

The liberalization of Tunisian agriculture and the European Union: a prospective analysis

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Abstract. In the year 2000, Tunisia and the European Union are to begin negotiations on the liberalization of agricultural trade between them under the terms of a partnership agreement signed in 1995. The political attachment of Tunisia to Europe will provide an opportunity for it to leave behind the agricultural policy pursued hitherto, a policy aimed essentially at achieving self-sufficiency in food production. This has proved to be costly for the country since it has led to poor resource allocation. The issue is therefore one of how to reform Tunisian agriculture at the least possible cost, especially for rural households, and to determine to what extent Europe can be of help in the move to a more dynamic agricultural system.

The present paper analyzes various prospective scenarios for Tunisian agriculture to the 2010 horizon, using dynamic general equilibrium modelling. The outcome is that in the absence of reciprocal concessions from the European Union, possibly in the form of a lifting of tariff quotas, Tunisia would have little incentive to reduce either its assistance to the agricultural sector or its protective barriers against outside pressure. Tunisian agriculture would in this case continue to show lacklustre performance, but the welfare of rural households would be more or less preserved.

Conversely, increased access to the European market for export products for which Tunisia has a competitive edge would greatly facilitate the transition and help improve resource reallocation. Some of the gains made could then be redistributed to rural communities in order to offset marginal losses. By granting the same trade privileges to its other partners, Tunisia would however maximize its growth potential and reduce still further its losses in the agricultural sector. The European Union would lose in terms of outlets for its exports but would gain overall in terms of the economic development of Tunisia.

Keywords: Tunisia, European Union, agriculture, regional integration, computable general equilibrium models.

JEL Classification: C68, F15, Q18

I. Introduction

In recent years, Tunisia has started down the road toward the liberalization of trade by signing two major agreements in 1994 and 1995. The multilateral General Agreement on Tariffs and Trade stipulates that consolidated tariffs imposed on imports of agricultural produce, and domestic subsidies on agriculture must be phased out over the period to 2004. The bilateral partnership agreement signed with the European Union (EU) provides for the complete abolition of tariff barriers on industrial products by 2010, following a twelve-year transitional period. However, this does not apply to agricultural products, for which the agreement is simply to begin negotiations in 2000.

The liberalization of trade is an event of major proportions for a small country such as Tunisia, which conducts a good deal of trade with other countries, the European Union in particular, the latter being its main trading partner. It is likely that the implementation of the above agreements will lead to significant changes in its overall economic activity and the sectoral distribution of that activity. The agricultural sector, which accounts for a large share of Tunisian trade and employment, is unlikely to be spared by the upheaval. This is so, firstly, because the reduction in tariff-based protection and domestic subsidies for agricultural products could strengthen competitive pressure facing Tunisian farmers and growers in their domestic market. Secondly, and in the other direction, the abolition of tariffs on industrial products could give agriculture in Tunisia greater effective protection compared with that afforded other sectors of the economy.

The question then arises as to how to lock into these changes in order to derive maximum advantage from them, notably by redefining the nature of agriculture policy in Tunisia within the framework of the partnership agreement with Europe. It is just this framework which provides an opportunity for Tunisia to introduce reform at less cost, since it would be in a position to obtain reciprocal advantages from its European partner. In addition, the defense component associated with the economic partnership means that the continued pursuit of Tunisia's goal of domestic self-sufficiency in food is less opportune.

The first task in this context is therefore to ensure correct understanding of the combined effect of signing up to GATT and the partnership agreement, followed by an examination of what might be the consequences of the measures which Tunisia and the EU are planning to take, either unilaterally or jointly, in the agricultural sphere, such as a further lowering of import barriers and the reduction of direct subsidies for agricultural production.

In situations where a large number of distortions are present, the theory of international trade is inadequate if used alone and we must use computational tools in an attempt to assess the consequences of the policies described. Computable general equilibrium models (CGE) are usually used for this. Their main advantage is that they offer a coherent framework for analysis based on highly detailed statistics and a fully explored corpus of economic theory. A number of studies have already employed this type of tool to analyze the impact of liberalization on Tunisia's agricultural sector (Decaluwé and Souissi, 1996, Boughanmi, 1997). Our own work differs from those cited on at least two grounds.

The first is that the model we use here is of dynamic type, unlike the two studies cited above, which, while they seek to measure long-term effects¹, do not take into account major dynamic phenomena. It is probable, as has been asserted by Boughzala (1997), that Tunisia would not have signed the partnership agreement if it had expected no more than the concretization of the predictions derived from static modelling. And it is in fact the case that a swifter accumulation of factors and acceleration in the transfer of technology can also be expected from those same agreements. Additionally, the sequential dimension of liberalization is important. The tariff consolidation provided for by GATT may for example lead initially to an increase in the nominal effective protection of Tunisian agriculture. The issue of co-ordination and the net effect over time of the two agreements now signed (and of those to be signed in the future) is also important. Only dynamic analysis can simulate the overall effect of the various measures to be implemented, measures which will come into force at different times.

The second difference from the studies cited relates to the fact that the statistics we have available make it possible for us to specify activity in the agricultural and industrial sectors in much greater

detail. They also enable us to differentiate between the instruments available to government in the area of agricultural policy and thus to study the specific impact of modification of each of those instruments individually.

We have begun by simulating the Tunisian economy to the 2010 horizon using the model as calibrated on 1992 and a set of assumptions relating notably to changes in levels of labor supply, natural resources and productivity. This initial simulation, which takes into account the changes provided for by GATT and the partnership agreement, forms the baseline scenario to which alternative agricultural scenarios are compared. This shows us that, in the absence of further reforms, distortions within the agricultural, compared with the other economic sectors, tend to increase over time, a fact which does not encourage this sector to adjust its system of production to the new conditions for international trade. At the same time, industry makes major efforts to adjust and shows greater drive. The rent provided by effective protection for landowners has the effect of reducing the gap in income between rural and urban households, but can be seen to be costly for Tunisia, since it stems from poor factor allocation. Our simulations of alternative policies suggest that liberalization of agriculture without reciprocal concessions from the European Union would not permit Tunisian agriculture to generate sufficient gains, since it would in that case be affected by a major constraint in terms of outlets for products on which it enjoys a relative competitive advantage. The reform seems to be viable only if accompanied by the lifting of the quotas facing Tunisian agricultural exports on the European market. Finally, one last simulation assesses the cost/benefit ratio for Tunisia of a multilateral, as opposed to bilateral, approach to the liberalization process.

The study is organized as follows. The second section describes the main characteristics of Tunisian agriculture and its instruments for economic regulation. The third describes the nature of the trade relations between Tunisia and the European Union. The fourth section presents the model used to assess the impact of the various reforms. The fifth describes in greater detail how Tunisian agriculture would develop without further reforms. The sixth looks at the impact of the reforms envisaged as part of liberalization. The final section presents our conclusions.

II. Agriculture and agricultural policy in Tunisia

General features. Tunisia possesses only limited natural resources favoring the development of agriculture. Of the almost 5 millions hectares of tillable land, 80% is actually cultivated. The rest is left fallow. Most land capable being ploughed is in arid or desert areas, and less than 3% is located in climatic zones comparable to southern Italy, France or Spain.² Land considered to be of poor quality (due to the nature of the soil or its deterioration due to erosion) accounts for over one third of all land resources. Erosion and desertification are major long-term obstacles to the development of Tunisian agriculture. These handicaps are accompanied by rapid urbanization, which deprives agriculture of arable land, labor and water. The latter is increasingly rare and precious, and the problem of its availability is in danger of worsening sharply over the coming years because Tunisia is on the point of reaching the maximum limit for water consumption before beginning to run the risk of irreversible depletion of its reserves. Exhaustion of the water table in the south and an increase in the salinity of underground water in the coastal region (due to excessive land exploitation) serve to underscore the danger that supplies will become inadequate.

Despite these drawbacks, agriculture and fisheries employ a large part of the working population in Tunisia. The work found in the agricultural sector is essentially casual in nature and is usually done by family members, which makes it difficult to pin down statistically. In fact, work done on a formalized basis in the agricultural sector accounted in 1992 for no more than 4% of total labor factor income in spite of the fact that a certain times of the year the sector may occupy over a quarter of the working population.

In the same year, 1992, taken together, the agriculture and food processing sectors accounted for 22% of total value added, 8% of total export revenue, 8% of expenditure on imports, and 35% of final consumption by households.

Production is dominated by olives (*cf.* Table 1), livestock and the major field crops (cereals, forage crops, legumes and industrial crops). Olive is the main domestic tree crop, representing 49% of total tree crop production in value terms, and 15% of overall agricultural production. Hard wheat is the main major field crop in Tunisia (48% of total common field crop production and 11% of overall agricultural production).

The products of the major field crops account for virtually all imports. Soft wheat is the main agricultural product imported by Tunisia, representing in its own right some 38% of all agricultural imports. Tunisia's exports consist largely of fruit (dates principally, followed by citrus fruit) and fisheries products, these two categories making up nearly 80% of all agricultural exports.

Table 1. Agriculture: percentage share of total economic activity in 1992

	Production	Imports	Exports
Major field crops	23.6	83.0	8.5
Tree crops	29.7	2.1	53.9
Market gardening	11.6	2.8	4.6
Livestock	26.2	7.2	4.7
Forestry	1.9	1.7	0.0
Miscellaneous	0.8	2.6	3.4
Fisheries	6.2	0.7	24.9
Total (<i>TND millions</i>)	2849.4	190.1	99.3

Source: Ministry of Agriculture (1993c).

Food processing is dominated by meat production (20% of all production in this economic sector), the processing of grain (18%), and oils and fats (19%). Tunisia's imports consist largely of vegetable oils (29% of all food imports), sugar (21%) and dairy products (18%). The country's food processing industries export olive oil (52% of all food exports), canned food (24%) and other food products (14%). Table 2 provides detailed figures for each type of activity within the general area of food production and trade.

Table 2. Food processing industries: percentage share of total economic activity in 1992

	Production	Imports	Exports
Meat	20.3	7.4	0.3
Milk	6.6	18.4	0.3
Flour-milling	18.4	0.6	3.2
Edible oils	19.0	28.8	52.3
Canned goods	6.7	0.5	24.2
Sugar	4.4	20.5	0.7
Other food products	17.0	20.3	14.0
Beverages	7.6	3.4	4.9
Total (<i>TND millions</i>)	2782.8	293.1	268.9

Source: Ministry of Agriculture (1993c).

The high level of dependency of agriculture on other countries is probably one of the reasons leading the Tunisian government to put in place a large number of administrative regulation mechanisms, the aim being to ensure adequate income levels for farmers and growers, national self-sufficiency for certain products and low prices for staple commodities. These mechanisms are deployed by means of five instruments of economic policy: i) the development of agricultural infrastructures and incentives for private investment; ii) the mobilization and protection of natural resources; iii) training for farmers and growers combined with dissemination of new technology and methods; iv) control of prices for products, agricultural input products and consumer prices; v) and protection of the domestic market against foreign competition.

Policy directed at encouraging private-sector investment has almost always been based on the artificial lowering of interest rates. Tax benefits granted to farmers and growers for the acquisition of agricultural equipment and machinery, added to capital investment subsidies (for irrigation systems for example) have also been used as incentives for private investment. Investment in agricultural infrastructure falls within the remit of government. The marshalling of water resources and the protection of agricultural land against erosion and desertification are also issues for the public sector. Through its land and water conservation programme, Tunisia has in this way proved able to limit the land loss caused every year by erosion and desertification, losses which amount to some ten thousand hectares annually.

The small size of individual agricultural holdings, usually run by families, also means that improvements in farming methods and technology and the search for plant varieties and animal species suited to the severe climatic conditions of Tunisia are properly the tasks of the state. Participation from the private sector is very actively sought, but is still in its infancy. Information outreach groups have been set up in all agricultural regions, but have been widely criticized, largely because of the large number of administrative bodies involved. As for scientific research, this has proved its worth by producing high-yield wheat varieties particularly well suited to Tunisia.

We discuss below in greater detail the last two major components of agricultural policy, which are the most likely to change over coming years in the context of the partnership agreement.

Prices. The agricultural and fisheries sector is subject to two forms of price control: control of production prices and control of prices for agricultural input products. There are two concurrent regimes for the regulation of producer prices. Under the first (which relates particularly to cereal crops and milk), at the beginning of each agricultural campaign the government sets a minimum guaranteed price for production. This is generally higher than the world price. Under the second, the price is also fixed, but unlike the first regime, the producer has no choice but to sell his produce at that price to a publicly owned collecting body. This is notably the case for sugarbeet and raw tobacco.³ The guarantee of a minimum price for production has ensured that the producers of these products have continued to enjoy sufficient income levels, protecting them against fluctuations in world prices. It has also meant that the movement of agricultural prices since 1970 has been very similar to those for industrial products⁴, thus maintaining farmers' purchasing power. The State also subsidizes consumption of agricultural input products in order to encourage intensive agriculture and to keep production costs down. Chemical fertilizers and pesticides can thus be sold to farmers and growers at lower than cost price thanks to public subsidies. Water distribution at the irrigated margins of agricultural land is billed at prices far below the actual cost of operating the water infrastructures.

Since 1986, Tunisia has been conducting a programme of structural adjustment aimed particularly at reforming the agricultural sector by shifting its prices closer to those in world markets and reducing production subsidies. Despite this programme, support for agricultural production considered to be of strategic importance remained at a very high level in 1992 (*cf.* Table 3). According to Lindert and Tuck (1996), the production subsidy equivalent (this being the difference between the world price and the domestic price paid to the producer) was 45% for hard wheat, 32% soft wheat and 14% for sugar.

As for marketing policy on agricultural products, this has gone through two major phases since the 1960s: the first involved strict control, a State monopoly and regulation by public agencies of the collection, import, export and distribution of the products concerned; this was followed by one of gradual liberalization and promotion of private-sector initiative to accompany the implementation of the structural adjustment programme since 1986.

The consumer price for each product whose producer price is subject to administrative control is also itself controlled. This is particularly true of staple commodities such as cereals and milk (*cf.* Table 3). Other products are regulated only at consumer level by setting a maximum selling price. Animal husbandry products and fruit and vegetable produce are the main targets of this type of regulation.

External protection. In 1992, two instruments were available to the Tunisian authorities to protect the domestic market from outside competition: tariff and non-tariff policies. The content of both began to be modified in 1995 with the implementation of GATT. However, in order to understand the

consequences of this agreement for agriculture, we need to keep in mind the nature of the situation prevailing in 1992, the baseline year for our model.

The main instrument of non-tariff protection was the imposition of quantity restrictions on imports. The implementation of quotas for imports and state monopolies for the administration of import operations (the national offices for cereals and oils) had the effect of stepping up the protection of local production, since tariff barriers were considered to be insufficient alone. Applied in the 1960s, the consequence of this policy was largely to isolate the local from the international market, thus attenuating the impact of international fluctuations on domestic prices. Where other categories of product were concerned, imports required a license issued by the Ministry of Trade, plus adherence to a stringent set of specifications related to technical and health-related standards.

The tariff equivalent of the non-tariff barriers provides an indicator for the scale of this type of protection. In order to assess this for the main agricultural products imported into Tunisia in 1992, we have used an approach developed precisely for this purpose by Deadorff and Stern (1984) and Baldwin (1989). It involves calculating the ratio between the domestic price less the world price after release from customs (shipping cost, insurance and customs duty included) to the world price, again after customs clearance. The percentage obtained in this way represents the tariff equivalent of the non-tariff barriers applied to a given product. Out of 19 products studied, six showed significant levels of tariff equivalent. Sugar had the highest non-tariff protection, with a tariff equivalent of 28%, followed by hard wheat (20%). The other protected products were barley, soft wheat, vegetable produce and canned goods (*cf.* Table 3).

In terms of tariff policy, Tunisia's customs regulations lay down three categories of duty: minimum, general and intermediate. However, the last two categories are rarely used and the minimum rate is therefore the base rate applicable to all imports with the exception of those covered by preferential tariff regimes (GATT, 1994). All duty is expressed *ad valorem* and based on the CIF value. There are no special duties or combined duties. Seasonal duties are also non-existent.

The structural adjustment under way since 1986 also relates to the liberalization of trade, and notably to the reduction and streamlining of high rates of duty and the phasing out of a large number of import restrictions. The latter have for example been made more flexible, with customs duty becoming increasingly important as an instrument of trade policy. During the initial phase of liberalization (1986-88), intermediate rates of duty and effective protection were reduced in most sectors, and tariff dispersion diminished significantly. The range of levels of duty, which ran from 5% to 236% in the early 1980s, had narrowed to a band between 17% and 43% by 1988. Nevertheless, the impact of this initial progress was limited since the dismantling of restrictions largely concerned goods not produced in Tunisia.

However, just when non-tariff liberalization was gaining ground, tariff liberalization was losing steam, and in 1991, provisional supplementary duty was put in place. The original objective (a rate of protection of 25%) was no longer on the agenda. Duty levels were increased by between 10 and 30 percentage points for a number of products, raising the maximum level to 73%. This caused the mean level of duty to rise by 3 percentage points, and the progressivity of duty levels increased, as did tariff dispersion (GATT, 1994).

As can be seen in Table 3, the agricultural and food processing sectors were continuing to benefit in 1992 from high levels of tariff-based protection compared with other sectors of the economy. In 1992, the average rate of nominal protection of agricultural and food products was 45% (non-tariff barriers not included), which is two and a half times as high as the rate of protection on other industrial products. Within this category, tariffs vary greatly between product categories and between products in the same category. Customs duty and other import taxes are generally high for fruit, forest cultivation products, tobacco, meat, dairy products, products derived from the processing of cereals, canned foods and beverages. They are less high for cereals, livestock, oils and sugar, four categories which together account for almost 60% of agricultural imports. It may be considered that the average tariff level in agriculture is a satisfactory general yardstick for distortion in that sector, and that a reduction of the average would tend to reflect a greater uniformity in the protection benefiting each type of agricultural production rather than the opposite.

Table 3. Instruments of price policy in 1992 (%).

Products	Average tariff collected	Non-tariff barrier	Value Added Tax	Other indirect taxes	Consumer subsidy	Production subsidy
Soft wheat	17.0	8.1	0.0	0.0	33.4	0.8
Hard wheat	17.0	20.4	0.0	0.0	45.8	0.8
Barley	17.0	10.0	0.0	0.0	0.0	0.9
Other cereal crops	18.0	0.0	0.0	0.0	0.0	0.1
Legumes	12.2	0.0	0.0	0.0	0.0	0.7
Forage crops	49.3	0.0	0.0	0.0	0.0	0.8
Sugar beet	0.0	0.0	0.0	0.0	0.0	0.8
Other industrial crops	62.3	0.0	0.0	0.0	0.0	0.5
Olives	0.0	0.0	0.2	0.2	0.0	0.0
Citrus fruit	0.0	0.0	0.1	0.1	0.0	0.0
Dates	0.0	0.0	0.1	0.2	0.0	0.0
Grapes	0.0	0.0	0.1	0.1	0.0	0.0
Other fruit	77.8	0.0	0.1	0.1	0.0	0.0
Vegetables	11.4	6.1	0.1	0.1	0.0	0.0
Other agricultural products	22.0	0.0	0.1	0.1	0.0	0.0
Livestock	17.0	0.0	0.0	0.1	0.0	0.5
Forestry	72.5	0.0	0.2	0.2	0.0	0.0
Fisheries	0.0	0.0	0.7	0.0	0.0	0.0
Meat	64.5	0.0	0.5	0.0	0.0	0.0
Milk	55.2	0.0	0.8	0.4	0.0	12.0
Flour-milling	35.0	0.0	1.3	0.4	0.0	2.5
Edible oils	19.6	0.0	0.3	0.2	4.4	0.0
Canned goods	39.3	1.1	2.7	0.4	0.0	0.0
Sugar	16.8	28.1	3.6	0.8	0.0	8.2
Other food products	145.8	0.0	37.3	0.1	0.0	0.0
Beverages	49.0	0.0	23.5	0.7	0.0	0.0
Other industrial products	17.1	0.0	2.1	0.6	0.0	0.7
Services	0.0	0.0	3.9	0.5	0.0	0.7

Source: Authors' calculations. Note: each instrument is constructed as a proportional tax on the relevant item (See section dealing with the modelling of economic policy instruments for further details).

III. Trade relations between Tunisia and the European Union

The European Union is Tunisia's main trading partner: 76% of Tunisia's trade goes to or comes from the EU. Imports of European agricultural and food products account for a little under half of all imports of products in these two categories (approximately 40%). As for the European market, this takes up about 70% of Tunisia's agricultural and food exports. Trade in industrial products is even more tightly linked, since 80% of all imported industrial products come from Europe, and 78% of Tunisian industrial exports go to the European market.

Table 4 shows the EU's share in 1992 of trade in the various agricultural and food product groups. The EU absorbs 77% and 63% of all agricultural and food exports. Conversely, imported European agricultural and food products account for no more than 39% and 40% of total imports of these products. European producers therefore stand to make greater gains in market share from a strengthening of mutual preferential relations than their Tunisian counterparts. This fact also means that the outlets for Tunisian exports are largely dependent on EU decisions as to its own agricultural policy.

Table 4: Percentage share of trade with the EU in total economic activity in 1992

	Imports	Exports
Agriculture	39	77
Major field crops	32	18
Tree crops	12	91
Market gardening	97	35
Livestock	85	4
Forestry	59	100
Miscellaneous	61	75
Fisheries	83	89
Food Processing	40	63
Meat	95	100
Milk	52	3
Flour-milling	98	2
Edible oils	29	92
Canned goods	60	37
Sugar	39	33
Other food products	17	24
Beverages	94	41
Other industrial products	80	78
Services	58	84
Total	74	79

Source: Ministry of Agriculture (1993c) and UNCTAD (1997)

Changes in the regulatory framework governing Tunisia-EU trade relations. Trade relations between Tunisia and the European Union are governed by the co-operation agreement signed in 1976 and subsequently amended at times.⁵ This agreement, which was also signed with Morocco and Algeria, was originally intended to encourage the industrialization of Tunisia and the modernization of its agriculture. To achieve those aims, it granted a preferential arrangement for certain agricultural exports (wine, fruit and vegetable produce), as well as to all Tunisian industrial products in the European market. This agreement was modified in 1987, following the enlargement of the European community to include Spain and Portugal. In order to offset the loss of preferential advantages due to the entry of the countries of the Iberian peninsula, the agreement was amended in such a way as to grant Tunisia access to the European market (for products already covered by the 1976 agreement) under conditions similar to those accorded to Spain and Portugal during the transitional period from 1986/ to 1996. Tunisia has also benefited since 1992 from the EU's Renovated Mediterranean Policy Programme, which strengthens trading and financial cooperation between Mediterranean countries.

Finally, in July 1995 Tunisia signed a partnership agreement with the EU. This provides for the setting up of a free trade area following a twelve-year transitional period. It also provides for closer co-operation on financial matters, in addition to technical issues, notably in education and vocational training. For the EU, this agreement with Tunisia forms part of an overall strategy aimed at widening and deepening links with its neighbors to the south, in order to create a secure, stable and prosperous Euro-Mediterranean economic area. For Tunisia, the new agreement holds out ambitious challenges and a promising future. As matters stand, it also requires that Tunisia undertake much more fundamental reform of its economy than that to which the EU is committed.

The agreement to set up an EU-Tunisia free trade area. The foundation of the partnership agreement is the principle of reciprocity. It provides for the removal of tariffs on all products with the exception of agricultural produce, as defined by the EU.⁶ The staging of this removal is not however identical for all products. Specifically, the agreement lays down that they are to be dismantled swiftly for imports of products without domestic equivalents, but more slowly for protected domestic products competing with imports. Some industrial products deemed to be of critical importance are not covered by the agreement.

In practice, industrial products are categorized in four lists. The first contains goods for which the removal of tariffs is immediate. This relates to capital goods not manufactured locally; in 1994 they accounted for 12% in value terms of all imports from the EU (World Bank, 1995). The second list contains goods for which tariffs are to be removed over a period of five years as from the effective date of the agreement. These consist essentially of raw materials and other input products not produced locally. Again in 1994, this list accounted for 28% in value of all imports from the EU. The third list comprises goods for which protection is to be removed over a period of 12 years (the duration of the transitional period), at the rate of one twelfth per year. The products concerned in this case are those which are manufactured locally and considered competitive by the Tunisian authorities. This latter list accounted for 30% of all imports from the EU in 1994. The fourth list contains the other industrial products, whose tariff protection will be removed over 12 years, including an initial 4-year period of grace, at the rate of one-eighth per year. This last list accounted in 1994 for 30% in value terms of all imports from the EU.

Given the degree of disaggregation in our model (23 industrial products), and the level of disaggregation defined in the partnership agreement for the classification and differentiation of the products concerned (7 decimal references, for a total of a little under 5,000 products), it seemed to us to be imperative to estimate the staged removal of tariff protection rather than to match up each of our 23 products with a single list chosen from among the four defined in the agreement. In actual fact, each of our 23 products includes within its definition items for which tariffs will be cut rapidly and others for which the reductions will be slower. The nominal level of protection of each of the 23 will for this reason diminish at a rate dependent on the respective weighting in its composition of the four tariff-removal categories. This process is detailed in Table 5. Firstly, it enables major differences to be observed in initial protection levels from one product to another. Secondly, it allows us to see that at the end of the period some products still benefit from significant nominal protection. This is the case for example for carpets and the whole food-processing sector. It is planned that the outcome for these latter products, and that of services, will be discussed five years after the effective date of the agreement, that is, beginning in 2000. As matters currently stand, the partnership agreement relates in reality solely to the industrial sector.

This dismantling of tariff barriers is more or less unilateral given that the vast majority of Tunisian industrial products are already freely available in the European market. This is not yet the case for the whole range of agricultural products, which are generally subject to specific arrangements, and in some cases affected by barriers to entry into the European market. Only on January 1, 2000 will the two partners begin to examine the position for agricultural products as a whole, with a view to defining liberalization provisions for implementation as from January 1, 2001 (Mahjoub, 1996). However, the present partnership agreement already contains some liberalization measures amending previous arrangements. These measures provide for the implementation at European level of the preferential status for some products already granted by France to third Mediterranean countries (early potatoes, tomato concentrate, oranges other than fresh produce). It is also planned that at certain times of the year free access will be granted to new products such as market garden produce. Finally, an increase is planned in zero-duty tariff quotas between 1997 and 2001 granted by the EU on oranges, early potatoes, tomato concentrate and fresh apricots. In return, Tunisia has given an undertaking to afford the European Union preferential access for its cereals, meat and dairy products and to consolidate its GATT-related concessions.

It is important to underline the fact that, contrary to the position on trade in industrial products, there can be no question of going immediately for free trade in the agricultural sphere. At the present time, the aim is simply to consolidate progress on certain products and to improve the terms of access to the EU market for some others. As matters currently stand therefore, it is not certain that the partnership agreement is compliant with World Trade Organization rules (Tunisia has been a member of the WTO since 1990), and specifically Article XXIV of GATT. Article XXIV stipulates that regional free trade agreements are compatible with the non-discrimination rules if they satisfy two conditions (Solignac Lecomte, 1998): they must (i) "be implemented in a reasonable time frame", and (ii) "cover substantially all types of trade". While the first condition seems to be fulfilled (the WTO considers a dozen years to be a reasonable time frame), it is not certain that the second may not be attacked by

third parties within the WTO due to the lack of clarity of this article (Nagarajan, 1998).⁷ However this may be, it is certain that the inclusion of agricultural products in the process of liberalization would reduce the risk of criticism of the partnership agreement. This consideration thus increases the interest of looking at the consequences of tighter integration between the EU and Tunisia.

Table 5: Planned removal of tariffs on imports from the EU (%)

	1995	1998	2001	2004	2007	2010
Meat	64	64	64	64	64	64
Milk	55	55	55	55	55	55
Flour-milling	35	35	35	35	35	35
Edible oils	29	28	27	25	25	25
Canned goods	39	39	39	39	39	39
Sugar	18	18	17	17	17	17
Other food products	214	211	202	193	192	191
Beverages	49	49	49	46	44	41
Mining and quarrying	31	27	20	10	5	0
Steel-making	18	13	7	1	1	0
Metals	33	28	23	14	7	0
Agricultural machinery	14	7	5	3	1	0
Transport materials	34	31	23	14	6	0
Electrical materials	17	9	6	3	1	0
Electronic materials	25	13	9	4	2	0
Household equipment	48	42	35	22	11	0
Chemicals	24	20	12	3	2	0
Yarn	5	5	4	3	1	0
Carpets	69	62	48	30	21	12
Clothing	2	2	2	1	0	0
Leather	5	5	4	2	1	0
Wood industry	33	31	26	16	8	0
Paper industry	28	25	22	14	7	0
Plastics	29	24	15	7	3	0
Other manufactured products	8	7	5	3	1	0

Source: Authors' calculations based on UNCTAD data (1997).

Analysis of staged reform of the instruments regulating trade between Tunisia Europe, along with domestic agricultural activity, requires a computing tool capable of assessing the consequences for price formation, supply and demand. This tool, the general dynamic equilibrium model, is described in the following section.

IV. The general equilibrium model

The model used here is based directly on the prototype developed by the OECD Development Centre (Beghin, Dessus, Roland-Holst and van der Mensbrugghe, 1996) for analysis of trade policies. It has been constructed and calibrated using information contained in Tunisia's social accounts matrix for 1992, assembled specifically for the purpose. It considers two representative Tunisian households, one rural and the other urban, plus one tourist household. The latter receives all its income from abroad and consumes it in its entirety. In all, 57 economic sectors and 5 types of work are taken into account, these being distinguished notably by their levels of qualification and geographical mobility: 3 are rural, 1 urban, and 1 allocated to the whole of the country. This last is a buffer between rural and urban areas. It covers casual workers, who react swiftly to fluctuations in labor demand. If the source of this demand is urban for example, they will go to that area and transfer a fixed part of their income to rural households. They therefore cushion the shocks which particularly affect one geographical area — changes in agricultural policy for example.

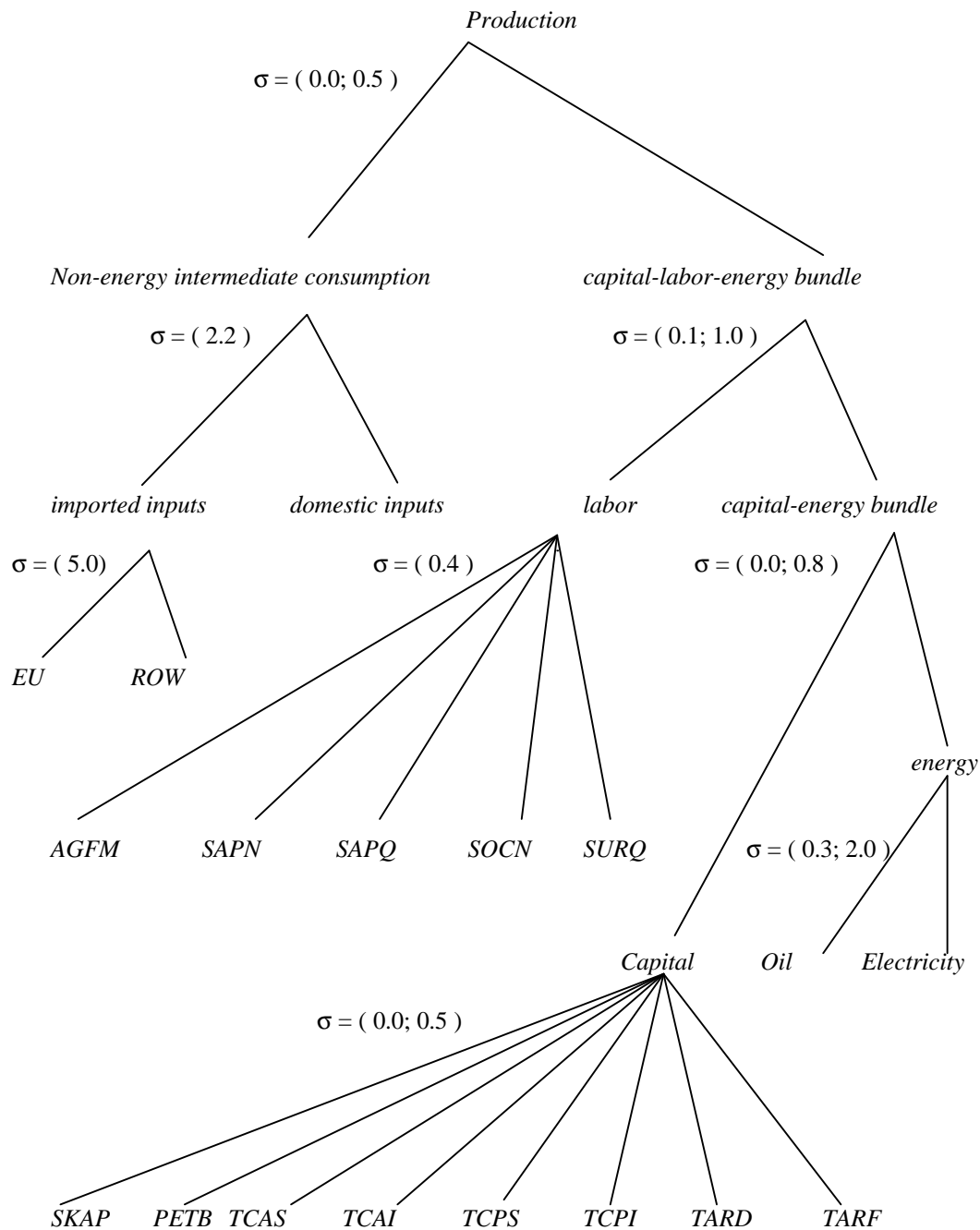
Of the 57 economic sectors, 26 relate to agriculture or food industries. The model takes into account three types of capital: physical capital, reserves of natural resources (crude oil, phosphates) and land. The last of these is itself broken down into categories based on the degree of permanence of its cultivation, the level of irrigation and the crop varieties grown, if these are specific. Thus the land allocated to date growing (mainly in oases), or forestland cannot be used for any other type of crop. Finally, the model makes a distinction between two trading partners for Tunisia: the European Union and the Rest of the World.

Appendix 3 contains a detailed list for each of these aspects. The model is dynamic and is resolved recursively for the years 1992, 1995, 1998, 2001, 2004, 2007 and 2010.⁸ Its main features are summarized below.

Production. Production is modelled using nested CES functions which describe the substitution and complement relations among the various inputs. Producers are cost-minimizers and constant return to scale is assumed. In the first place, products break down into two aggregates, intermediate consumption excluding energy, and value added plus energy consumed. The value-added and energy components are decomposed in two parts: aggregate labor and capital plus energy. Labor demand then breaks down into five categories, as mentioned above. Within each segment, labor is totally mobile and completely employed. The composite capital/energy factor is disaggregated into capital and energy. Demand for physical capital makes a distinction between “old capital” and “new” capital. The model thus integrates the notion of vintage capital in order to make a distinction between the process of allocating capital existing at the beginning of the period, or which is already in place, from that resulting from contemporary investment (that is, a production function of putty/semi-putty type). “New” capital can be allocated more flexibly than already installed, or “old” capital. It substitutes for other types of capital more easily (land, natural resources) than does old capital. Accelerating investment therefore strengthens the capacity for adjustment of the productive sector to match changes in relative prices. Finally, the energy aggregate comprises two types of energy, oil/gas and electricity, which are targeted by distinct, substitutable demand. Figure 1 illustrates the process whereby successive decisions are taken in the process of choosing production factors. Substitution elasticities reflect the possibilities for adjustment of demand for production factors to match movements in their relative pricing. We have selected the following⁹: 0.00 between intermediate consumption and value added incorporating old capital plus energy; 0.50 between intermediate consumption and value added incorporating new capital plus energy; 0.12 between aggregate labor and the capital-energy aggregate incorporating old capital; 1.00 between aggregate labor and the capital-energy aggregate incorporating new capital; 0.40 between the various categories of labor; 0.00 between old capital and energy; 0.80 between new capital and energy; 0.25 between the various sources of energy linked to old capital; 2.00 between the various sources of energy linked to new capital; 0.0 between the various types of capital (land, natural resources, physical capital) linked to old capital; 0.5 between the various types of capital (land, natural resources, physical capital) linked to new capital; and 0.4 between the different types of labor.

Distribution of income and absorption. Income from labor is allocated between the various households using a standardized fixed-coefficient distribution matrix. Income from capital is allocated in the same way between households, companies and foreign investors. Companies pay tax on this income to the government and save the remainder. Household demand is derived from a programme for maximizing the utility function (following the ELES system developed by Lluch, 1973), specific to each household, subject to the constraints of available income and consumer price vector. Household utility is a positive function of consumption of the various products and savings. Income elasticities are differentiated by product and by household, and vary from 0.75 for staple products for households with the highest income to 1.20 for services. The calibration of the model determines a per capita subsistence minimum for each product, whose aggregate consumption grows with population, while the remaining demand is derived through an optimization process. The share of the various products in government demand and investment demand is fixed once the aggregate levels of these have been defined.

Figure 1: The production function



Notes: Each tree structure represents the choices facing producers in formulating factor demand. One or two substitution elasticities are associated with each decision level. These reflect the possibilities for adjustment of production factor demand in line with their relative pricing levels. The substitution elasticities associated with old capital are placed in front of the comma; elasticities associated with new capital are placed after the comma. Substitution elasticity between intermediate products is nil. Conversely, it is possible to substitute the domestic product for the same imported product. Types of labor and capital are detailed in Appendix 3.

International Trade. The model assumes imperfect substitution among goods originating from different geographical areas. Import demand results from a CES aggregation function of domestic and imported goods (Armington, 1969). Export supply is symmetrically modelled as a Constant Elasticity of Transformation (CET) function. Producers decide to allocate their output to domestic or foreign markets responding to relative prices. At the second stage, importers (exporters) choose the optimal choice of demand (supply) across regions, again as a function of the relative imports (exports) prices

and the degree of substitution across regions. Substitution elasticity between domestic and imported products is set at 2.2, and at 5.0 between imported products according to origin (EU or the Rest of the World). The elasticity of transformation between products intended for the domestic market and products for export is 5.0, and 8.0 between the different destinations for export products. The small country assumption holds, Tunisia being unable to change world prices; thus, its imports and exports prices are exogenous. Capital transfers are exogenous as well, and determine the trade balance.

Model Closure and Dynamics. The equilibrium condition on the balance of payments is combined with other closure conditions so that the model can be solved for each period. First consider the government budget. Its surplus / deficit is exogenous and the household income tax schedule shifts in order to achieve the predetermined net government position. Second, investment is savings-driven, the latter originating from households, enterprises, government and abroad. The sequential dynamic path of the model results from this closure rule. A change in savings influences capital accumulation in the following period. Finally, exogenously determined growth rates are assumed for other factors that affect the growth path of the economy, such as population and labor supply and (in the baseline scenario) the total factor productivity. Agents are assumed to be myopic and to base their decisions on static expectations about prices and quantities.

Instruments of economic policy. The model considers a large set of policy instruments, some of which have been mentioned above: production subsidies (by type of activity), consumption subsidies (by product), value added taxes (by activity), other indirect taxes (by activity), tariff barriers (by imported product, and according to origin), non-tariff barriers (by imported product, and according to origin), direct taxes (by household), and taxes on corporate profits. The model also describes the tariff policy implemented by the EU for Tunisian exports. Finally, the model describes tariff quotas policies applied by Tunisia and the EU.

The modelling of these different policy instruments is of conventional type. It defines each instrument as a tax on the relevant resource. For example, a production subsidy is modelled as a negative tax on production price. In the case of differential tariffs, the process is a little more complex, but boils down to expressing the average tariff level as the average of the preferential and non-preferential tariffs, weighted by the volume of the imported products in each quota. If M is the total imported volume, \bar{M} the volume level below which preferential tariff t_A is applied, and t_B the non-preferential tariff ($t_A < t_B$), then the average tariff t for all imports of a product verifies the following:

$$t M = t_A \min[M, \bar{M}] + t_B \max[M - \bar{M}, 0] \quad (1)$$

Since imports subject to these regulatory controls are usually placed under the administrative authority of a public agency, we assume that the latter passes on the average tariff to the imported product's domestic price, in order not to penalize one category of importer of the same product more than others. This average tariff is therefore endogenous in the model, since total imports are endogenous. If total demand for imports exceeds quota \bar{M} , the nominal level of protection can rise, up to the point at which the domestic price of the imported product is equal to the marginal utility provided by consuming it.

V. Baseline scenario

Several assumptions have been made in order to define what seems to be the plausible development of the Tunisian economy up to 2010. This exercise in simulation must not however be seen as an exercise in forecasting, for which general equilibrium models are not the best tools. The definition of a benchmark using major exogenous hypotheses is intended merely to define a baseline scenario to which alternative policy scenarios can then be compared in order to isolate the specific impact of the latter. The fact that the value of the exogenous variables are set on *a priori* basis, within a realistic confidence interval, does not however have any major consequences. When the impact of alternative economic policies is assessed, it can be seen that these choices affect very little either amplitude or sign of the variations in the different aggregates relative to the baseline scenario (notably the measurement of welfare changes), as can be observed in the sensitivity analysis (*cf.* Appendix 2).

Growth hypotheses. In order to construct a baseline scenario, the values of a number of variables need to be set. The rate of growth in Gross Domestic Product (GDP) is set for the period to 2010 in order to estimate a growth rate for total factor productivity compatible with this development¹¹. We have chosen a figure of 5.7% for the average annual GDP growth rate between 1998 and 2010, in accordance with the targets and forecasts of the ninth social and economic development plan (Ministry of Economic Development, 1998). Over the same period, the rural (urban) population is assumed to grow at an average annual rate of 1.0% (1.8%). Between 1998 and 2010, labor market supply grows by 0.9% yearly in rural areas, and by an annual 2.0% in urban areas.¹² The percentage of irrigated land increases, reducing total dryland accordingly. The total area for the former increases by 1.0% annually up to 2010, leading to an annual shrinkage of 0.8% in the latter. Total cultivated land area does not change.¹³ The surface areas allocated to tree crops and forestry also remain unchanged. Reserves of natural resources are also unaffected. Average land productivity improves by 2% per year, thus rewarding the efforts of agronomic researchers in identifying appropriate crop varieties and farming methods.

Economic policies implemented in the baseline scenario. We assume here that the government continues with its policy of fiscal stabilization. Budget spending (excluding investment) increases in real terms by only 1.5% annually up to 2010. In the baseline scenario, public savings are endogenous. In the alternative scenarios, they are exogenous (and remain at their baseline reference level), and are obtained by endogenous shifting of the VAT vector. In order to neutralize the impact of changing the latter, which is judged to cause distortion, (Rutherford, Ruström and Tarr, 1995), as a reaction for example to a reduction in tariff revenue¹⁴, we assume that the rate of VAT is gradually unified over the period 1998 to 2010. By 2010 there would be just one VAT rate applicable to all products and equal to the average revenue collected in 1992, the figure being 3.7%.

While this working hypothesis is debatable, and is formally justified only because it seems to offer methodological advantages (the contribution of which is discussed in detail in Appendix 2), the inclusion of the other changes in economic policy reflects the formal undertakings given by the Tunisian government to the international community, specifically where trade is concerned. The reference simulation therefore also incorporates the following policy changes:

In connection with GATT implementation:

1. Removal of non-tariff barriers on agricultural products from 1995 on.
2. Reduction of agricultural tariffs (consolidated in 1995) by 24% over the period from 1995 to 2004 for trade with all partners.
3. Reduction of agricultural subsidies by 13% between 1995 and 2004.

In connection with the EU partnership agreement:

1. Product-related reductions in tariffs applied to imports of European industrial products (*cf.* Table 5), between 1998 and 2010.
2. Changes in preferential tariffs and quotas applicable to certain agricultural products exported by Tunisia (beverages, citrus fruit, vegetable produce) to the EU, between 1997 and 2001.

In connection with the dismantling of MFA:

1. Tunisia loses market power for its textile exports in Europe from 2005 onwards.

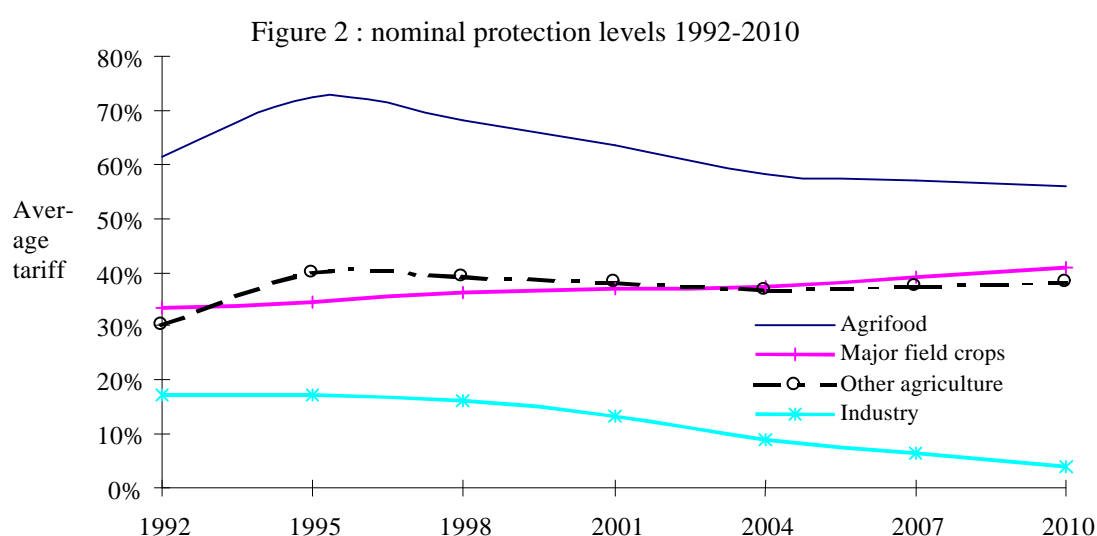
The changes to policy, levels of activity and public expenditure which are introduced determine budget balance in the baseline scenario before the addition of public investment¹⁵. This remains stable throughout the period at roughly +4.5% of GDP. The rate of growth in total factor productivity (which relates solely to capital physical and labor) is also determined endogenously in this initial scenario. Notably, it is dependent on the rate of growth in the economy and the initial stock of physical capital, which in turn determines the rate at which the latter accumulates. At an annual average GDP growth rate of 5.7%, and with an initial stock of physical capital equal to twice the 1992 product, the annual rate of growth in total factor productivity comes out as 0.8% on average over the period 1992 to 2010.¹⁶ Finally, we have made the assumption that there will be a hardening in external constraints. In 2010, the deficit in the trade balance falls to 2.6% of GDP, compared with 13.6% in 1992. External prices remain unchanged. Appendix 1 contains the detailed results for this simulation and for those which follow.

Tunisian agriculture in the absence of further reforms. The baseline simulation allows us to see that the signing of the GATT and partnership agreements with the EU further integrates Tunisia into the system of international division of labor. Exports grow in volume terms at 8.1% per year, and imports at 6.2%. Due to the preference granted by Tunisia to European industrial products, the Rest of the World's share of the market is approximately halved for industrial products. Without further incentives to substitute one source of agricultural imports for another, the share of agricultural imports originating in the Rest Of the World does however remain stable at around 60%.

The increase in exports is due largely to the industrial sector, whereas agricultural exports tend to fall in volume. Domestic demand for agricultural products increases (due notably to population pressure), and focuses on domestic products, which are subsidized and protected. In this situation, limited production capacity in the agricultural sector encourages producers to devote an increasingly large share of their production to the domestic market, to the detriment of foreign markets.

Gains in competitiveness allowing Tunisia to increase export market share are not due to genuine depreciation, given that the price of value added remains unchanged because the cut in revenue on capital offsets the rise in real wages. These gains are in fact due to the reduction in prices for imported input products and a lessening of the distortion of international trade other than in agriculture, a situation which benefits the industrial sector particularly.

The latter encounters fewer constraints than the agricultural sector (limits on land suitable for cultivation) as regards increases in its production, but it is also more exposed to international competition than the agricultural sector, forcing it to make greater efforts to adapt. Figure 2 makes it apparent that the nominal level of protection of the industrial sector, already low compared with agriculture, declines significantly up to 2010. Conversely, where agriculture is concerned, nominal protection remains high and declines very little. Indeed, the protection of certain agricultural sectors even rises over the period 1992 to 2010 due to the implementation of the system of preferential tariffs: growing demand for imported products leads inevitably to quota overflow and thereby to an endogenous increase in average protection levels. This is particularly true of soft wheat, livestock, sugar and fruit. This comparative rise in nominal protection for the agricultural and food processing sectors increases their effective level of protection, since they also benefit from the fall in prices for industrial inputs: between 1992 and 2010, the average level of effective protection¹⁷ of the agricultural and food processing sectors increases from 36% to 43%, whereas that of industry declines from 22% to 18% over the same period.



Source: Authors' calculations. Note: the average tariff comprises tariff barriers abolished in 1995 in return for the tariff consolidation provided for by GATT.

After the consolidation of 1995, average tariff levels tend to level out. The expected effects of the reduction in tariffs up to 2004 provided for in the GATT implementation process are counteracted by endogenous tariff increases affecting agriculture. These two phenomena combine to explain the observed convergence in average tariff levels in the agricultural and food processing sectors.

As has already been emphasized above, the effort devoted to factor reallocation and to enhancing competitiveness is supplied virtually entirely by industry, which experiences a much more severe external shock than agriculture or food processing. A specific yardstick for the scale of the reallocation effort is the change in composition of the production vectors in each of these two areas of activity. This indicates a level nine times higher in industry than in agriculture and food processing.¹⁸ The equivalent relative index for labor is six times higher in industry.

The distortions caused by sector-targeted incentives in agriculture ensure that it remains at a low dynamic level. The food industry, which depends on agriculture to a large extent, also suffers the negative effects. Production in the agricultural, food processing and industrial sectors increases at the respective annual rates of 3.3%, 4.6% and 7.0% over the period 1992 to 2010.

An increasingly high percentage of mobile production factors (physical capital and casual labor) is captured by industry, which acquires more substantial commercial outlets, especially abroad. Consequently, labor factor income rises more swiftly in non-agricultural than agricultural sectors. Household income levels reflect this. However, due to much slower growth in the rural population, the gap between the real income levels of urban and rural households tends to narrow (the factor declining from 1.8 in 1992 to 1.6 in 2010), notably thanks to the assured income provided to owners of arable land by the protection of agriculture. However, consumers of agricultural products are penalized in this baseline scenario: the consumer price for agricultural products climbs by 9% between 1992 and 2010, while that for industrial products falls by 9%.¹⁹

Despite a high level of state support, agricultural activity does not therefore appear to be able to derive benefit from the increasing openness of the Tunisian economy to trade and partnership with Europe, and remains to a large extent outside the globalization process.

VI. Alternative policies

We now go on to an evaluation of the impact of the various reforms of policy agricultural policy which might be envisaged as part of a stepping up of the partnership between Tunisia and the European Union, and which will probably be under discussion from 2000 on. The first two of these – reductions in tariffs and in government support in the agricultural sector in Tunisia – can be implemented unilaterally. It would nevertheless be in the interests of Tunisia to subordinate such reforms to reciprocal concessions from the European Union, in order to limit the costs induced. One possibility would for example be to grant Tunisian agricultural exports increased access to the European market.

Initially, each of the three reforms is assessed separately in an endeavor to evaluate and define its intrinsic impact on the economy and agriculture of Tunisia. A fourth simulation combines the first three. A fifth simulates the addition to the three combined reforms of a unilateral reduction in tariffs on agricultural and industrial products imported from the Rest Of the World, the aim being to evaluate the loss of revenue due to the granting of preferential trading terms to the European Union alone.

Abolition of tariff barriers on agricultural imports from the EU. The scenario defined here provides for a staged reduction in preferential and maximum customs tariffs on agricultural and food imports sourced in the European Union over the period 2001 to 2010. These tariffs are reduced by 25% in 2001 compared with the baseline scenario, by 50% in 2004, by 75% in 2007, and abolished in 2010.

The macroeconomic impact of this reform is modest. Overall, activity is relatively unaffected (real GDP is down 0.3% on the baseline scenario for 2010). The loss of tariff income amounts to approximately 8% of total government revenue in 2010. This loss is offset by an increase of one-fifth in the average rate of VAT, which rises from 3.7% to 4.4% by 2010. The stepping up of the European Union's preferential status is reflected in a marginal rise in total import volume of the order of 2% compared with the baseline scenario level for 2010. All of these new imports come from Europe, and

relate essentially to a small number of agricultural products which were previously highly taxed, such as soft wheat, milk, sugar and other food products. The volume of imports of agricultural products from the Rest of the World declines, but proportionally less than the rise in imports from Europe. Domestic agricultural production is also affected. In other words, consumers substitute European imports for imports from the Rest of the World and local production. Faced with this intensified competition, Tunisian agriculture does not appear to be capable of reallocating its resources to more competitive types of production, due to the immobile structural nature of available land, a system of domestic support which remains highly focused on those sectors now exposed to European competition, and the impossibility of significant enlargement of commercial outlets abroad.

Industry cannot make up for these losses because it must cope with two phenomena by which it is penalized: firstly, the increase in fiscal pressure, and, secondly, the fall in domestic demand due to a fall in the relative price of agricultural compared with industrial products. However, industry is less affected than rural activity and benefits from the unification of protective tariffs. Factor demand in agriculture falls significantly. Agricultural wages decline, although less than income from land use thanks to increased labor mobility. The income of landowners is badly hit. The gap in real income widens between urban and rural households. The agricultural sector's very limited capacity obliges the Tunisian economy to cut its real exchange rate in order to ensure the viability of its balance of payments. In other words, the purchasing power of Tunisia for foreign-sourced products declines. This reform leads to a relative cut in welfare of -1.1% for rural households and a gain of $+1.0\%$ for urban households, compared with their available income in the baseline scenario for 2010.²⁰ In other words, the fall in consumer prices offsets the fall in urban household income levels. Conversely, it does not make up for the same fall in the case of rural household income levels.

Reduction in government support for agriculture. We simulate here the gradual reduction of domestic support for agriculture between 2001 and 2010. Production subsidies and consumption subsidies on cereals and oils are reduced along the same lines as in the preceding simulation: by 25% in 2001 compared with the baseline scenario, by 50% in 2004, by 75% in 2007 and by 100% in 2010.

The macroeconomic impact is once again limited, but it is positive (GDP has expanded by 0.8% by 2010). The magnitude of the fiscal impact is greater than in the case of unilateral liberalization of agricultural trade: reduced aid for agriculture leads to an increase in revenue equivalent to 11% of total public revenue. The average rate of VAT falls accordingly from 3.7% to 2.6%.

The major consequence of this reform is to reduce production generated by those agricultural activities which were previously assisted (hard wheat, soft wheat, milk, sugar) or which previously benefited from an indirect subsidy on intermediate consumption – milling for example.

For reasons symmetrical to those given in the case of the previous simulation, the fall in factor demand in the sectors affected by the reform is not offset by a sufficient increase in demand in other agricultural sectors. The affected sectors retain substantial advantages in terms of real effective protection, and the outlets which exports of other products could provide are limited by the barriers erected by the EU. This observation therefore seems to confirm what Lahouel says (1998) for the whole economy: that is, that domestic liberalization cannot be envisaged without associated liberalization of foreign trade: given the limited size of the Tunisian economy, efforts made to encourage competition cannot be effective unless there is combined liberalization of the domestic market and foreign trade.

This is not the case in the present simulation. Total agricultural production falls, despite the fact that some sectors (livestock, meat, other cereal crops, other food products) experience positive substitution effects. Conversely, the industrial sector appears to benefit from the reform: it is helped by the reduction in fiscal pressure, and expansion in domestic demand, since the cut in support for agriculture means that industrial products are less costly. A growing percentage of mobile factors is thus taken up by industry, and once again, the gap widens between the income levels of urban and rural households. Loss of revenue focuses particularly on a single factor – annual dry cropland – used principally for cereal crops. Agricultural wages remain comparatively unaffected however, which seems to indicate that support for agriculture mainly benefits owners of land used for cereal crops. The decline in the welfare of rural households is assessed at -3.2% by 2010 compared with the available income level in

the baseline scenario for the same period. Conversely, the welfare impact of the diminution of support for agriculture turns out to be positive for urban households, standing at +2.1% in 2010 compared with the baseline position.

The European Union also derives benefit from the reform due to its privileged position as an exporter of industrial products, towards which domestic demand turns. On the other hand, its agricultural exports to Tunisia do not increase since there has been no change in external barriers. The increase in total import volume (up by 5.3% by 2010 compared with the baseline scenario) is made up almost exclusively of European industrial products. This is offset by an increase, all monetary amounts being equal, in industrial exports to the European Union and the Rest of the World. Such exports are made more competitive by the fall in VAT. No real depreciation is to be observed in this simulation. In other words, the cut in support provided for agricultural activity allows Tunisia's industrial competitiveness to improve sufficiently (thanks to a decrease in fiscal pressure) to make up for the rise in imports generated by increased urban household income levels.

Increased access to the EU for Tunisian agricultural exports. We saw above that the two reforms envisaged by Tunisia are positive for the European Union. The abolition of tariffs imposed on EU agricultural exports automatically improves their competitiveness in the Tunisian market; and the reduction in support for agriculture increases, by substitution, demand for industrial products in Tunisia, a principal beneficiary of which is the EU, due to the preference granted by Tunisia to its products under the terms of the partnership agreement already in force.

It is therefore legitimate to allow that Tunisia may seek reciprocal concessions from its European partner, and this would automatically entail reform of the Common Agricultural Policy (CAP). This must however be proportional to the importance of such reform for Europe, and that importance remains limited²¹. No radical amendment to the CAP can therefore be expected as part of a change in the bilateral relationship between the EU and Tunisia. It is however possible to envisage reform of those measures which relate specifically and expressly to Tunisian products, such as the differential tariff policies dependent on quantities exported to the EU, which involve vegetable produce, oils and beverages. Agenda 2000 (European Commission, 1997), which lays down the broad lines of the common agricultural policy in the EU from 2000 onwards, makes no mention of quota-based policies with respect to products from the Mediterranean region.

Demand from the European Union is not explicitly specified in our model. We include "small country" assumptions, according to which Tunisia determines its export volume on the basis of the price paid for Tunisian exports on the European market. This price is exogenous, but Tunisia can modify the unit price it receives according to the quantity exported: by exceeding the quantity for which it has a preferential tariff, it increases the average tariff imposed upon it (leading to a lower pre-tariff export price), and it must therefore make greater efforts to be competitive. Equilibrium is reached when export price reduces production cost to a minimum. This mechanism can be expressed formally as shown below. If exports are taxed on the foreign market (the equivalent of a tariff t), the price at which the exporting nation can sell its goods changes in the following manner:

$$Pe_t / Pe_{t-1} = (1 + t_{t-1}) / (1 + t_t) \quad (2)$$

If the average tariff includes two tariff regimes, the export price paid to the producer will depend on export volume:

$$Pe_t [E + t_A \min[E, \bar{E}] + t_B \max[E - \bar{E}, 0]] = E(1 + t_0) \quad (3)$$

$$\text{where } t_0 \cdot E_0 = t_A \min[E_0, \bar{E}] + t_B \max[E_0 - \bar{E}, 0] \text{ and } Pe_0 = 1$$

We have simulated a reduction, staged over the period 2001 to 2010, of the preferential and maximum tariffs imposed by the EU on Tunisian exports of the products mentioned above, on the following lines: a reduction of 25% in 2001 compared with the baseline scenario, 50% in 2004, 75% in 2007 and 100% in 2010.

The reform has no effect on activity or on fiscal balance. Its main impact is on the export of oils, which have progressed by 150% by 2010 compared with the baseline volume, generating unit revenue up by 40%. The beverage sector also benefits from the reform, but to a lesser extent (exports are up 50% in volume, with unit revenue better by 5%). This growth in foreign demand leads to demand for agricultural production factors, increasing the revenue these can generate. Mobile factors also focus on the agricultural and food processing sectors. The gap in income level narrows between urban and rural households. The impact on welfare is very positive for rural households in this case (+2.7% compared with the baseline scenario in 2010), and marginally negative for urban households (-0.5%).

Within the agriculture and food sectors, a shift toward export sectors is observed in production. The decline caused in production in sectors competing with imports is offset by growth in imports of agricultural products. However, all in all, trade with foreign countries tends to lessen in volume terms due to the rise in the real exchange rate caused notably by increased agricultural wage levels (and through contagion from urban wage levels). Industrial exports and imports decline in volume.

In the end, then, the reform can be seen to be more favorable than not to Tunisian agriculture, but its impact is nevertheless restricted, since the reallocation of agricultural factors to expanding sectors is slowed by the incentives given to the Tunisian farmers and growers to compete with European producers. The next simulation integrates the combined effect of all three reforms described above.

Reciprocal reform of agricultural trade between Tunisia and the European Union. This combined reform amplifies the impact of the individual reforms taken separately. Its influence on macroeconomic activity is marginal (+0.5% GDP by 2010), and its consequences for fiscal balance are similar to the sum of the respectively negative and positive effects of the cut in agricultural tariffs and subsidies. We observe a slight cut in VAT rate, the latter standing at 3.4% in 2010 (compared with the baseline scenario's 3.7%).

Factor movements within the agricultural sphere are numerous. Agriculture devotes a much larger share of its resources to export crops. Exports of oils²² rise threefold in volume compared with the baseline level for 2010, and twofold for beverages. These two sectors alone account for the major part of the increase in agriculture and food exports (export volume rises by 33% overall). Conversely, agricultural activity is sharply down on the baseline scenario in areas of activity previously protected and assisted. Hard wheat, and to a lesser extent the other industrial crops, are particularly hard hit: their 2010 production volume is lower than the actual figure for 1992. The other sectors affected (soft wheat, milk, sugar, milling and other food industries) experience a worsening in their situation compared with the baseline scenario for 2010, but their production nevertheless tends to progress over time. Import substitution compensates for declining production in these sectors and, overall, agricultural production is down 2% on the baseline scenario figure for 2010. Greater access to the European market does not therefore offset completely the negative effects of liberalization where agriculture is concerned, despite a less marked institutional braking effect on the reallocation of production factors in agriculture. The relative decline in welfare comes out at -0.5% for rural households. The relative gain for urban households is +2.4%. Aggregate gain in welfare stands at +1.2% relative to baseline GDP for 2010.²³

The Tunisian industrial sector is substantially benefited by the liberalization of the agricultural sector, and its production in 2010 is 7% up on the baseline figure. A significant share of resources is taken up by this activity and urban factor return rises significantly.

The European Union is also substantially benefited by combining the reforms: its exports to Tunisia are up 10% by 2010 on the baseline level. Its imports from Tunisia also rise, but to a lesser extent, with the result that over the period 1992 to 2010 Europe's trade balance with Tunisia is better by TND 0.5bn than the baseline level.

It gains a strengthened preferential regime and increased domestic demand. The Rest of the World sees a cut in its export volume, with the result we witness an absolute trade diversion phenomenon. This is somewhat less marked than in the simulation of unilateral liberalization of agricultural trade with Europe, due to a smaller loss of revenue, which tends to control the decline in Tunisian demand for products from the Rest of the World.

Multilateral reform of agricultural and industrial trade. This last scenario adds to the simulation of the three reforms discussed above a cut in the tariffs applied to industrial and agricultural products from the Rest Of the World similar to that implemented up to that time on European products alone.

In this final scenario, Tunisian agriculture goes irrevocably down the road of globalization. An increasingly large share of its resources is devoted to export crops, which progress by 40% in volume terms compared with the 2010 baseline. Despite the fact that mobile resources devoted to agriculture are generally at lower levels than in the previous or the baseline scenarios, they are more effectively employed and the revenue they generate declines less quickly than consumer prices. As a result, the real income of rural households increases. There is a general opening up of the country to trade: total exports are up 14% and imports 15%. Gross domestic product expands by 1.2%, despite an increase in tax on value added (from 3.7% to 4.2% by 2010). For the first time, gains in welfare are positive for both categories of Tunisian household. They nevertheless remain on an unequal footing: the improvement in the welfare of urban households equates to a rise of +4.5% in their available income, compared with only +0.2% in the case of rural households. In absolute terms, the gap is even more striking, since the marginal amount generated by the reform is approximately eighty times greater for urban than for rural households. Aggregated improvement in welfare is equivalent to a rise by 2010 of +2.5% in GDP over the baseline scenario.

The major difference from the preceding scenario is the fact that we no longer observe any phenomenon of trade diversion. The percentage of Rest of the World imports is significantly greater than the baseline figure. Europe continues to benefit from Tunisian domestic reforms, but its exports rise less quickly than in the previous scenario. Its trade balance with Tunisia remains positive and unchanged from the baseline scenario in 2010. It may however be considered that it derives benefit from the increase in household income in Tunisia on another level: that of migrant pressure.

One final scenario could be envisaged: one in which agriculture and industry liberalizes trade with all the country's partners without awaiting any corresponding concession from the EU. This policy does however produce more limited gains in welfare at the aggregate level than the policy described above (2.1% against 2.5%), and it is particularly detrimental to rural households, whose welfare is sharply down on the baseline scenario by 2010 (-3.1%).

VII. Conclusion

The institutional attachment of Tunisia to the European Union provides it with an opportunity to leave behind the agricultural policy it has pursued hitherto, which has been largely directed at ensuring self-sufficiency in food. This policy is turning out to be a costly one for Tunisia, but allows the loss of purchasing power of its rural households, already much lower than that of urban households, to be mitigated. Given this, changes in agricultural policy can be envisaged only where they do not degrade even further the situation of rural areas, a consideration which involves, directly or indirectly, a quarter of the country's population. Faced with significant reallocation costs (Rutherford, Ruström and Tarr, 1995), it is probably more appropriate, where the gain in aggregate welfare is similar, to opt for any policy which reduces as far as possible the loss of welfare for rural households.

Our results suggest that a unilateral reduction in the protection and support of Tunisian agriculture is not likely to improve the situation of rural communities. Nor is it likely to improve significantly the wealth of the Tunisian economy, of which a part could be indirectly redistributed to rural households to offset their losses. This negative outcome can be explained by Tunisian agriculture's limited capacity for reallocation and adjustment. This sector seems to enjoy a relative advantage in terms of tree-crops and their derivatives (olives specifically), but its production capacity is nevertheless limited by the very nature of those crops (for which the investment payback time is very long) and by the constraint imposed by natural resources. Moreover, the tariff quota policy currently applied by the European Union under the common agricultural policy acts as a brake on any expansion of its potential commercial outlets.

Reform of Tunisian agriculture is viable only if accompanied by greater access to the European market for the country's exports. Tunisia would be entitled, as part of a deepening of its partnership with the

EU,²⁴ to ask for concessions of this type in return, since the liberalization of its agriculture would be of significant benefit to the EU for two reasons. The first is that the EU would gain a great deal from reductions in the tariffs imposed on its agricultural exports to Tunisia, as well as from cuts in domestic support for agriculture in Tunisia, since this support essentially covers products competing with those of the EU. The second is that the rise in the income levels of urban households generated by agricultural reform would lead to a significant increase in the demand for industrial imports. And in this event, because of the preferential status granted by Tunisia to the European Union, the latter would be benefited, to the detriment of the Rest of the World.

In this new context, the loss of welfare in rural communities would be limited, and the resulting gain for the Tunisian economy would allow the losses incurred by rural households to be largely offset. This concession is therefore of critical importance for agriculture in Tunisia, and very probably determines whether reform in the sector is politically feasible or not.

However, the fact that the development of Tunisian agriculture depends in large measure on its relationship with the EU does not mean that Tunisia could not derive benefit from multilateral liberalization of its foreign trade. In deciding to grant the same trading privileges to its other partners, it would maximize its potentiality for growth while minimizing losses in its agricultural sector. It would also eliminate any risk of finding itself in non-compliance with WTO rules on the compatibility of regional agreements with the non-discrimination principle. The European Union would lose out in terms of commercial outlets for its exports, but it would gain in terms of the stability and economic development of Tunisia, which was main motivation driving the EU to strengthen its partnership with Tunisia in the first place.

NOTES

¹ These two studies assume perfect mobility of physical capital between sectors, which means that their computerized simulations should be seen more in the long-term context.

² COMETE Engineering (1996).

³ The government also imposes upon farmers and growers in the north-west of the country wanting to use the public irrigation network an obligation to devote at least a minimum percentage of their land to beet and tobacco.

⁴ An annual increase of 9.1% for industrial products and 8.7% for agricultural products between 1970 and 1995 (COMETE Engineering, 1996).

⁵ See Fontagné and Périody (1997) for a detailed presentation of the regulatory framework.

⁶ An exhaustive list of agricultural products can be found in Annex I of the Treaty of Rome as updated following the signing of the Amsterdam Treaty in 1997. It includes all products from soil cultivation, animal husbandry and fisheries, plus products derived from first-stage processing related directly to such products. In practice, all agricultural products and most food products are included in this Annex.

⁷ Two criteria, which are still under discussion, seem to have been selected by the WTO to assess the scope of trade (Solagral, 1998). The first is quantitative. The WTO considers that 80% to 90% of the total value of trade must be included in the agreement. It is unfortunately not made clear whether the basis of assessment of the value of such trade is what is actually observed or the amount which one would obtain by liberalizing a greater share of trade. If the former applies, the parties to the agreement can achieve sufficient coverage by excluding the most sensitive products. The second criterion is qualitative. It is not possible to exclude from the agreement any whole sector, such as agriculture for example, even if the monetary value of the trade in that sector is low.

⁸ The model includes approximately one hundred generic equations, each describing the behavior of an agent or a market, or an accounting linkage. When all the dimensions of the model are taken into account (number of sectors, households, and so on) the number of equations per period totals some six thousand.

⁹ These elasticities come from the most recent literature devoted to this type of model. They are not specific to Tunisia. See most notably Burniaux, Nicoletti and Oliveira-Martins (1992).

10 Labor supply also includes an endogenous component determined by changes in level of real wages. Price-elasticities are in the range from 0.10 for the most highly qualified workers to 0.30 for the least qualified and/or casual workers.

11 In constructing the baseline scenario, a figure is defined for the rate of growth in the economy. Total factor productivity will then be endogenous. When simulating alternative policies, the previously estimated total factor productivity becomes exogenous and gross domestic product endogenous.

12 These forecasts take account of population movements from rural to urban areas.

13 This comes down to saying that we assume that effective exploitation of new land offsets losses due to erosion and desertification.

14 See Abed (1998), for a discussion on the capacity of the Tunisian tax administration to develop alternative fiscal instruments permitting the loss of tariff income to be made up.

15 The model makes no distinction between public and private investment. Public savings are merged with private savings in determining the level of investment.

16 Morrisson and Talbi (1996) estimate that total factor productivity grew by between 0.9% and 1.3% annually throughout the period 1962 -1993.

17 The average level of effective protection is defined by weighting in each period the effective protection rate of each sector by its production in volume terms. The measurement of effective protection levels can be found in Hoeckman and Djankov (1997).

18 The effect of reallocation can be assessed as follows:

$$\sum_i^N (a_{i,2010} - a_{i,1992})^2 / N$$

where $a_{i,t}$ is the share of sector i in period t in the production of all activities (industry or agriculture and food), which comprise N sectors.

19 This effect could be increased by the expected rise in world food prices following the implementation of GATT (Goldin, Knudsen and van der Mensbrugge, 1993), which is not taken into account here.

20 The chosen yardstick for welfare is the assessment of compensatory variation proposed by Sadoulet and de Janvry (1995). If E is the monetary equivalent of the utility function, and y available income, then measurement is as follows for period t :

$$(y^* - y) - (E(p^*, u) - E(p, u))$$

where u is utility, p the price system, and the star exponent the reform. The first term, $y^* - y$, measures the gain (or the loss) of revenue caused by the reform. The second term measures the revenue needed after the reform to obtain the same level of utility as before the reform.

21 In 1996, Tunisian exports accounted for 0.6% of EU imports compared with the Rest Of the World. In 1995, Tunisian imports accounted for 0.7% of EU exports to the Rest Of the World (Bayar, 1998).

22 Exports of olive oil rise much more rapidly than total production of olive oil, which by 2010 is up only 17% on the baseline figure (due to the resource constraint of land for tree-crops). Exports substitute for production intended for the domestic market. Conversely, imports of groundnut oil and sunflower-seed oil from Europe are multiplied by 3.5 in volume terms in order to satisfy domestic demand.

23 Variation in aggregated welfare is measured by dividing the sum of the compensatory variations by the baseline figure for gross domestic product in 2010.

24 This concession could also be discussed in the WTO as part of future multilateral negotiations. It is nevertheless premature to make assumptions as to the nature and scope of any such talks. Although it is probable that agriculture will be the central focus, the general shape of the discussions has not yet been determined (Konandreas, 1998). Notably, uncertainty surrounds the question of whether they will be conducted at sectoral level, as is provided in Article XX of GATT, or on a wider basis so as to include all sectors in the same discussion, and to deal with new issues such as the environment or competition policies.

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Appendix 1: Detailed results

We give below the detailed results for the various simulations. For each variable of interest, the first and second columns contain the values obtained in the baseline scenario for 1992 and 2010. The next five columns contain the values obtained for 2010 in the alternative policy simulations: unilateral liberalization of trade with the EU (A1), reduction of domestic support (A2), increased access to the EU market (A3), the combination of the three reforms A1, A2 and A3 (A123), the combination of reforms A2, A3 and the liberalization of agricultural and industrial trade with all partners (A4).

Table A1: Macroeconomic results

	1992	2010	A1	A2	A3	A123	A4
Real Gross Domestic Product	12.31	33.67	33.56	33.94	33.68	33.83	34.06
Total production	27.17	75.57	74.82	78.29	75.08	76.71	80.13
Private consumption	9.82	26.43	26.60	26.68	26.53	26.96	27.46
Investment	3.65	8.96	8.79	9.22	8.98	9.05	9.21
Public consumption	2.19	2.87	2.87	2.87	2.87	2.87	2.87
Exports	4.23	17.27	17.59	18.18	17.08	18.19	19.75
Exports to EU	3.33	11.91	12.54	12.13	11.91	12.86	12.38
Exports to R.O.W.	0.89	5.36	5.04	6.05	5.17	5.34	7.37
Imports	6.10	18.17	18.49	19.08	18.13	19.27	20.83
Imports from EU	4.53	15.19	16.01	16.00	15.12	16.70	15.63
Imports from R.O.W.	1.57	2.98	2.48	3.09	3.01	2.57	5.20
VAT revenue	0.90	2.46	2.94	1.87	2.48	2.41	2.84
Tariff revenue	1.13	1.00	0.42	1.00	1.02	0.43	0.04
Physical capital stock	24.62	81.35	81.00	82.23	81.39	81.88	82.64
Real rural available income	776	1,751	1,733	1,706	1,801	1,755	1,771
Real urban available income	1,397	2,862	2,890	2,930	2,852	2,939	3,006
GDP deflator	1.00	1.01	0.98	1.02	1.01	1.01	1.01
Labor remuneration							
Agricultural family	1.00	1.68	1.56	1.68	1.76	1.67	1.65
Unqualified agricultural workers	1.00	1.70	1.62	1.71	1.72	1.65	1.62
Qualified agricultural workers	1.00	2.37	2.22	2.46	2.38	2.33	2.26
Unqualified casual workers	1.00	1.72	1.67	1.78	1.72	1.74	1.77
Qualified casual workers	1.00	1.78	1.74	1.76	1.79	1.73	1.74
Return on capital							
Natural resources	1.00	2.59	2.50	2.70	2.58	2.59	2.65
Annual dryland	1.00	6.10	5.07	3.84	6.19	3.25	3.16
Annual irrigated land	1.00	3.67	3.22	3.81	3.62	3.26	3.32
Permanent dryland	1.00	3.34	2.49	3.65	6.15	6.00	5.83
Permanent irrigated land	1.00	3.16	3.19	3.28	2.56	2.63	2.54
Date-growing land	1.00	6.01	5.89	6.20	5.95	5.98	6.07
Forest	1.00	8.51	5.89	9.23	8.43	6.26	5.69
Physical capital	1.00	0.80	0.80	0.82	0.79	0.81	0.81

Note: These macroeconomic aggregates are expressed in billions of 1992 TND. Real available income levels are the available income levels per inhabitant in 1992 TND, divided by the consumer price index for each area.

Table A2: Sectoral Output (TND millions 1992)

	1992	2010	A1	A2	A3	A123	A4
Soft wheat	54	112	91	102	111	83	85
Hard wheat	348	367	378	297	367	303	306
Barley	87	84	84	93	87	96	97
Other cereal crops	61	168	167	184	162	173	148
Legumes	71	123	126	132	122	133	134
Forage crops	66	142	141	149	141	147	145
Beet	10	24	18	20	24	16	16
Other industrial crops	14	17	11	17	16	10	9
Olives	420	442	424	450	504	511	513
Citrus fruit	93	180	178	181	186	186	188
Dates	127	183	184	184	182	183	184
Grapes	20	58	58	60	65	71	72
Other fruit	328	554	558	554	525	520	511
Vegetables	410	797	801	805	790	799	799
Other agricultural products	25	38	37	42	37	39	41
Livestock	782	1747	1738	1806	1731	1781	1754
Forestry	61	99	95	100	98	95	94
Fisheries	246	657	654	652	656	647	647
Meat	596	1422	1428	1484	1409	1477	1437
Milk	181	423	362	358	422	304	310
Flour-milling	555	1032	1074	858	1036	890	894
Edible oils	480	495	472	503	574	580	582
Canned goods	204	477	493	480	457	471	471
Sugar	140	324	248	277	328	213	215
Other food products	733	2136	1994	2195	2075	1952	1953
Beverages	247	781	780	811	880	954	977
Mining and quarrying	1031	2765	2602	3045	2720	2783	3281
Steel-making	347	685	656	724	682	690	701
Metals	389	1182	1160	1245	1171	1208	1243
Agricultural machinery	204	527	509	540	525	522	506
Transport materials	334	846	818	860	846	834	818
Electrical materials	285	1083	1020	1097	1086	1042	1083
Electronic materials	188	378	359	398	378	379	393
Household equipment	90	265	253	274	265	263	265
Chemicals	1366	8243	7174	10399	7808	8378	13614
Yarn	603	1235	1216	1288	1229	1272	1126
Carpets	70	222	219	224	224	224	222
Clothing	1721	2797	2607	2893	2808	2740	2328
Leather	350	4087	5522	4323	3876	5765	3833
Wood industry	453	1211	1184	1238	1218	1218	1180
Paper industry	333	870	862	895	860	876	857
Plastics	182	593	574	620	591	598	627
Other manufactured products	165	620	597	639	623	620	620
Petroleum oil and gas	1362	1429	1428	1432	1429	1430	1431
Electricity	415	973	923	1054	963	978	1133
Water	117	246	239	254	246	245	260
Construction	1871	4983	4889	5123	4993	5033	5123
Commerce	1540	4860	4867	5142	4780	5058	5126
Transport	1337	4154	4172	4004	4170	4039	4003
Communication	248	809	809	796	811	796	797
Hotels and restaurants	1242	3619	3617	3662	3632	3674	3704
Finance	622	2095	2037	2174	2091	2102	2240
Other services	227	3762	3868	3002	3873	3224	2887
Real estate	609	2646	2595	2619	2671	2592	2610
Repairs	248	1002	990	1003	1006	992	1013
Health	398	1448	1407	1472	1461	1446	1466
Public services	2462	3054	3052	3058	3053	3057	3057

Table A3: Sectoral exports (TND millions 1992)

	1992	2010	A1	A2	A3	A123	A4
Soft wheat	0	0	0	0	0	0	0
Hard wheat	0	0	0	0	0	0	0
Barley	5	0	1	1	0	1	1
Other cereal crops	0	1	1	1	0	1	1
Legumes	1	0	0	0	0	0	0
Forage crops	0	0	0	0	0	0	0
Beet	0	0	0	0	0	0	0
Other industrial crops	2	1	1	1	1	1	1
Olives	0	0	0	0	0	0	0
Citrus fruit	8	8	8	7	9	9	9
Dates	44	24	27	24	23	24	24
Grapes	0	0	0	0	0	0	0
Other fruit	2	1	1	0	0	0	0
Vegetables	5	2	3	2	2	3	3
Other agricultural products	3	1	1	1	1	1	1
Livestock	5	6	9	7	6	9	10
Forestry	0	0	0	0	0	0	0
Fisheries	25	121	121	112	122	113	110
Meat	1	1	1	1	1	2	2
Milk	1	1	2	1	1	1	1
Flour-milling	9	4	7	1	4	1	1
Edible oils	141	89	98	88	228	265	271
Canned goods	65	129	146	128	113	124	124
Sugar	2	5	5	2	5	2	2
Other food products	38	445	526	463	407	488	531
Beverages	13	115	130	124	178	228	235
Mining and quarrying	126	376	352	404	370	370	436
Steel-making	51	138	129	148	137	138	143
Metals	36	165	159	175	163	167	174
Agricultural machinery	38	159	151	162	157	154	149
Transport materials	50	244	232	246	243	235	233
Electrical materials	210	786	738	792	788	751	787
Electronic materials	32	118	110	127	118	118	129
Household equipment	13	61	57	64	61	60	62
Chemicals	467	4441	3745	5816	4160	4496	8034
Yarn	93	193	193	202	191	202	173
Carpets	14	61	61	60	61	61	60
Clothing	1300	1992	1837	2070	1997	1941	1569
Leather	129	2589	3614	2748	2438	3775	2408
Wood industry	13	58	56	58	59	58	57
Paper industry	31	119	117	123	118	120	119
Plastics	23	162	152	173	161	161	180
Other manufactured products	30	190	181	197	191	189	190
Petroleum oil and gas	540	153	164	140	154	154	142
Electricity	0	0	0	0	0	0	0
Water	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0
Commerce	0	0	0	0	0	0	0
Transport	504	1450	1491	1307	1461	1366	1287
Communication	20	83	84	77	83	79	76
Hotels and restaurants	0	0	0	0	0	0	0
Finance	15	94	92	93	94	92	95
Other services	119	2682	2780	2032	2777	2232	1917
Real estate	1	11	11	10	12	10	10
Repairs	0	0	0	0	0	0	0
Health	0	0	0	0	0	0	0
Public services	0	0	0	0	0	0	0

Table A4: Sectoral imports (TND millions 1992)

	1992	2010	A1	A2	A3	A123	A4
Soft wheat	72	200	260	153	203	195	195
Hard wheat	8	54	64	36	55	43	42
Barley	1	6	8	5	6	6	6
Other cereal crops	37	118	107	112	117	101	125
Legumes	0	1	1	1	1	1	1
Forage crops	0	3	5	2	3	4	3
Beet	0	0	0	0	0	0	0
Other industrial crops	39	122	123	126	119	123	123
Olives	0	0	0	0	0	0	0
Citrus fruit	0	0	0	0	0	0	0
Dates	0	0	0	0	0	0	0
Grapes	0	0	0	0	0	0	0
Other fruit	4	13	25	14	15	29	56
Vegetables	5	21	25	21	21	26	29
Other agricultural products	5	23	24	23	23	24	29
Livestock	14	28	46	28	29	47	45
Forestry	3	21	35	23	22	38	42
Fisheries	1	2	2	3	2	2	3
Meat	22	64	167	62	65	170	162
Milk	54	131	219	145	132	242	245
Flour-milling	2	7	10	10	7	15	15
Edible oils	85	320	360	337	358	425	503
Canned goods	2	5	7	5	5	8	9
Sugar	60	124	220	134	126	242	244
Other food products	60	130	408	131	133	427	485
Beverages	10	23	42	24	23	41	42
Mining and quarrying	91	430	406	481	423	439	600
Steel-making	452	1306	1270	1361	1303	1318	1368
Metals	138	517	514	542	511	532	568
Agricultural machinery	889	2135	2099	2197	2139	2162	2212
Transport materials	536	1600	1573	1639	1604	1613	1646
Electrical materials	250	706	683	729	707	705	736
Electronic materials	251	672	655	692	674	676	698
Household equipment	22	94	93	97	95	95	101
Chemicals	618	2729	2562	3125	2658	2801	3749
Yarn	928	1981	1928	2057	1980	2017	1830
Carpets	0	1	1	1	1	1	2
Clothing	248	656	636	667	663	656	661
Leather	96	416	492	434	405	513	405
Wood industry	97	306	300	316	307	310	354
Paper industry	139	463	461	476	458	467	475
Plastics	74	267	267	273	267	273	281
Other manufactured products	73	179	175	184	180	180	186
Petroleum oil and gas	401	1459	1401	1538	1451	1456	1652
Electricity	0	0	0	0	0	0	0
Water	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0
Commerce	0	0	0	0	0	0	0
Transport	188	586	572	610	586	591	621
Communication	8	22	22	23	22	22	23
Hotels and restaurants	0	0	0	0	0	0	0
Finance	17	43	42	46	43	44	47
Other services	102	183	178	200	181	189	212
Real estate	1	2	2	2	2	2	2
Repairs	0	0	0	0	0	0	0
Health	0	0	0	0	0	0	0
Public services	0	0	0	0	0	0	0

Appendix 2: Sensitivity analysis of variations in welfare

Here we test the influence of the various hypotheses on the nature of the results obtained in terms of variations in welfare. The first (VAT) relates to the unification of the VAT rate, which is assumed to be staged. The second relates to the balanced budget rule (BUD). The third concerns the rate of growth in the economy (GDP). The fourth relates to the values for international trade substitution elasticities (INT). The fifth concerns substitution elasticities between fixed and mobile factors (MOB).

The first column in the next table contains the variations in welfare to which reference is made in the body of the text. Differences in the welfare of households are measured for 2010 comparative to baseline available income. Aggregate variation in welfare is the sum of the compensatory variations divided by 2010 baseline GDP.

Table A5: Sensitivity analyses

	BASE	TVA	BUD	PIB	INT	MOB
A1: Rural	- 1.1	- 0.9	0.9	- 1.0	- 0.1	- 1.1
A1: Urban	1.0	0.4	0.5	0.9	0.2	1.0
A1: Aggregate	0.3	0.0	0.4	0.3	0.1	0.3
A2: Rural	- 3.2	- 4.3	- 6.3	- 3.2	- 4.7	- 2.6
A2: Urban	2.1	2.3	2.5	2.1	2.5	2.1
A2: Aggregate	0.5	0.4	0.2	0.5	0.4	0.6
A3: Rural	2.7	2.9	2.8	4.0	3.2	3.3
A3: Urban	- 0.5	- 0.6	- 0.5	- 0.6	- 0.6	- 0.6
A3: Aggregate	0.3	0.2	0.3	0.4	0.4	0.3
A123: Rural	- 0.5	- 1.2	-1.4	0.8	-1.2	0.6
A123: Urban	2.4	1.9	2.3	2.1	2.0	2.3
A123: Aggregate	1.2	0.8	0.9	1.3	0.8	1.3
A4: Rural	0.2	-1.2	0.5	1.5	- 0.7	1.9
A4: Urban	4.5	4.3	4.4	4.0	2.7	4.3
A4: Aggregate	2.5	2.1	2.4	2.5	1.3	2.6

The first sensitivity analysis involves carrying out the same simulations as those described above, but without including an assumption that the VAT rate is gradually unified. The sectoral VAT rate vector therefore remains unchanged from 1992, and adjusts homothetically in line with budget shock. The retention of the initial VAT vector appears to disadvantage urban households compared with rural households: when the VAT rate is increased to offset loss of tariff revenue, the gain in welfare for urban households is smaller than before (0.4% against 1.0%). Symmetrically, a cut in VAT made possible by reduction of public aid to agriculture worsens the decline in welfare for rural households. The negative impact for rural households of a cut in this indirect tax is present in the same way in the case of the combined reforms. Reform of the VAT system does however appear to have only a limited impact on the outcome, which would seem to contradict the results previously obtained by Rutherford, Ruström and Tarr (1995) and Decaluwé and Souissi (1996). The explanation for this discrepancy probably lies in the fact that the authors consider all indirect taxes without distinction, whereas we consider four distinct types (VAT, other indirect taxes, production subsidies and consumption subsidies, *cf.* Table 3), and we consider reform of only the first of these.

The second sensitivity analysis involves modifying the balanced budget rule. Endogenous variation in fiscal revenue (aimed at maintaining a predetermined fiscal balance) is no longer obtained by shifting the VAT vector, but by homothetic changes in the rate of direct taxation on households. We can see here that the increase in fiscal pressure aimed at making up for the loss of tariff revenue favors rural

households, which are subjected to less pressure than if fiscal compensation took the form of a rise in VAT (+0.9% against -1.1%). Conversely, a diminution in fiscal pressure disadvantages such households greatly (-6.3% against -3.2%).

These two budget policy alternatives do not however modify the tenor of the conclusions given above: agricultural liberalization without corresponding concessions from Europe penalizes rural households greatly, and is only marginally offset by a gain in aggregated welfare. The gain in welfare derived from increased access to the European market is not changed by the revised budget balance rules, since this shock has no effect on fiscal balance.

The next three analyses test the robustness of the conclusions when exogenous hypotheses are modified and in relation to the behavior of agents. The first involves a downward revision of growth forecasts. GDP is made to grow in this case at the annual rate of 4% over the period 1998 to 2010, compared with the previous figure of 5.7%. It can be seen that this change affects the results only marginally, with the exception of the gain of welfare for rural households after the removal of European quotas (+4.0% compared with +2.7%). This can be explained by the fact that the nominal gain from this shock, which can be considered to be exogenous, is identical in both simulations, but the denominators, the available income levels, are very different since they are directly related to the assumed growth rate.

The fourth analysis tests the impact on the results of a modification of substitution elasticities in international commerce. These are halved for imports and exports, at first and second levels. This cut in substitutability between domestic and foreign products reduces the magnitude of the impact of a cut in tariffs. On the other hand, it increases the impact of a cut in support for domestic products. Prices for the latter rise, but consumers do not turn toward foreign products.

The final analysis looks at factor mobility. We double the substitution elasticity between capital and labor, and between the different types of capital. This shows that the cost of agricultural liberalization is lower for rural households, who now have more capacity for adjustment. The gain from the removal of European quotas is also greater, because producers can now devote a larger percentage of their resources to the new commercial outlets.

However, once again, the conclusions given above as to the benefits of liberalizing the Tunisian agricultural sector, whether or not this is accompanied by corresponding concessions from the EU, remain fundamentally unchanged.

Appendix 3: The dimensions of the Model

The model includes three types of household:

- 1 Rural
- 2 Urban
- 3 Tourist

The model makes a distinction between two trading partners for Tunisia:

- 1 European Union (15)
- 2 Rest Of the World

The model makes a distinction between five categories of worker:

- 1 Agricultural farming families
- 2 Unqualified, permanent paid agricultural workers
- 3 Qualified, permanent paid agricultural workers
- 4 Unqualified casual workers
- 5 Qualified urban workers

The model makes a distinction between eight types of capital stock:

- 1 Physical capital stock
- 2 Reserves of crude oil and phosphates
- 3 Annual dryland
- 4 Annual irrigated land
- 5 Permanent dryland
- 6 Permanent irrigated land
- 7 Date-growing land
- 8 Forest

The model comprises 57 sectors of activity, and 57 associated products. The exhaustive list is given in Tables A2. Sectors have been aggregated for presentational purposes in the body of the text. The following aggregates are made up as follows: *major field crops*: sectors 1-8; *tree crops*: sectors 9-13; *market gardening*: sector 14; *livestock*: sector 16; *forestry*: sector 17; *miscellaneous*: sector 15; *fisheries*: sector 18; *agriculture*: sectors 1-18; *food processing*: sectors 19-26; *industry*: sectors 27-43; *services*: sectors 44-57.