therefore balance between investment and saving is maintained by a decrease of investment, as well as of household and companies savings on the one hand, and on the other hand by an increase of public saving. The decline of the total investment is explained essentially by the decline in terms of volume of the demand of total investment of agricultural produce (by 0.29% in sim6), while we notice a stability in terms of volume of the demand of total investment of manufactured goods (in sim5 and sim6), even a weak increase in the last two simulations. On the other hand, in terms of value, we observe that the demands of total investment of the three products decrease in four simulations. Furthermore, total intermediate demands for three products also decrease in

terms of value. This decrease is greater for manufactured goods than by farm produce. It is only the total intermediate demands of the manufactured goods which decreases, in terms of volume essentially, which explains the decline of the production of manufactured goods.

Now, we will interpret sector-based production from the prices for value added in every activity.

In simulation 5, we observe that the price for the value added of the agricultural sector falls 0.20%, that of industrial sector falls 0.50% and that of tradable services which falls to 0.30%. This explains that the agricultural sector remains the sector least "unprotected" (because - 100 < TPE $_{S2}$ < TPE $_{S3}$ < TPE $_{S1}$ < 0)[(5)] with the sector of tradable services. But we notice that it is only this last sector which attracts the labour (verified for four simulations), while for the other two sectors (agricultural and non tradable services), we see a stable labour demand in simulation 5. But from the other simulations we notice that it improves only for the agricultural sector. All these results explain the decline of production in the industrial sector and an increase of agricultural sector and tradable service sector.

The production of non-tradable services is equal to the public consumption. In our CGEM, we supposed that the volume of services offered by the State is exogenous (x (s4) = D 3,420.9 million). In other words, the decline of the price of production of these services (by 0.40% (sim5)) is the only cause of the decline of the production in terms of value (g). This decrease is also noticed in the other three simulations (by 0.90% in sim6; by 2.60% in sim7 and by 5.40% in sim8). We notice that the longer the period of application of the commercial liberalisation is the greater the decline of public consumption is. This result can be explained by the evolution of the phenomenon of the privatisation in Tunisia which is considered as a political reform with the aim of decreasing the presence of the State in the market. In other terms, it favours the liberalization of the market. It is necessary to remember that in our model, the production of non-tradable services demands only the labour, in other words the labour demand in volume remains constant in four simulations. It is, logically, due to the stability offered by these services. We notice that the incomes of the factors of production decrease in four simulations. Furthermore, the market prices of the local production of our three products decrease and provoke a decline of the marginal productivity of the labour in terms of value (that is the wage). In the sim5, the decrease of the wage is weaker than the decrease of the rate of capital return of the industrial sector in four simulations. On the other hand, it is bigger than the decrease of the rate of return on the capital of the other two sectors (s1 and s3).

The decrease of the production costs of primary factors inevitably explains the almost-equal decrease of household income (by 0.25%) and its savings (by 0.22%) in sim5. This almost equality is almost maintained for the other simulations.

(5) Effective Protection Rate: TPE(s1) = -0.2%, TPE(s2) = -0.6%, TPE(s3) = -0.24% (calculated from sim5), see table n°2 (Annex 2).

In simulation 5, we see the reduction of the price market of three composite products (pq (s1), pq (s2) and pq (s3)). This decrease provoked an increase in the volume of the household consumption of manufactured goods and non tradable services. In this simulation, we observe the reorientation of the household consumption towards manufactured goods. It is due to the liberalization applied in this type of product. Now the consumption of agricultural produce remains constant in the first three simulations and it decreases in the last one.

Table 1.2 : the numeric value of Equivalent Variations (EV) and Compensating Variations (CV)

	simulation 5		*simulation 6*		*simulation 7*		*simulation 8*	
	CV 5	**EV 5**	**CV 6**	**EV 6**	**CV 7**	**EV 7**	**CV 8**	**EV 8**
Households	-1.033	1.035	-1.337	1.344	5.225	-5.308	41.491	-42.848
Interpretation	We have : CV < 0 et EV > 0 There is an increase of well-being		We have : CV < 0 et EV > 0 There is an increase of well-being		We have : CV > 0 et EV < 0 There is an decrease of well-being		We have : CV > 0 et EV < 0 There is an decrease of well-being	

* Calculated by the author

According to this table, we notice that there is an increase of well-being in the first two simulations and a decrease of well-being in the last two. These results confirm the advantage of the application of a commercial liberalization of manufactured goods during a reasonable period, like 12 years, as the case appears within the framework of the calendar of the tariff dismantling of the Euro-Tunisian Agreement. This can also be confirmed from the comparison of the simulation n°8 with the first two simulations. We notice that in this simulation, the evolution of aggregates is almost similar to the other two (sim6 and sim7), but it is greater when we abolish the customs duties on manufactured goods immediately. These influences (positive or negative) can reverberate negatively on the structure of the Tunisian economy, which is considered as a small developing economy.

4. Conclusions

By comparing the simulations of block 1 with those of block 2, we notice big differences. First a commercial liberalization applied during a reasonable, progressive period remains a good economic reform for developing countries. Then, such liberalization is considered as preferable when it is applied to one or to a certain category of product. Finally, we think that when it concerns a liberalization concerning certain products from a single partner or certain group of partners, it is more advantageous than that applied to every partners all together. But in our CGE model, The European Union formed all the account of the rest of the world, as it represents the main partner of Tunisia. However, a study of decomposition of the ROW account seems so interesting because we show the notion of diversion or the creation of the trade from one partner to the other one. It is in this context that we can show the orientation of the trade of an economy (for example, of the Tunisian economy) either towards a new grouping of countries or towards a traditional partner.

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Annex 1:

Table n°1: The CGEM of Tunisia: basic statistics and various simulations (in million DT and in %) : *tariff declines concern all the imported products ("s1","s2"et "s3")*

Names of variables	Names in GAMS	reference Year	simulation (1)		simulation (2)		simulation (3)		simulation (4)	
		value	volume	value	volume	value	volume	value	volume	value
adaptation factor	*adj*	1		0.0560		0.1110		0.3160		0.5700
saving of the housekeeping	*savh*	2,241		-0.0031		-0.0062		-0.0196		-0.0433
saving of the government	*savg*	348		0.0460		0.0891		0.2759		0.5690
saving of the companies	*savf*	1,652		-0.0163		-0.0321		-0.0962		-0.1901
adaptation of the indirect tax	*adj_ntax*	0								
total receipts resulting from the indirect tax	*itxrev*	1,072		0.1007		0.2024		0.6250		1.3069
total receipts of the government resulting from direct taxes paid by housekeeping and companies	*dtxrev*	1,586		-0.0038		-0.0069		-0.0214		-0.0467
Total receipts resulting from taxes to the imports	*tmrev*	1,328		-0.0776		-0.1559		-0.4789		-1.0000
disposable income of the housekeeping	*dyh*	13,134		-0.0030		-0.0062		-0.0198		-0.0432
income of companies	*yf*	3,193		-0.0044		-0,0088		-0,0272		-0,0573
income of the housekeeping	*yh*	14,381		-0.0031		-0.0063		-0.0199		-0.0433
income of capital factor	*yk*	9,672		-0.0043		-0.0088		-0.0271		-0.0572
income of labour factor	*yl*	6,989		-0.0043		-0.0084		-0.0262		-0.0548
imports of product "s1"	M_{s1}	452.138	0.0221	0.0049	0.0414	0.0056	0.1381	0.0215	0.3094	0.0410
imports of product "s2"	M_{s2}	8,970.7	0.0056	-0.0018	0.0113	-0.0035	0.0349	-0.0090	0.0725	-0.0169
imports of product "s3"	M_{s3}	366.344	0.0000	0.0020	-0.0028	0.0002	-0.0083	0.0005	-0.0193	0.0000
exports of product "s1"	E_{s1}	97	0.0103	0.0103	0.0206	0.0206	0.0515	0.0515	0.1031	0.1031
exports of product "s2"	E_{s2}	5,386	0.0078	0.0078	0.0158	0.0158	0.0490	0.0490	0.1029	0.1029
exports of product "s3"	E_{s3}	2,545	0.0024	0.0024	0.0043	0.0043	0.0134	0.0134	0.0279	0.0279
demand for composite product "s1"	q_{s1}	3,675.64	0.0019	-0.0069	0.0042	-0.0125	0.0134	-0.0382	0.0295	-0.0782
demand for composite product "s2"	q_{s2}	22,085.4	-0.0002	-0.0037	-0.0004	-0.0066	-0.0015	-0.0222	-0.0042	-0.0436
demand for composite product "s3"	q_{s3}	7,076.92	-0.0001	-0.0011	-0.0003	-0.0052	-0.0011	-0.0179	-0.0034	-0.0399
total investment	*tinv*	4,771		-0.0038		-0.0075		-0.0228		-0.0449
total demand of investment of product "s1"	inv_{s1}	347.82	0.0029	-0.0059	0.0088	-0.0079	0.0294	-0.0229	0.0647	-0.0467
total demand of investment of product "s2"	inv_{s2}	4356.82	-0.0005	-0.0041	-0.0008	-0.0071	-0.0023	-0.0229	-0.0051	-0.0445
total demand of investment of product "s3"	inv_{s3}	65.78	0.0000	-0.0010	0.0000	-0.0049	0.0000	-0.0168	0.0000	-0.0366
intermediate demand for the product "s1"	$intd_{s1}$	1,927.34	0.0000	-0.0093	-0.0005	-0.0177	-0.0021	-0.0528	-0.0048	-0.1089
intermediate demand for the product "s2"	$intd_{s2}$	12,330.9	-0.0004	-0.0040	-0.0008	-0.0072	-0.0023	-0.0230	-0.0044	-0.0438
intermediate demand for the product "s3"	$intd_{s3}$	2,918.61	0.0003	-0.0010	0.0003	-0.0046	0.0003	-0.0165	0.0007	-0.0359
public consumption	*g*	3,421		-0.0041		-0.0082		-0.0248		-0.0514
internal demand for the product "s1"	d_{s1}	3,155.71	-0.0003	0.0130	-0.0009	0.0052	-0.0031	-0.0255	-0.0065	-0.0756
internal demand for the product "s2"	d_{s2}	13,121	-0.0041	-0.0051	-0.0084	-0.0103	-0.0259	-0.0306	-0.0546	-0.0627
internal demand for the product "s3"	d_{s3}	6,710.57	0.0000	-0.0030	-0.0002	-0.0061	-0.0008	-0.0195	-0.0026	-0.0420

Annex 1:

Table n°1: The CGEM of Tunisia: basic statistics and various simulations (in million DT and in %) : *tariff declines concern all the imported products ("s1","s2"et "s3")***(the following)**

Names of variables	Names in GAMS	Reference	Year	simulation (1)		simulation (2)		simulation (3)		simulation (4)	
		volume	value	volume	value	volume	value	volume	value	volume	value
consumption of housekeeping of product "s1"	ch_{s1}	1,368	1,399.46	0.0051	-0.0037	0.0102	-0.0066	0.0322	-0.0203	0.0687	-0.0431
consumption of housekeeping of product "s2"	ch_{s2}	4,855	5,398.76	0.0004	-0.0032	0.0006	-0.0057	0.0008	-0.0199	-0.0033	-0.0427
consumption of housekeeping of product "s3"	ch_{s3}	4,044	4,092.53	-0.0002	-0.0012	-0.0007	-0.0057	-0.0022	-0.0190	-0.0064	-0.0428
labour demand of activity "s1"	l_{s1}	268	268	-0.0037	-0.0077	-0.0075	-0.0154	-0.0149	-0.0405	-0.0336	-0.0867
labour demand of activity "s2"	l_{s2}	2,323	2,323	-0.0013	-0.0053	-0.0026	-0.0106	-0.0069	-0.0327	-0.0133	-0.0676
labour demand of activity "s3"	l_{s3}	1,764	1,764	0.0023	-0.0017	0.0040	-0.0041	0.0113	-0.0150	0.0221	-0.0341
labour demand of activity "s4"	l_{s4}	2,634	2,634	0.0000	-0.0040	0.0000	-0.0080	0.0000	-0.0260	0.0000	-0.9071
total intermediate consumption of the activity "s1"	$intp_{s1}$	702	754.234	0.0000	-0.0048	-0.0014	-0.0106	-0.0014	-0.0303	-0.0043	-0.0606
total intermediate consumption of the activity "s2"	$intp_{s2}$	11,752	1,2815.2	-0.0006	-0.0046	-0.0011	-0.0085	-0.0031	-0.0271	-0.0060	-0.0530
total intermediate consumption of the activity "s3"	$intp_{s3}$	2,676	2,822.14	0.0007	-0.0022	0.0011	-0.0050	0.0034	-0.0169	0.0064	-0.0350
total intermediate consumption of the activity "s4"	$intp_{s4}$	727	785.333	0.0014	-0.0030	0.0014	-0.0062	0.0014	-0.0204	0.0014	-0.0403
value added of the activity "s1"	va_{s1}	2,574	2,574	-0.0004	-0.0074	-0.0008	-0.0148	-0.0016	-0.0435	-0.0035	-0.0912
value added of the activity "s2"	va_{s2}	5,100	5,100	-0.0004	-0.0054	-0.0010	-0.0100	-0.0031	-0.0310	-0.0059	-0.0635
value added of the activity "s3"	va_{s3}	6,353	6,353	0.0005	-0.0025	0.0009	-0.0051	0.0030	-0.0171	0.0060	-0.0363
value added of the activity "s4"	va_{s4}	2,634	2,634	0.0000	-0.0040	0.0000	-0.0080	0.0000	-0.0260	0.0000	-0.0550
output of the activity "s1"	x_{s1}	3,328	3,328	-0.0003	-0.0063	-0.0006	-0.0136	-0.0015	-0.0404	-0.0033	-0.0840
output of the activity "s2"	x_{s2}	17,918	17,918	-0.0005	-0.0045	-0.0011	-0.0091	-0.0031	-0.0280	-0.0060	-0.0567
output of the activity "s3"	x_{s3}	9,176	9,176	0.0005	-0.0025	0.0011	-0.0049	0.0032	-0.0169	0.0061	-0.0362
Rate of average wage	w		1		-0.0040		-0.0080		-0.0260		-0.0550

Annex 1:

Table n°1: The CGEM of Tunisia: basic statistics and various simulations (in million DT and in %) : *tariff declines concern all the imported products ("s1","s2"et "s3")***(the following)**

Names of variables	Names in GAMS	Reference	Year	simulation (1)		simulation (2)		simulation (3)		simulation (4)	
		volume	value	volume	value	volume	value	volume	value	volume	value
input output matrix :											
between the product "s1" and the activity "s1"	*mat s1.s1*	210	214.83	0.0000	-0.0088	0.0000	-0.0166	0.0000	-0.0508	0.0000	-0.1046
between the product "s1" and the activity "s2"	*mat s1.s2*	1,525	1,560.08	-0.0007	-0.0094	-0.0013	-0.0179	-0.0033	-0.0539	-0.0066	-0.1105
between the product "s1" and the activity "s3"	*mat s1.s3*	130	132.99	0.0000	-0.0088	0.0000	-0.0166	0.0077	-0.0435	0.0077	-0.0977
between the product "s1" and the activity "s4"	*mat s1.s4*	19	19.437	0.0000	-0.0088	0.0000	-0.0166	0.0000	-0.0508	0.0000	-0.1046
between the product "s2" and the activity "s1"	*mat s2.s1*	415	461.48	0.0000	-0.0036	-0.0024	-0.0087	-0.0024	-0.0230	-0.0048	-0.0442
between the product "s2" and the activity "s2"	*mat s2.s2*	9,054	10,068	-0.0006	-0.0041	-0.0011	-0.0074	-0.0031	-0.0237	-0.0060	-0.0453
between the product "s2" and the activity "s3"	*mat s2.s3*	1,126	1,252.11	0.0000	-0.0036	0.0009	-0.0054	0.0027	-0.0181	0.0062	-0.0336
between the product "s2" and the activity "s4"	*mat s2.s4*	494	549.328	0.0000	-0.0036	0.0000	-0.0063	0.0000	-0.0207	0.0000	-0.0396
between the product "s3" and the activity "s1"	*mat s3.s1*	77	77.924	0.0000	-0.0010	0.0000	-0.0049	0.0000	-0.0168	0.0000	-0.0366
" between the product "s3" and the activity "s2"	*mat s3.s2*	1,173	1,187.08	-0.0009	-0.0018	-0.0009	-0.0058	-0.0034	-0.0202	-0.0060	-0.0423
between the product "s3" and the activity "s3"	*mat s3.s3*	1,420	1,437.04	0.0007	-0.0003	0.0014	-0.0035	0.0035	-0.0133	0.0063	-0.0305
between the product "s3" and the activity "s4"	*mat s3.s4*	214	216.568	0.0000	-0.0010	0.0000	-0.0049	0.0000	-0.0168	0.0000	-0.0366
between the product "s4" and the activity "s1"	*mat s4.s1*	0	0	0							
between the product "s4" and the activity "s2"	*mat s4.s2*	0	0	0							
between the product "s4" and the activity "s3"	*mat s4.s3*	0	0	0							
between the product "s4" and the activity "s4"	*mat s4.s4*	0	0	0							
rate of return on the capital in the activity "s1"	*r s1*		1		-0.0070		-0.0140		-0.0440		-0.0920
rate of return on the capital in the activity "s2"	*r s2*		1		-0.0050		-0.0100		-0.0300		-0.0610
rate of return on the capital in the activity "s3"	*r s3*		1		-0.0030		-0.0050		-0.0170		-0.0370
price for the total investment	*pinv*		1.54		-0.0039		-0.0078		-0.0227		-0.0448
weighted price for value added	*pindex*		1		-0.0040		-0.0090		-0.0270		-0.0560
price of production of the product "s1"	*px s1*		1		-0.0060		-0.0130		-0.0390		-0.0810
price of production of the product "s2"	*px s2*		1		-0.0040		-0.0080		-0.0250		-0.0510
price of production of the product "s3"	*px s3*		1		-0.0030		-0.0060		-0.0200		-0.0420
price of production of the product "s4"	*px s4*		1		-0.0040		-0.0080		-0.0250		-0.0520
price of value added in activity "s1"	*pva s1*		1		-0.0070		-0.0140		-0.0420		-0.0880
price of value added in activity "s2"	*pva s2*		1		-0.0050		-0.0090		-0.0280		-0.0580
price of value added in activity "s3"	*pva s3*		1		-0.0030		-0.0060		-0.0200		-0.0420
price of value added in activity "s4"	*pva s4*		1		-0.0040		-0.0080		-0.0260		-0.0550
market price of composite product "s1"	*pq s1*		1.023		-0.0088		-0.0166		-0.0508		-0.1046
market price of composite product "s2"	*pq s2*		1.112		-0.0036		-0.0063		-0.0207		-0.0396
market price of composite product "s3"	*pq s3*		1.012		-0.0020		-0.0049		-0.0168		-0.0366

Annex 1:

Table n°1: The CGEM of Tunisia: basic statistics and various simulations (in million DT and in %) : *tariff declines concern all the imported products ("s1","s2"et "s3")***(the following)**

Names of variables	names in GAMS	Reference year value	simulation (1) Value in (%)	simulation (2) Value in (%)	simulation (3) Value in (%)	simulation (4) Value in (%)
Internal price (of the market) for the imported product "s1"	pm_{s1}	1.249	-0.0168	-0.0344	-0.1025	-0.2050
Internal price (of the market) for the imported product "s2"	pm_{s2}	1.224	-0.0074	-0.0147	-0.0425	-0.0833
Internal price (of the market) for the imported product "s3"	pm_{s3}	1.012	0.0020	0.0030	0.0089	0.0198
price to producer of the product "s1" for the sale on inner market	pl_{s1}	1	-0.0070	-0.0130	-0.0400	-0.0840
price to producer of the product “s2" for the sale on inner market	pl_{s2}	1	-0.0060	-0.0120	-0.0360	-0.0740
price to producer of the product "s3" for the sale on inner market	pl_{s3}	1	-0.0040	-0.0090	-0.0280	-0.0580
price paid to the export of the product "s1"	pe_{s1}	1	0.0000	0.0000	0.0000	0.0000
price paid to the export of the product "s2"	pe_{s2}	1	0.0000	0.0000	0.0000	0.0000
price paid to the export of the product "s3"	pe_{s3}	1	0.0000	0.0000	0.0000	0.0000
market price of local product "s1" sold on inner market	pd_{s1}	0.977	0.0133	0.0061	-0.0225	-0.0696
market price of local product "s2" sold on inner market	pd_{s2}	1.047	-0.0010	-0.0019	-0.0048	-0.0086
market price of local product "s3" sold on inner market	pd_{s3}	1.012	-0.0030	-0.0059	-0.0188	-0.0395

Legend :

Activities and products :

"s1" : agriculture and fishing

"s2" : industries

"s3" : tradable services

"s4" : non tradable services

Annex 2 :

Table n°2 : The CGEM of Tunisia: basic statistics and various simulations (in million DT and in %) : *tariff declines concern only the industrials products ("s2")*

Names of variables	names in GAMS	Reference year	simulation (5)		simulation (6)		simulation (7)		simulation (8)	
		value	volume	value	volume	value	volume	value	volume	value
adaptation factor	adj	1		0.0730		0.0580		0.4200		0.7970
saving of the housekeeping	savh	2,241		-0.0022		-0.0049		-0.0161		-0.0348
saving of the government	savg	348		0.0460		0.0948		0.2845		0.5833
saving of the companies	savf	1,652		-0.0163		-0.0327		-0.0975		-0.1937
adaptation of the indirect tax	adj_ntax	0								
total receipts resulting from the indirect tax	itxrev	1,072		0.0942		0.1894		0.5821		1.2127
total receipts of the government resulting from direct taxes paid by housekeeping and companies	dtxrev	1,586		-0.0032		-0.0057		-0.0170		-0.0366
Total receipts resulting from taxes to the imports	tmrev	1,328		-0.0730		-0.1468		-0.4503		-0.9352
disposable income of the housekeeping	dyh	13,134		-0.0024		-0.0050		-0.0160		-0.0348
income of companies	yf	3,193		-0.0034		-0.0066		-0.0204		-0.0426
income of the housekeeping	yh	14,381		-0.0025		-0.0050		-0.0161		-0.0348
income of capital factor	yk	9,672		-0.0032		-0.0065		-0.0202		-0.0424
income of labour factor	yl	6,989		-0.0046		-0.0092		-0.0280		-0.0582
imports of product "s1"	M_{s1}	452.138	-0.0028	-0.0028	-0.0083	-0.0091	-0.0304	-0.0319	-0.0608	-0.0645
imports of product "s2"	M_{s2}	8,970.7	0.0061	-0.0013	0.0123	-0.0026	0.0378	-0.0088	0.0791	-0.0161
imports of product "s3"	M_{s3}	366.344	0.0000	0.0020	-0.0028	0.0002	-0.0055	0.0033	-0.0166	0.0009
exports of product "s1"	E_{s1}	97	0.0103	0.0103	0.0103	0.0103	0.0206	0.0206	0.0515	0.0515
exports of product "s2"	E_{s2}	5,386	0.0067	0.0067	0.0136	0.0136	0.0420	0.0420	0.0876	0.0876
exports of product "s3"	E_{s3}	2,545	0.0024	0.0024	0.0047	0.0047	0.0141	0.0141	0.0295	0.0295
demand for composite product "s1"	q_{s1}	3,675.64	-0.0006	-0.0035	-0.0011	-0.0070	-0.0031	-0.0187	-0.0067	-0.0397
demand for composite product "s2"	q_{s2}	22,085.4	-0.0001	-0.0037	-0.0003	-0.0074	-0.0011	-0.0218	-0.0033	-0.0445
demand for composite product "s3"	q_{s3}	7,076.92	0.0001	-0.0018	0.0001	-0.0048	0.0003	-0.0165	-0.0001	-0.0347
total investment	tinv	4,771		-0.0034		-0.0069		-0.0208		-0.0409
total demand of investment of product "s1"	inv_{s1}	347.82	0.0000	-0.0029	-0.0029	-0.0088	-0.0059	-0.0214	-0.0088	-0.0418
total demand of investment of product "s2"	inv_{s2}	4,356.82	0.0000	-0.0036	0.0000	-0.0072	0.0003	-0.0204	0.0008	-0.0406
total demand of investment of product "s3"	inv_{s3}	65.78	0.0000	-0.0020	0.0000	-0.0049	0.0000	-0.0168	0.0000	-0.0346
intermediate demand for the product "s1"	$intd_{s1}$	1,927.34	-0.0005	-0.0040	-0.0011	-0.0075	-0.0042	-0.0198	-0.0090	-0.0420
intermediate demand for the product "s2"	$intd_{s2}$	12,330.9	-0.0007	-0.0043	-0.0015	-0.0086	-0.0045	-0.0252	-0.0093	-0.0503
intermediate demand for the product "s3"	$intd_{s3}$	2,918.61	0.0000	-0.0020	0.0000	-0.0049	0.0000	-0.0168	-0.0003	-0.0353
public consumption	g	3,421		-0.0044		-0.0085		-0.0263		-0.0541
internal demand for the product "s1"	d_{s1}	3,155.71	0.0003	0.0177	0.0003	0.0146	0.0009	0.0040	0.0015	-0.0149
internal demand for the product "s2"	d_{s2}	13,121	-0.0044	-0.0053	-0.0088	-0.0107	-0.0272	-0.0319	-0.0572	-0.0644
internal demand for the product "s3"	d_{s3}	6,710.57	0.0002	-0.0028	0.0003	-0.0056	0.0006	-0.0172	0.0008	-0.0368

Annex 2 :

Table n°2 : The CGEM of Tunisia: basic statistics and various simulations (in million DT and in %) : *tariff declines concern only the industrials products ("s2")*

(The following)

Names of variables	Names in GAMS	Reference year		simulation (5)		simulation (6)		simulation (7)		simulation (8)	
		volume	value	volume	value	volume	value	volume	value	volume	value
consumption of housekeeping of product "s1"	ch_{s1}	1,368	1,399.46	0.0000	-0.0029	0.0000	-0.0059	0.0000	-0.0156	-0.0022	-0.0354
consumption of housekeeping of product "s2"	ch_{s2}	4,855	5,398.76	0.0010	-0.0026	0.0021	-0.0051	0.0054	-0.0154	0.0070	-0.0347
consumption of housekeeping of product "s3"	ch_{s3}	4,044	4,092.53	0.0000	-0.0020	0.0002	-0.0047	0.0007	-0.0161	0.0002	-0.0343
labour demand of activity "s1"	l_{s1}	268	268	0.0000	-0.0050	0.0037	-0.0053	0.0112	-0.0171	0.0261	-0.0334
labour demand of activity "s2"	l_{s2}	2,323	2,323	-0.0022	-0.0071	-0.0043	-0.0133	-0.0138	-0.0414	-0.0276	-0.0840
labour demand of activity "s3"	l_{s3}	1,764	1,764	0.0028	-0.0022	0.0057	-0.0034	0.0159	-0.0126	0.0323	-0.0276
labour demand of activity "s4"	l_{s4}	2,634	2,634	0.0000	-0.0050	0.0000	-0.0090	0.0000	-0.0280	0.0000	-0.0580
total intermediate consumption of the activity "s1"	$intp_{s1}$	702	754.234	0.0000	-0.0032	0.0000	-0.0066	0.0014	-0.0175	0.0028	-0.0356
total intermediate consumption of the activity "s2"	$intp_{s2}$	11,752	12,815.2	-0.0010	-0.0044	-0.0020	-0.0089	-0.0062	-0.0258	-0.0126	-0.0519
total intermediate consumption of the activity "s3"	$intp_{s3}$	2,676	2,822.14	0.0011	-0.0020	0.0019	-0.0038	0.0045	-0.0137	0.0090	-0.0286
total intermediate consumption of the activity "s4"	$intp_{s4}$	727	785.333	0.0014	-0.0031	0.0014	-0.0065	0.0014	-0.0195	0.0014	-0.0393
value added of the activity "s1"	va_{s1}	2,574	2,574	0.0000	-0.0020	0.0004	-0.0036	0.0012	-0.0129	0.0027	-0.0274
value added of the activity "s2"	va_{s2}	5,100	5,100	-0.0010	-0.0060	-0.0020	-0.0119	-0.0061	-0.0379	-0.0125	-0.0767
value added of the activity "s3"	va_{s3}	6,353	6,353	0.0006	-0.0024	0.0014	-0.0046	0.0042	-0.0148	0.0088	-0.0315
value added of the activity "s4"	va_{s4}	2,634	2,634	0.0000	-0.0050	0.0000	-0.0090	0.0000	-0.0280	0.0000	-0.0580
output of the activity "s1"	x_{s1}	3,328	3,328	0.0000	-0.0020	0.0003	-0.0047	0.0012	-0.0138	0.0027	-0.0294
output of the activity "s2"	x_{s2}	17,918	17,918	-0.0010	-0.0050	-0.0020	-0.0100	-0.0061	-0.0290	-0.0126	-0.0590
output of the activity "s3"	x_{s3}	9,176	9,176	0.0008	-0.0022	0.0015	-0.0045	0.0044	-0.0147	0.0088	-0.0305
Rate of average wage	w		1		-0.0050		-0.0090		-0.0280		-0.0580

Annex 2 :

Table n°2 : The CGEM of Tunisia: basic statistics and various simulations (in million DT and in %) : *tariff declines concern only the industrials products ("s2")*

(The following)

Names of variables	names in GAMS	Reference volume	Year value	simulation (5) volume	simulation (5) value	simulation (6) volume	simulation (6) value	simulation (7) volume	simulation (7) value	simulation (8) volume	simulation (8) value
input output matrix :											
between the product "s1" and the activity "s1"	$mat_{s1.s1}$	210	214.83	0	-0.0029	0.0000	-0.0059	0.0048	-0.0110	0.0048	-0.0286
between the product "s1" and the activity "s2"	$mat_{s1.s2}$	1,525	1,560.08	-0.0013	-0.0042	-0.0026	-0.0085	-0.0066	-0.0221	-0.0131	-0.0459
between the product "s1" and the activity "s3"	$mat_{s1.s3}$	130	132.99	0.0000	-0.0029	0.0077	0.0018	0.0077	-0.0081	0.0154	-0.0184
between the product "s1" and the activity "s4"	$mat_{s1.s4}$	19	19.437	0.0000	-0.0029	0.0000	-0.0059	0.0000	-0.0156	0.0000	-0.0332
between the product "s2" and the activity "s1"	$mat_{s2.s1}$	415	461.48	0.0000	-0.0036	0.0000	-0.0072	0.0000	-0.0207	0.0024	-0.0391
between the product "s2" and the activity "s2"	$mat_{s2.s2}$	9,054	10,068	-0.0010	-0.0046	-0.0020	-0.0092	-0.0062	-0.0267	-0.0126	-0.0534
between the product "s2" and the activity "s3"	$mat_{s2.s3}$	1,126	1,252.11	0.0009	-0.0027	0.0018	-0.0054	0.0044	-0.0163	0.0089	-0.0329
between the product "s2" and the activity "s4"	$mat_{s2.s4}$	494	549.328	0.0000	-0.0036	0.0000	-0.0072	0.0000	-0.0207	0.0000	-0.0414
between the product "s3" and the activity "s1"	$mat_{s3.s1}$	77	77.924	0.0000	-0.0020	0.0000	-0.0049	0.0000	-0.0168	0.0000	-0.0346
between the product "s3" and the activity "s2"	$mat_{s3.s2}$	1,173	1,187.08	-0.0009	-0.0028	-0.0026	-0.0075	-0.0060	-0.0227	-0.0128	-0.0469
between the product "s3" and the activity "s3"	$mat_{s3.s3}$	1,420	1,437.04	0.0007	-0.0013	0.0021	-0.0028	0.0049	-0.0120	0.0092	-0.0257
between the product "s3" and the activity "s4"	$mat_{s3.s4}$	214	216.568	0.0000	-0.0020	0.0000	-0.0049	0.0000	-0.0168	0.0000	-0.0346
between the product "s4" and the activity "s1"	$mat_{s4.s1}$	0	0								
between the product "s4" and the activity "s2"	$mat_{s4.s2}$	0	0								
between the product "s4" and the activity "s3"	$mat_{s4.s3}$	0	0								
between the product "s4" and the activity "s4"	$mat_{s4.s4}$	0	0								
rate of return on the capital in the activity "s1"	r_{s1}		1		-0.0020		-0.0040		-0.0120		-0.0260
rate of return on the capital in the activity "s2"	r_{s2}		1		-0.0060		-0.0110		-0.0350		-0.0710
rate of return on the capital in the activity "s3"	r_{s3}		1		-0.0020		-0.0050		-0.0150		-0.0330
price for the total investment	*pinv*		1.54		-0.0032		-0.0071		-0.0208		-0.0409
weighted price for value added	*pindex*		1		-0.0040		-0.0080		-0.0230		-0.0490
price of production of the product "s1"	px_{s1}		1		-0.0020		-0.0050		-0.0150		-0.0320
price of production of the product "s2"	px_{s2}		1		-0.0040		-0.0080		-0.0230		-0.0470
price of production of the product "s3"	px_{s3}		1		-0.0030		-0.0060		-0.0190		-0.0390
price of production of the product "s4"	px_{s4}		1		-0.0040		-0.0090		-0.0260		-0.0540
price of value added in activity "s1"	pva_{s1}		1		-0.0020		-0.0040		-0.0140		-0.0300
price of value added in activity "s2"	pva_{s2}		1		-0.0050		-0.0100		-0.0320		-0.0650
price of value added in activity "s3"	pva_{s3}		1		-0.0030		-0.0060		-0.0190		-0.0400
price of value added in activity "s4"	pva_{s4}		1		-0.0050		-0.0090		-0.0280		-0.0580
market price of composite product "s1"	pq_{s1}		1.023		-0.0029		-0.0059		-0.0156		-0.0332
market price of composite product "s2"	pq_{s2}		1.112		-0.0036		-0.0072		-0.0207		-0.0414
market price of composite product "s3"	pq_{s3}		1.012		-0.0020		-0.0049		-0.0168		-0.0346

Annex 2 :

Table n°2 : The CGEM of Tunisia: basic statistics and various simulations (in million DT and in %) : *tariff declines concern only the industrials products ("s2")*

(The following)

Names of variables	Names in GAMS	Reference year value	simulation (5) Value in (%)	simulation (6) Value in (%)	simulation (7) Value in (%)	simulation (8) Value in (%)
Internal price (of the market) for the imported product "s1"	pm_{s1}	1.249	0.0000	-0.0008	-0.0016	-0.0040
Internal price (of the market) for the imported product "s2"	pm_{s2}	1.224	-0.0074	-0.0147	-0.0449	-0.0882
Internal price (of the market) for the imported product "s3"	pm_{s3}	1.012	0.0020	0.0030	0.0089	0.0178
price to producer of the product "s1" for the sale on inner market	pl_{s1}	1	-0.0230	-0.0050	-0.0160	-0.0330
price to producer of the product “s2" for the sale on inner market	pl_{s2}	1	-0.0060	-0.0110	-0.0340	-0.0690
price to producer of the product "s3" for the sale on inner market	pl_{s3}	1	-0.0040	-0.0080	-0.0260	-0.0550
price paid to the export of the product "s1"	pe_{s1}	1	0.0000	0.0000	0.0000	0.0000
price paid to the export of the product "s2"	pe_{s2}	1	0.0000	0.0000	0.0000	0.0000
price paid to the export of the product "s3"	pe_{s3}	1	0.0000	0.0000	0.0000	0.0000
market price of local product "s1" sold on inner market	pd_{s1}	0.977	0.0174	0.0143	0.0031	-0.0164
market price of local product "s2" sold on inner market	pd_{s2}	1.047	-0.0010	-0.0019	-0.0048	-0.0076
market price of local product "s3" sold on inner market	pd_{s3}	1.012	-0.0030	-0.0059	-0.0178	-0.0375

Legend :

Activities and products :

"s1" : agriculture and fishing

"s2" : industries

"s3" : tradable services

"s4" : non tradable services

Annex 3 :
The measures of well-being : Equivalent Variation (EV)
and Compensating Variation (CV)

Indirect Utility: in three products

We assume the Cobb-Douglas function of direct utility :

$$U = \prod_{td} ch_{td}^{kt\_ch_{td}} = ch_{s1}^{kt\_ch_{s1}} * ch_{s2}^{kt\_ch_{s2}} * ch_{s3}^{kt\_ch_{s3}}$$

With:

td : three products (s1, s2 et s3)

kt_ch_{td} : part of the consumption of the product *td* with regard to the disposable income of household

ch_{td} : consumption of the household product of td (volume)

To determine the functions of demand for three products (*ch s1*, *ch s2* and *ch s3*), we proceed thus : The consumers maximize their total utility (*U*) under constraint of their disposable income (*dyh*) and considering the prices for three products:

$$Max \ U = \prod_{td} ch_{td}^{kt\_ch_{td}}$$

$$\text{s.c.} \quad dyh = \sum_{td} pq_{td} * ch_{td}$$

With:

pq_{td} : market price of the product *td*.

kt_ch_{td} : the elasticity of substitution of the total utility with regard to consummate quantities.

$$\sum_{td} kt\_ch_{td} = 1$$

These consumers maximize their total utility if they equalize the marginal substitution rate of two given products (TMS) for their relative prices (with i, j = {1,2,3}):

$$TMS_{(i,j)} = \frac{d\,ch_j}{d\,ch_i} = \frac{\partial U / \partial ch_i}{\partial U / \partial ch_j} = \frac{pq_i}{pq_j}$$

From the function of direct utility, we determine the following marginal utilities:

$$\frac{\partial U}{\partial ch_i} = kt\_ch_i * \left(\frac{U}{ch_i}\right)$$

The Marginal Substitution Rates of products (TMS) is expressed as follows :

$$TMS_{(i,j)} = \frac{kt\_ch_i}{kt\_ch_j}\,\frac{ch_j}{ch_i} = \frac{pq_i}{pq_j} \iff \frac{ch_j}{ch_i} = \frac{pq_i}{pq_j} * \left(\frac{kt\_ch_j}{kt\_ch_i}\right)$$

The functions of demand for three products are definite in the same way. For example the function of the demand for the product " s1 " defined as follows:

$$dyh = pq_{s1}\,ch_{s1} + pq_{s2}\,ch_{s2} + pq_{s3}\,ch_{s3} \iff \frac{dyh}{ch_{s1}} = pq_{s1} + pq_{s2} * \frac{ch_{s2}}{ch_{s1}} + pq_{s3} * \frac{ch_{s3}}{ch_{s1}}$$

We modify the previous expression by introducing the expressions of quotients $\frac{ch_{s2}}{ch_{s1}}$ and $\frac{ch_{s3}}{ch_{s1}}$. We obtain:

$$\frac{dyh}{ch_{s1}} = pq_{s1} + pq_{s2} * \left(\frac{pq_{s1}}{pq_{s2}}\,\frac{kt\_ch_{s2}}{kt\_ch_{s1}}\right) + pq_{s3} * \left(\frac{pq_{s1}}{pq_{s3}}\,\frac{kt\_ch_{s3}}{kt\_ch_{s1}}\right)$$

$$\iff \frac{ch_{s1}}{dyh} = \frac{kt\_ch_{s1}}{pq_{s1}\left(kt\_ch_{s1} + kt\_ch_{s2} + kt\_ch_{s3}\right)}$$

We suppose in our model that it concerns a return on a constant scale, that is:

$$\sum_{td} kt\_ch_{td} = 1$$

So, we obtain the function of the demand for the product " s1 ":

$$ch_{s1} = \frac{kt\_ch_{s1} * dyh}{pq_{s1}}$$

Also, for the other two products, we obtain the following functions of demand:

$$ch_{s2} = \frac{kt\_ch_{s2} * dyh}{pq_{s2}} \quad \text{et} \quad ch_{s3} = \frac{kt\_ch_{s3} * dyh}{pq_{s3}}$$

The function of indirect utility (U^{ind}) is determined from the introduction of the three previous expressions of functions of demand for three products in the function of direct utility:

$$U^{ind} = \prod_{td} \left(\frac{kt\_ch_{td}}{pq_{td}}\right)^{kt\_ch_{td}} * dyh$$

The composite price for a unity of a basket of consumption is expressed as follows :

$$pcu = \prod_{td} \left(\frac{pq_{td}}{kt\_ch_{td}} \right)^{kt\_ch_{td}}$$

Whence the function of indirect utility which can be rewritten as follows:

$$U^{ind} = \frac{dyh}{pcu}$$

It means that U^{ind} is considered as the real income of the consumers. According to B. Decaluwé, A. Martens and L. Savard (2001), we can put the disposable income in the consumption (dyh) according to the indirect utility:

$$dyh = pcu * U^{ind}$$

In other words, *dyh* is considered as the nominal income which applicants have to have the to reach a level of indirect utility U^{ind}, that is to say the price for a unity of the basket of consumption is estimated in *pcu*.

The calculation of the Equivalent Variation (EV) and Compensating variation (CV):

The economists of the CGEM use measures to show the effects of shocks and economic reforms in a given economy. When a user wants to estimate the impact of certain economic policies on the well-being through various scenarios, it is better to use the most common monetary measures to know Equivalent Variations (EV) and Compensating Variations (CV). The rest of this paragraph emphasizes the way of calculating these measures. Certain economists prefer to use them in the case of a more detailed desegregation of the household account (example: Véronique Robichaud (MIMAP Group (Micro and Macroeconomic Policies)) and others use them in the aggregated case of the household account, through a set of scenarios. In our model, we preserved an aggregated shape of the household account and we are therefore going to estimate well-being by comparing various simulations (Sim j: j=1.. p) with the reference situation (Sim 0).

In the reference situation, the function of corresponding indirect utility (outcome of the function of Cobb-Douglas direct utility) is expressed as follows :

$$U^{ind\ 0} = \prod_{td} \left(\frac{kt\_ch_{td}}{pq_{td}^{0}} \right)^{kt\_ch_{td}} * dyh^{0}$$

In the simulation sim j (j=1.. p), the function of corresponding indirect utility is expressed as follows:

$$U^{ind\ j} = \prod_{td} \left(\frac{kt\_ch_{td}}{pq_{td}^{\ j}} \right)^{kt\_ch_{td}} * dyh^{\ j}$$

The evaluation of the effect of the well-being consists simply in the comparison between $U^{ind\ 0}$ et $U^{ind\ j}$. This can be worked out by two manners:

- the situation of the simulation j is taken as basic situation of the comparison:

$$U^{ind\ 0} - U^{ind\ j} = \{ \prod_{td} \left(\frac{kt\_ch_{td}}{pq_{td}^{\ 0}} \right)^{kt\_ch_{td}} * dyh^{\ 0} \} - \{ \prod_{td} \left(\frac{kt\_ch_{td}}{pq_{td}^{\ j}} \right)^{kt\_ch_{td}} * dyh^{\ j} \}$$

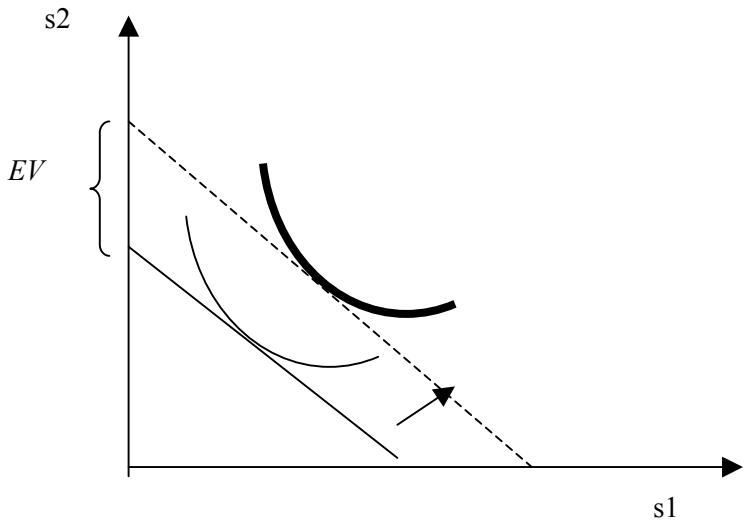
- the reference situation is taken as basic situation of the comparison:

$$U^{ind\ j} - U^{ind\ 0} = \{ \prod_{td} \left(\frac{kt\_ch_{td}}{pq_{td}^{\ j}} \right)^{kt\_ch_{td}} * dyh^{\ j} \} - \{ \prod_{td} \left(\frac{kt\_ch_{td}}{pq_{td}^{\ 0}} \right)^{kt\_ch_{td}} * dyh^{\ 0} \}$$

From the second sort of comparison, we can obtain the expression of the Equivalent Variation (EV) by multiplying the expression considered by the composite price for a unity of the reference situation (that is $pcu^{\ 0} = \prod_{td} \left(\frac{pq_{td}^{\ 0}}{kt\_ch_{td}} \right)^{kt\_ch_{td}}$) :

$$EV = \left(U^{ind\ j} - U^{ind\ 0} \right) * pcu^{0} = \left(\frac{pq_{s1}^{\ 0}}{pq_{s1}^{\ j}} \right)^{kt\_ch_{s1}} \left(\frac{pq_{s2}^{\ 0}}{pq_{s2}^{\ j}} \right)^{kt\_ch_{s2}} \left(\frac{pq_{s3}^{\ 0}}{pq_{s3}^{\ j}} \right)^{kt\_ch_{s3}} dyh^{j} - dyh^{0}$$

That means that *EV* measures increase or decrease of the consumers' income of the situation of the simulation j with regard to the reference situation, expressed according to the composite price for a unity of the basic situation, of which the purpose consists in realizing their satisfaction (the indirect utility) of the situation of the simulation j. We can schematise the *EV* in the case of two goods (s1 and s2):



Legend :

——— The curve of indifference of the reference situation : $U^{ind\,0}$

▬▬ The curve of indifference of the simulation j : $U^{ind\,j}$

Interpretation :

$$U^{ind\,0} \longrightarrow U^{ind\,j}$$

$$\left(-\frac{\overline{pq_1^0}}{pq_2^0} \right)$$

Remarks :

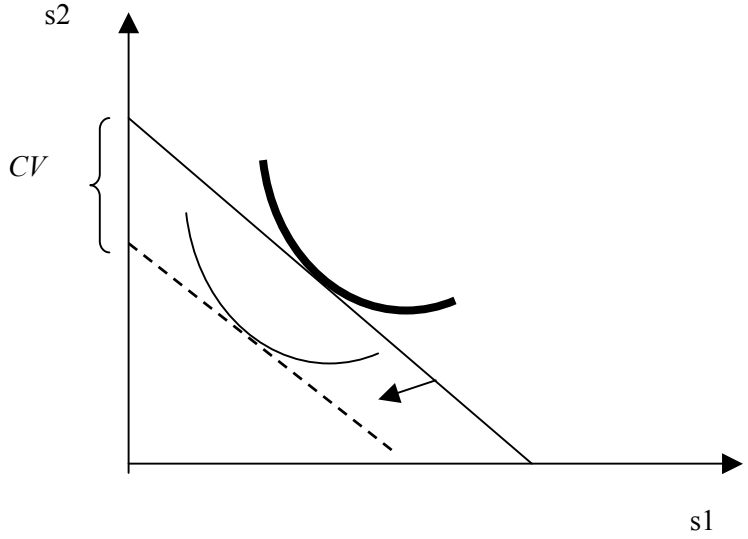
If $VE > 0$: we notice an improvement of the well-being $(U^{ind\,j} > U^{ind\,0})$

If $VE < 0$: we notice a decrease of the well-being $(U^{ind\,j} < U^{ind\,0})$

From the first method of comparison, we can then obtain the expression corresponding to the Compensating Variation (*CV*) by multiplying ($U^{ind\,0}$ -$U^{ind\,j}$) by the composite price for a unity of the situation of the simulation j (that is $pcu^{J} = \prod_{td} \left(\frac{pq_{td}^{j}}{kt\_ch_{td}} \right)^{kt\_ch_{td}}$) :

$$CV = \left(U^{ind\,0} - U^{ind\,j} \right) * pcu^{j} = \left(\frac{pq_{s1}^{j}}{pq_{s1}^{0}} \right)^{kt\_ch_{s1}} \left(\frac{pq_{s2}^{j}}{pq_{s2}^{0}} \right)^{kt\_ch_{s2}} \left(\frac{pq_{s3}^{j}}{pq_{s3}^{0}} \right)^{kt\_ch_{s3}} dyh^{0} - dyh^{j}$$

This expression shows the CV which measures decrease or increase of the income of the consumers of the reference situation with regard to the situation of the simulation j, expressed according to the composite price for a unity of the reference situation. This measure can be schematised in the following figure (case of two goods: s1 and s2):



Legend :

The curve of indifference of the reference : $U^{ind\,0}$

The curve of indifference of the simulation j : $U^{ind\,j}$

Interpretation :

$$U^{ind\,j} \xrightarrow{\left(-\frac{\overline{pq_1^j}}{pq_2^j} \right)} U^{ind\,0}$$

Remarks :

If $CV < 0$: we notice an improvement of the well-being ($U^{ind\,0} < U^{ind\,j}$)

If CV > 0 : we notice a decrease of the well-being ($U^{ind\,0} > U^{ind\,j}$)