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Trade Options for the Palestinian Economy

Some Orders
of Magnitude

by
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Trade Options for the Palestinian Economy: Some Orders of Magnitude

by

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Middle East and North Africa Region

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خلاصة

تقيم الدراسة تقييما كميا البدائل (الخيارات) المختلفة لنظام التجارة الفلسطيني مستقبلا. ومع اقرار التحليل بأن القيود على حركة السلع والأشخاص كان لها أثر سلبي على أداء التجارة الفلسطينية، فانه يشير الى أن الاتحاد الجمركي الحالي كانت له أيضا آثار باهظة. والتحرك نحو نظام تجاري أكثر استقلالية يمكن أن يحقق مزايا اذا استخدم لتخفيض الضرائب على الواردات وبالتالي تخفيض الأسعار المحلية للواردات. ويتم تقييم انشاء منطقة تجارة حرة مع اسرائيل – مما سيستدعي تنفيذا قد يكون باهظ التكلفة لقواعد المنشأ – مقابل تنفيذ نظام غير تمييزي تتخلى بموجبه الضفة الغربية وقطاع غزة عن امكانية الوصول التفضيلي الى الأسواق الاسرائيلية. ويستند التحليل الى عمليات محاكاة لنموذج توازن عام للاقتصاد الفلسطيني قابل للحساب الالكتروني باستخدام مصفوفة المحاسبة الاجتماعية لعام ١٩٩٨ كأساس لذلك.

Résumé

Le document évalue de manière quantitative différentes options pour le futur régime commercial Palestinien. Tour en reconnaissant que les restrictions sur les mouvements de biens et personnes ont eu un impact négatif sur le commerce extérieur, l'analyse suggère que l'union douanière en place a également été coûteuse. Le passage à un régime plus autonome présente des avantages s'il sert à réduire les taxes d'importation, et ainsi le prix intérieur des importations. La création d'une zone de libre-échange avec Israël, qui requiert l'adoption de règles d'origine potentiellement coûteuses, est comparée a celle d'un régime non discriminatoire dans lequel la Cisjordanie et Gaza renoncent à leur accès préférentiel au marché israélien. L'analyse se fonde sur des simulations effectuées a l'aide d'un modèle d'équilibre général calculable de l'économie Palestinienne, calibré sur la matrice de comptabilité sociale de 1998.

Summary

The paper quantitatively assess different options for the future Palestinian trade regime. While acknowledging that restrictions on movements of goods and people have had a negative impact on Palestinian trade performance, the analysis suggests that the current Customs Union has been costly as well. Moving toward a more autonomous trade regime may present advantages if used to reduce import taxes thereby lowering the domestic price of imports. Creating a Free Trade Area with Israel, necessitating a potentially costly implementation of rules of origin, is weighted against implementing a non-discriminatory regime in which West Bank and Gaza renounce to its preferential access to the Israeli market. The analysis is based on simulations of a Computable General Equilibrium model of the Palestinian economy using the Social Accounting Matrix for 1998 as base.

Trade Options for the Palestinian Economy : Some Orders of Magnitude

I. Overview

It is most likely that the choice of a future trade regime for the Palestinian economy will be determined not by economic criteria alone. Political choices will necessarily affect the range of possible options. Moreover, the choice of a trade regime has major implications for fiscal and labor policies. However, it remains useful to assess quantitatively the impact of different trade regimes *per se* in order to inform the debate. Such an analysis would be an important, but hardly the only, informational factor for the parties making choices.

The guiding principles for the current Palestinian trade regime is laid out in the Paris Protocol signed in 1994, which formalizes the *de facto* customs union with Israel in effect since 1967. A continuation of this system, which grants preferential access for Israeli goods on the Palestinian market and vice versa, would require a great degree of harmonization of trade and fiscal policies between the two economies. On the other hand, granting more autonomy to the Palestinian authorities to determine its future trade regime with regard to Israel and third parties, as well as its fiscal policy (e.g. the rate of VAT), would necessitate adopting another kind of trade relationship with Israel. Several options could be envisaged in this respect, from the implementation of a free trade agreement, which would maintain preferential trade between the two partners, to the adoption of a non-discriminatory regime, in which Israel would be considered by West Bank and Gaza as any other country.

According to a number of studies[1], the poor trade performance of the Palestinian economy since 1993 is primarily the result of an imperfect implementation of the Paris Protocol, caused mainly by restrictions on movement of goods and people at borders and within West Bank and Gaza as a result of security measures implemented by Israel. Without playing down the negative impact of movement restrictions, this paper argues that other factors have also played an important role. In particular, the current trade and fiscal regimes have led to significant trade diversion, as well as increased dependency on Israeli security concerns. This paper also argues that moving towards a more autonomous Palestinian trade regime may present some advantages, but

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[1] See notably UNCTAD (1998), Alonso et al. (1999), and European Commission (1999).

that the final outcome will depend on the design of the new trade policy, and the extent to which transaction costs will be affected by the new trading environment. A more autonomous regime may be rewarding if used to lower the domestic price of imported goods, develop competitive markets and re-balance trade flows with Israel and the rest of the world. There are important options to be considered. Given the low level of tariff duties in Israel, West Bank and Gaza could also consider renouncing its preferential access to the Israeli market by adopting a non-discriminatory regime with low external tariffs, as opposed to creating a Free Trade Area with Israel which could imply costly rules of origin.

If the theoretical debate on the desirability of different trade options for West Bank and Gaza has already been the object of several publications,[2] the empirical literature on the subject remains very poor. To our knowledge, only a few quantitative estimates of the impacts of different trade regimes have been produced (e.g. Arnon, 1996) and these are generally outdated. The common argument raised for not undertaking such studies is the lack of adequate data (Kanafani, 1996), regarding trade flows between Israel and the Palestinian economy. The Palestinian Central Bureau of Statistics (PCBS) has been producing, since 1997, supply and use tables (SUT) which now, to a large extent, permit this obstacle to be overcome. The SUT offers a coherent picture of the different flows occurring among economic agents (producers, consumers, government, trade partners), by reconciling the supply and demand dimensions of the Palestinian economy in each market.[3] It gives then the amount of export and imports by products that is consistent with the output in each activity and the consumption (intermediate and final) in each market. It also permits some of the trade distortions that affect the Palestinian economy to be identified and measured.

We use the supply and use table for 1998 to calibrate an economy-wide computable general equilibrium (CGE) model designed to assess the impact of different trade policies. Such type of model has become a standard tool for integrated assessment of trade policies for small economies.[4] Its main advantage lies in the possibility of combining detailed and consistent databases with a theoretically sound framework, able to capture feedback effects and market interdependencies, that may either mute or accentuate first-order effects.

This paper is organized as follows. Section II describes the current patterns of trade and trade policies in the Palestinian economy. Section

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[2] See for instance Kanafani (1996) and Panagarya and Diwan (1997).
[3] The supply and use table does not include East Jerusalem.
[4] See for instance Rutherford, Rustrom and Tarr (1997), for Morocco, or Dessus and Suwa (2000), for Egypt and Tunisia.

III presents the CGE model. Section IV reports the results of the analysis and Section V concludes.

II. Trade Patterns and Trade Policies.

The most important current trade partner of West Bank and Gaza is Israel. Of the total estimated imports of US$ 3.2 billion in 1998, approximately 3/4 originated in Israel (cf. Table 1). Figures for trade between West bank and Gaza and Israel are subject to some degree of uncertainty because not all trade flows between Israel and the Palestinian economy are registered due to the porous border, especially between Israel and West Bank.[5] When balancing the Supply and Use table, however, correction is made for the estimated value of unregistered trade. With regard to exports, Palestinian trade is estimated to be even more one-sided with around 95 percent of exports destined for Israel. This is a result of both the historical circumstances, notably Israel's lack of trade with Islamic countries, the current trade regime, and other impediments to Palestinian trade with third parties. The following table presents an estimation of trade patterns for West Bank and Gaza in 1998. After Israel, the most important source of imports were countries which signed a Free Trade Agreement with Israel (cf. Table 1 for the list of countries), where 13.3 percent of all Palestinian imports originate.

Table 1. Estimated Palestinian Foreign Trade Patterns in 1998

	Imports		Exports	
	Mill. US$	(%)	Mill. US$	(%)
Arab League Members	35	1.1	25	3.4
Free Trade Countries	423	13.3	5	0.7
Israel	2,422	75.9	697	95.8
Rest of the World	312	9.8	0	0.0
Total	3,192	100.0	727	100.0

Source: Authors' calculation based on data from the Palestinian Central Bureau of Statistics. It is assumed that services trade takes place only between West Bank and Gaza and Israel. The Free Trade Area Countries group includes: EU countries, USA, Canada, The Czech and Slovak republics, Turkey, Hungary, Poland and Slovenia.

As observed in Table 1, West Bank and Gaza ran a trade deficit in 1998 of US$ 2.5 billion (or approximately 3/5 of GDP), as total exports amounted to only 1/4 of total imports. The exported products reflect

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[5] Further, it is not possible to determine to which extent the import from Israel represent genuine Israeli value added or whether Israel merely serves as transit country for import from the rest of the world.

Palestinian comparative advantages vis-à-vis Israel in the present circumstances and consist mainly of agricultural produce, clothing, stone and basic metal products. These products account for approximately 60 percent of total Palestinian exports.

The trade deficit is partly financed by remittances from Palestinian workers working in Israel. After a sharp drop in the number of Palestinian workers working in Israel in 1995 and 1996 due to border restrictions and extensive closures, the number subsequently rebounded and in 1998 employment in Israel accounted for more than 20 percent of total Palestinian employment. Total net factor income amounted to US$ 828 million in 1998, that is, more than the total amount of exports of goods and non-factor services. Also a significant inflow of foreign aid, a cumulated amount of approximately US$ 3 billion since 1993, has contributed to the financing of the trade deficit. Although time series data of Palestinian foreign trade is weak, it may be observed that the trade deficit vis-à-vis Israel has been widening since 1993.[6] While the increase in trade deficit with Israel in the first years of the interim agreement can be attributed to some extent to the increase in the restrictions of movements, (more harmful for exports than for imports), it is more difficult to explain why it still increased in the years 1998 and 1999, which witnessed only a few days of closures.

In the period 1967 to 1994 Palestinian trade policy was completely determined by the Israeli trade policy. All tariffs, other levies, requirements of standards etc. applied to imports from third parties adopted by Israel were automatically in effect for West Bank and Gaza too. Since 1994, the guiding principles for West Bank and Gaza trade policy has been defined in the *Protocol on Economic Relations Between Israel and the PLO*, signed in Paris on April 29 1994, henceforth the *Paris Protocol*. The Paris Protocol was, with only minor modifications, incorporated as Annex V in the Interim Agreement – the Oslo Agreement – signed in Washington, September 28 1995.

In broad terms, the Paris Protocol formalized the *de facto* customs union, which existed while West Bank and Gaza was totally under Israeli control. Thus, the main feature of the trade regime defined in the Paris Protocol is to give free access for Palestinian goods to the Israeli market (and vice versa) and to keep policies governing import from third parties under Israeli control. In particular, the Paris Protocol ensures that West Bank and Gaza is not allowed to set tariffs and other levies lower than

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[6] According to the *Israel* Bureau of Statistics, the Palestinian trade deficit vis-à-vis Israel was approximately US$ 1.5 billion in 1993-94 (against US $ 1.7 billion in 1998).

the Israeli ones. But it also implies that West Bank and Gaza can benefit from Israeli free trade agreements with e.g. EU and the US.[7]

The Paris Protocol does, however, provide the Palestinian Authority with some degree of autonomy to define its own trade policy. This is accomplished through the creation of three lists (lists A1, A2 and B) of products for which the Palestinian Authority is free to set any tariff it finds suitable.[8] In terms of establishing a more non-discriminatory trade regime than the Israeli trade regime, the potential given by the three lists appear nevertheless rather limited since the Israeli tariffs on the products included are already either zero or very low, and in fact the Palestinian Authority has so far not used the autonomy provided by the Paris Protocol to set its own tariffs. Hence, Palestinian trade policies are identical to Israeli trade policies.

Most customs declaration of goods destined for West Bank and Gaza takes place at Israeli points of entry and is carried out by Israeli customs officials. The accrued amount of import taxes is subsequently transferred to the Palestinian Authority through the so-called revenue clearance system.[9] Almost 90 percent of the total revenue from import taxes received by the Palestinian Authority comes from the clearance system. Customs declarations of imports into Gaza through the Rafah and Eretz crossing points and into West Bank via the Allenby Bridge are overseen by Palestinian officials and revenues are immediately collected by the Palestinian Authority, but the total amounts are only minor.

The revenue clearance system is based on the principle of "final destination", which implies that only levies on imports from third parties whose official destination is clearly marked "West Bank" or "Gaza" are transferred. On the other hand, purchase taxes collected on imported Israeli goods and on indirect imports (imports from third parties that are ultimately consumed in West Bank and Gaza, but imported through an

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[7] Following the signing of the Paris Protocol, United States ratified a separate free trade agreement with West Bank and Gaza in 1996, which essentially extended the agreement that Israel had with the US to West Bank and Gaza. In 1997, the Palestinian Authority and EU signed an Interim Association Agreement which provides duty-free access for Palestinian goods to the EU and makes the Palestinian Authority a full participant in the Euro-Mediterranean partnership. See European Commission (1999).

[8] With respect to products on list A1 and A2, mainly consumer goods, the Palestinian Authority has full discretion over tariff setting, but the total amount of import from third parties is limited by quotas. With respect to products on list B, mainly equipment goods, the Palestinian Authority can set any tariff rate, but the products must meet Israeli standards requirements. There are not quotas for the goods on list B. For a detailed description and assessment of lists A1, A2 and B see Kanafani (1996).

[9] Also VAT on Palestinian/Israeli transactions are cleared through this system as are direct taxes on e.g. Palestinian workers working in Israel. Israel charges a 3 percent fee on all clearance revenue.

Israeli agent) have until now not been included in the revenue clearance system. This has led to a considerable loss of revenue for the Palestinian Authority, since the revenue from purchase taxes levied on these imports by the Israeli administration was not transferred.[10]

The total amount of import taxes which accrued to the Palestinian Authority in 1998 was US$ 128 million, according to figures from the Ministry of Finance in West Bank and Gaza. The figure includes revenues from regular tariffs on imports, as well as purchase tax levied on imported goods from third parties, and revenues from a so-called protection tax, which is marginal. This corresponds to a total average implicit import tax of 16.6 percent on goods imported from third parties. Thus, the combined effect of tariffs and purchase taxes creates a sizeable wedge between world market prices and the prices which consumers and producers in West Bank and Gaza face.[11] Further, as no duties are levied on imports from Israel a preference is obviously given to Israeli products in comparison to imports from third parties.[12]

The purchase tax is considered here as an import tax. Although purchase tax is in theory levied on both imported and domestically produced good, the delineation of the tax base is such that in practice only goods *not* produced domestically is subject to the purchase tax. Indeed, the revenue generated by purchase tax levied on domestically produced goods is insignificant – only US$ 200,000 in 1998

In order to derive implicit import tax rates across countries of origin and across products we use data on individual customs transactions in 1999 obtained from the Customs Department of the Palestinian Ministry of Finance. The data includes information on the country of origin, the

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[10] As of August 2000 this problem has partly been solved within the framework of the Joint Economic Committee, by reaching an agreement in principle on the rebate to the Palestinian Authority of the purchase tax collected on some of the Israeli products exported to West Bank and Gaza.

[11] Moreover, the wedge between domestic and world market prices is exacerbated by the fact that the effective rate of collection of VAT is significantly higher on imports from third parties than on domestic production. We do not know the effective VAT collection rate on imports from Israel. We only know the value of VAT revenue which is cleared by Israeli authorities. This amount, approximately US$200 million, corresponds to the *net* refunding of VAT paid by Palestinian enterprises on inputs imported from Israel. We make the assumption that the effective rate of collection of the VAT on imports from Israel is the same as that for imports from third parties, that is 8.6 percent for agricultural goods (fruits and vegetables are exempted) and 12.8 percent for other goods and services.

[12] It should be noted, however, that since purchase taxes are levied on imports from Israel (even if not rebated until now to the Palestinian Authority), it is most likely that Israelis products enjoy a smaller advantage than the one produced by the combination of tariffs and purchase taxes. This issue will be addressed in more details in Section IV.

type of product identified by 8-digit HS-codes, the value of the transaction and the tariffs and purchase tax levied on the good.

Table 2. Taxes on Imports (%)

	Tariffs	Purchase Tax	VAT	Total*
Arab League Members	11.1	0.5	10.5	23.4
Free Trade Countries	2.1	11.3	12.2	27.2
Israel	0.0	0.0	12.6	12.6
Rest of the World	10.7	11.1	12.5	37.2

Source: Authors' calculation based on data from Ministry of Finance and Palestinian Central Bureau of Statistics. *:VAT is applied on the top of other taxes.

It is interesting to note that although the average tariff is lowest for goods originating from Free Trade countries, 2.1 percent,[13] the preference given via low tariffs are counteracted by high purchase taxes, 11.3 percent on average. This reflects the composition of products imported from these countries which is characterized by a large share of equipment goods and durable consumer goods where the purchase taxes are relatively high. On the contrary, the burden from tariffs is significant on imports from the Arab world, whereas hardly any purchase tax is levied on these products. The total implicit tax on imports from the Arab world is of the same order of magnitude as that for import from Free Trade countries.[14] Imports from the Rest of the World (ROW) are particularly discriminated.

There is substantial dispersion of the imposed tariffs and purchase taxes across products (see Annex 1). The total implicit import tax ranges from virtually zero on dairy products to around 50 percent on tobacco and beverages, with a standard deviation of 11.5 percent. Compared to a uniform tariff structure, a dispersed tariff structure induces distortions as it favors some activities at the expense of others by twisting market signals and it thereby adds to the distortions created by the existence of a wedge between world market and domestic prices. Further, a uniform

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[13] The average tariff on goods originating from Free Trade countries exceeds zero because not all goods, notably agricultural goods, are included in the free trade agreements. The average tariff on agricultural products reached 22 percent in Israel in 1999. Average tariff on dairy produce exceeded 95 percent. The Israeli agricultural sector also benefited of large domestic support measures, as well as of considerable non-tariff barriers (WTO, 1999).

[14] Restrictions on trade with Arab countries for a given set of products (except those permitted in lists A1 and A2 of the interim agreement) are likely to represent a significant impediment to the expansion of imports and exports. While the modeling exercise performed below will give us a tentative assessment of the costs implied by both the current trade policy and the high transaction costs, it is, on the contrary, very difficult in methodological terms to measure the implicit cost of a zero-quota policy.

tax structure is easier to administer and it may reduce rent seeking behavior on part of both importers and government officials.

Apart from the distortions created by the trade policy, Palestinian producers face considerable transactions costs, which severely impede the development of trade activity. The high transaction costs are reflected in the fact that trade and transport costs adds 35 percent to the cost (producer price before trade and transportation costs) of domestic tradable goods, according to the Supply and Use Table of the Palestinian Central Bureau of Statistics.[15] This has to be compared with a premium of 10 percent in the rest of the Middle East region (GTAP, 1999).[16] The source of these extraordinary high transactions costs can not be identified with certainty, but it is most likely that they are to some degree due to extensive security checks of Palestinian cargo at Israel's external borders, between Gaza and West Bank and within West Bank, which are time consuming and which may damage the goods, especially those perishable. A study carried out by the Federation of Palestinian Chambers of Commerce, Industry and Agriculture in 1998 concluded that the transaction cost are on average 30 percent higher for Palestinian importers and exporters than for Israeli. Other reasons for high transaction costs in West Bank and Gaza include notably a deficient infrastructure and poor administrative procedures.

III. The Model

The following paragraphs are not intended to describe precisely the characteristics of the model employed here, but rather to describe in non-mathematical terms its main hypotheses, mechanisms, and the statistical information used for the Palestinian economy. The reader may refer for this purpose to Beghin et al. (1996) for a formal presentation of this class of models, and to the Annex 2 attached to this paper.

In this model, prices are endogenous on each market (goods, factors) and equalize supplies and demands, so as to obtain the equilibrium. The equilibrium is general in the sense that it concerns all the markets simultaneously. For instance, a decrease in tariffs on imports will affect the demand of imports of both final and intermediate goods. This will in turn affect the supply of domestic goods, and the demand of factors in each activity. This will equally affect the price of

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[15] This measure is obtained by dividing the intermediate consumption of trade and transport services by the sum of the other producers' expenses before tax (that is, value added plus other intermediate consumption).

[16] This region includes Israel, Jordan, Lebanon, Syria and the Gulf countries.

goods and the income of households, and the budget of the government, who will need to find another source of financing.

The model uses the information contained in the supply and use table for 1998. It considers one representative Palestinian household and 31 economic sectors (cf. Annex 1 for the list of activities/products). The model distinguishes the four trading partners for the Palestinian economy mentioned previously: Israel, the countries with which Israel has signed a Free Trade Agreement, the group of members of the Arab League, and the rest of the world (ROW). The basic features of the model are summarized below.

Supply is modeled using nested constant elasticity of substitution (CES) functions, which describe the substitution and complement relations among the various inputs. Producers are cost-minimizers and constant return to scale is assumed. Output results from two composite goods: intermediate consumption and value added, combined in fixed proportions. The intermediate aggregate is obtained by combining all products in fixed proportions (Leontief structure). The value-added is then decomposed in two substitutable parts: labor and capital, which are both fully employed and perfectly mobile across sectors. A Cobb-Douglas production function is assumed.

Even if static, this model is therefore intended to capture long term allocative effects of different trade policies, since adjustment costs of reallocating productive factors are ignored. However, it does not incorporate the dynamic effects of trade policies, and notably their impact on GDP growth, since resources (labor, capital, productivity) are fixed in this model. Interpretations of results are therefore to be taken with caution, since they only indicate what would be the impact of a given policy on the allocation of resources, and not on their level.

Income from labor and capital is allocated to the representative household. Household demand is derived from maximizing the utility function, 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. The calibration of the model determines a per capita subsistence minimum for each product, which will be consumed whatever the price and the income of the households, while the remaining demand is derived through an optimization process. The subsistence share in the consumption of basic goods is higher than in the consumption of luxury goods. Government and investment demands are disaggregated in sectoral demands once their total value is determined according to fixed coefficient functions.

The model assumes imperfect substitution among goods originating from different geographical areas (the so-called Armington assumption). Import demand results from a CES aggregation function of domestic and imported goods. Export supply is symmetrically modeled as a constant elasticity of transformation 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 (Israel, Arab countries or ROW). 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 [17].

The model considers the four policy instruments which have been mentioned previously: VAT on domestic supply (by product), VAT on imports (by product), tariff barriers (by product and by origin), purchase taxes (by product and by origin). Quotas of lists A1 and A2 are not modeled, since it appears that they have not been binding until now. They have therefore no effects on the supply of imported goods.

Finally, several macro-economic constraints are introduced in this model. First, the small country assumption holds, the Palestinian economy being unable to change world prices; thus, its imports and exports prices are exogenous. Capital transfers are exogenous as well, and therefore the trade balance is fixed, so as to achieve the balance of payments equilibrium. Second, the model imposes a fixed real government deficit, and fixed real public expenditures. Public receipts thus adjust endogenously in order to achieve the predetermined net government position, by shifting uniformly the VAT effective rates of collection on domestic and imported goods.[18] Third, investment is determined by the availability of savings, the latter originating from households, government and abroad. Since government and foreign

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[17] Production function and trade elasticities come from the empirical literature devoted to CGE models. They are not specific to the West Bank and Gaza. See for instance Burniaux, Nicoletti and Oliveira-Martins (1992), Konan and Maskus (1997) or more recently Gallaway, McDaniel and Rivera (2000).

[18] In the model, only effective rates of collection matter (cf. Annex 2). This means that increasing VAT receipts by improving tax collection or by increasing nominal VAT rates strictly produce the same results. Assessing the practical feasibility of these two fiscal options, as well as their respective impacts on economic activity, goes beyond the scope of this paper. Besides, alternative fiscal closure rules have been tested, including (i) the harmonisation of VAT rates on domestic and imported products, and (ii) the increase in direct taxes in order to compensate for the loss in import duties. Results are only marginally affected by these alternative choices, and are available upon request from the authors.

savings are exogenous in this model, changes in investment volumes reflect changes in household savings and changes in the price of investment.

Policy impacts are compared to the situation observed in 1998, in terms of real consumption and investment, exports and imports volumes, real wages, real rate of return of capital, and households' welfare. The chosen yardstick for welfare is the assessment of equivalent variation, which is the sum of two terms. The first one measures the gain (or the loss) of disposable income caused by the reform, and the second one measures the income needed after the reform to obtain the same level of utility as before the reform.

IV. Simulating Elements of Trade Reform.

Rather than simulating scenarios of comprehensive trade reforms, which would combine different trade measures with different relative weights, we prefer to simulate individual trade measures in order to isolate and better understand the effect of each of them (even if some of them are unlikely to be implemented alone). Several measures are considered here, which - if combined with different weights - could represent different choices of trade regime, from an improved customs' union to a full separation.

Reduced Transaction costs.

It is assumed here that a relaxation of security controls translates into a 15 percent decrease in trade and transport margins. Even if *ad hoc*, this assumption is rather conservative, since it leaves transaction costs approximately three times higher the average level that can be observed in neighboring countries.[19] This scenario is modeled by increasing exogenous total factor productivity levels in commerce and transport sectors by 15 percent. Column 1 in Table 3 reports the results of this scenario.

Reduced transaction costs induce a significant increase in trade activity. Exports volume increase by 6.9 percent, while gains in terms of consumer welfare represent more than 3 percent of the level of GDP in

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[19] Reducing by 15 percent the average transaction cost means that the producer price is increased by 30 percent (instead of 35 percent previously) once trade and transport margins are added to the price out of factory. We therefore implicitly assume that only 5 percentage points out of 35 — or less than one-fifth of the difference in transaction cost with neighbouring countries — can be attributed to security checks.

1998. The general increase in productivity is illustrated by the augmentation of labor and capital real remuneration (respectively 3.5 and 2.4 percent).

Beneficiary sectors are those who consume a lot of trade and transport services, e.g. vegetables, animal food, chemical products, and more directly the trade and transport service sectors who see their demand increasing. Israel also benefits from reduced transaction costs in the Palestinian economy. It imports more products from West Bank and Gaza – because they become on average cheaper, and exports more to West Bank and Gaza, due to increased activity and demand. Overall trade balance with Israel remains almost unchanged. Exports to the rest of the world (ROW) increase much more rapidly than to any of the three other regions, +33.7 percent, suggesting that trade with this region is not only discriminated by higher nominal protection (see Table 2), but that it also suffers from particularly high transaction costs.

Real private consumption increases more rapidly than investment (respectively 2.8 and 0.7 percent), meaning that the price of final goods decline more with reduced transaction costs than the price of investment. This, to a large extent, because investment expenditures are heavily concentrated in construction services (approximately 74 percent of total investment expenditures), which are mostly non-tradable.

Results obtained here — already significant in terms of magnitude despite the fact that we attribute only a small portion of the high transaction costs to security-related trade barriers, can still be considered as lower bound estimates of their influence on economic activity, when compared with the estimates obtained by Limão and Venables (2000). Using 1990 data for 93 countries, these authors estimate that a 1 percent decrease in transport costs increases by 2.5 percent on average the volume of imports (or equivalently, a 15 percent decreases in transport costs leads to a 37.5 percent increase in the volume of imports). This effect is much larger than the one we obtain, since a decreases of 15 percent in trade and transport costs corresponds in our model only to an increase of 1.6 percent in imports.

Even if only indicative, our results therefore clearly underline the large potential impact of a relaxation of security controls on the Palestinian economy and trade.

Elimination of tariffs and purchase taxes on imports from third parties.

This measure could be implemented within a Free Trade Area agreement, or a non discriminatory regime which would leave the

possibility for the Palestinian Authority to define unilaterally its own trade policy with regard to third parties, as well as its fiscal policy. Associated costs of implementing a free trade area or a non discriminatory regime, such as establishing borders (physical or notional) and rules of origin, are not accounted for in this scenario, and will be discussed below.

Tariffs and purchase taxes on imports from third parties are in this simulation set to zero, and the loss of tariff and purchase taxes receipts for the government is compensated by an uniform relative increase in the VAT rate on domestic products and imports.

The simulation measures the costs of granting preferences to Israeli imports within the current customs' union framework. This cost appears to be substantial, since a removal of these preferences translates into an aggregate welfare gain for households equivalent to 2.2 percent of GDP (Column 2, Table 3). Imports become cheaper, and the remuneration of factors increase: real wages increase by 3.1 percent and capital rate of return by 2.5 percent. In other words, gains of reallocation/efficiency are sufficient to increase exports (by 3.2 percent, to finance additional imports) without necessitating a real depreciation (a decrease in the real remuneration of labor and capital). Metal products and vegetables are among the beneficiary sectors, while equipment goods and beverages, which were previously protected from the competition with third countries by tariffs and purchase taxes, tend to lose with this reform.

Given their importance in comparison to tariffs, most of the impact of such policy comes from the removal of purchase taxes. Thus, the removal of tariffs on imports from third parties has only a minor impact on the Palestinian economy, given the already low levels of nominal protection of that kind.

The results suggest that the abolition of the purchase tax and tariff has a larger relative impact on the price of investment than on the price of private consumption (as illustrated by a larger increase in investment than in private consumption). This, in spite of the fact that equipment goods (whose price is more likely to diminish with trade liberalization) represents less than 30 percent of total investment expenditures. The price of equipment goods diminishes indeed by more than 10 percent, while the price of construction remain unchanged with respect to the pre-reform situation. Even if not accounted for in this model, this decrease in the price of investment, as well as the observed increase in the rate of return of capital, could have an additional positive impact on capital formation, and in turn, on GDP growth.

Removing tariffs and purchase taxes on imports from third parties has on the other hand obvious negative consequences for Israel. Its exports to Palestine are reduced by 22 percent, despite the (small) increase in the overall Palestinian demand for imported goods. This decrease corresponds approximately to a 3 percent decrease in total export receipts for Israel. Trade deficit with Israel drops significantly, from US$ 1.7 to US$1.2 billion. Therefore, the relatively small decrease in protection simulated here, which concerns only directly less than one-fourth of total imports, could have a large impact on the diversification of imports destined to West Bank and Gaza. Imports volumes from FTA countries increase by 35 percent, and imports volumes from the rest of the world more than double. On the other hand, imports from Arab countries, which hardly exceeded 1 percent of total imports in 1998, increase by only 20 percent. This phenomenon of high substitution of imports from Israel to other sources denotes the small degree of industrialization of the Palestinian economy, with little base at risk, and low levels of intra-industry relations. Since a very large share of finished goods are imported, they can be easily substituted from one origin to another, without affecting dramatically the structure of production of the Palestinian economy.

As mentioned previously, public receipts in the model adjust endogenously in order to achieve the predetermined net government position, by shifting uniformly the VAT rates of collection on domestic and imported goods. In the present simulation, the loss in government revenue arising from the cancellation of tariff and purchase taxes on imports from third parties is compensated by a increase of 30 percent in VAT collection.

Cancellation of the purchase tax on imports from Israel.

It may be argued that a removal of purchase taxes on Palestinian imports from third parties would discriminate the Israeli exporters, if not accompanied by a similar removal of the purchase tax on goods imported from Israel. The reciprocal argument holds similarly that is, removing the purchase tax on imports from Israel only would discriminate further imports from third parties, making this simulation as well as the previous one unlikely to be implemented alone. We nevertheless perform here this simulation, as well as we performed the previous one, in the sake of distinguishing their respective likely impacts.

We simulate the impact of a removal of the purchase tax on imports from Israel by reducing accordingly the price of imports from Israel

(Column 3, Table 3).[20] It is important to notice that this simulation does not correspond to a simple transfer of purchase taxes receipts on Israeli goods to the Palestinian Authority, since goods from Israel which were previously highly taxed, are now only subject to VAT. This is hence equivalent to a positive terms of trade shock.

The simulation may be seen as symmetric to the one in which purchase taxes on imports from third parties were removed. In the present case, imports from Israel increase by 20 percent (Column 3, Table 3), and the trade deficit with Israel increases by 9.7 percent, from US$ 1.7 to US$ 1.9 billion. Total imports from third parties decrease by 22 percent, while total imports increase by 10 percent.

Consumers substitute their consumption of goods from third parties to goods originating from Israel, which become cheaper after the reform, and it provides them with some significant welfare gains, representing 4.4 percent of GDP in 1998. This increase mostly comes from an increase in final consumption of 3.7 percent, which is the largest component of GDP. Still, the impact on investment is not to be neglected, with an increase of 5.8 percent, larger in relative terms than for consumption, and also larger with respect to private consumption than in the previous simulation. This would tend to suggest that the purchase tax on imports from Israel is more concentrated on equipment goods than are the sum of tariffs and purchase taxes on imports from third parties.

The difference in magnitude with the previous simulation – notably in the increase of total imports of 10 percent against 0.7 percent, is to be explained by the fact that this scenario directly concerns a much larger share of imports, since imports from Israel represented more than 3/4 of total imports in 1998.

Another important difference with the previous simulation lies in the negative impact on economic activity and factor remuneration. While in the previous simulation the increase in households' welfare was both the result of an increase in factor remuneration and a decrease in the price of consumption goods, here we can observe a strong decrease in the price of consumption goods, but also a decrease in the real remuneration of labor and capital (-1.2 and -1.7 percent). In other words, the windfall gain of cheaper imports from Israel reduces domestic activity, and the demand for labor and capital. Gains of reallocation, although significant, are not sufficient to finance the additional bill of imports, and the required increase in exports also necessitates a real depreciation.

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[20] Given the composition of exports from Israel to West Bank and Gaza, it is estimated that the average price on imports from Israel would decline by 8.7 percent, as a result of the cancellation of the purchase tax.

The metal products sector is again among the largest beneficiaries, while sectors producing beverages and "other manufactured goods" are losing from the reform.

Similar to the previous reforms, this scenario necessitates an increase in VAT rates, to compensate from the loss in government revenue. This loss originates from the substitution of imports from third parties (on which tariff and purchase taxes are applied) to imports from Israel, only subject to VAT. The loss is compensated by a 10 percent increase in the total collection of VAT revenues.

Elimination of tariffs and purchase taxes on imports from all origins.

As mentioned earlier, this last scenario is to be combined with the above to become more realistic. Tariffs, purchase taxes on imports from third parties and purchase taxes on imports from Israel are therefore in this scenario all set to zero (Column 4, Table 3). This reform produces significant effects. First, final consumption of goods previously taxed augments significantly, which explains to a large extent the observed gain in welfare for household, amounting to 5.7 percent of GDP. Investment expenditures, which become much cheaper, also increase by 7.8 percent.

More important is however that the combined effects of these different measures produce significant reallocation gains, amounting to the equivalent of 2.5 percent of GDP. Changes in the price wedges between domestic and imported goods, which did not occur to any large extent in the previous simulations, where agents mostly substituted one source of imports to another, with only limited impact on domestic production, tend to produce now substantial gains of specialization. We observe significant movements of factor reallocation, with 2 percent of the labor force and 3 percent of the capital stock moving from one sector to another. As a result, exports volumes increase by 5 percent, without being accompanied by any real depreciation. Real wages increase by 2.9 percent and capital remuneration by 2.1 percent.

Exports volumes to Israel increase (5.2 percent), while imports from Israel decline (-1.5 percent). Besides, terms of trade with Israel are improved (due to the removal of the purchase tax), which reduces significantly the trade deficit with Israel (-16.4 percent, or equivalently a deficit reduced by almost US$ 300 million). This result suggests that a significant part of the current trade deficit with Israel is to be explained by the nature of the Paris Protocol, and not only by security barriers. This, possibly as a result of the taxation of important inputs imported

from third parties and Israel, such as metallic goods, machinery and equipment goods or other manufactured goods, which penalize the Palestinian industry in competition with foreign producers on the Israeli market, the latter being only taxed on final goods.

This reform necessitates an increase of 30 percent in VAT collection, to compensate from the loss in tariff and purchase tax revenues on imports.

Customs Union, Free Trade Agreement or Non-Discriminatory regime ?

Implementing the measures described above may require a significant departure from the current arrangements provisioned in the Paris protocol. This is especially the case for reforms concerning imports from third parties, while reforms concerning purchase taxes on imports from Israel could be implemented within the current customs-union framework, since it would not necessitate to control for the origin of goods. In this last case, however, trade flows between Israel and the Palestinian economy would increase further, to the detriment of third parties, which would augment the degree of dependency of the Palestinian export industry to the Israeli security concerns – and possibly transaction costs. On the other hand, removal of tariffs / purchase taxes on imports from third parties would require mechanisms to identify the origin of goods, such as rules of origin and/or entry/customs stations in order to avoid trade deflection[21], which might in turn also increase transaction costs.

Another solution could consist of increasing the range of goods and quotas provisioned in lists A1, A2 and B of the Paris protocol. However, this presents high risk of trade deflection in the absence of mechanisms to control trade flows between Israel and West Bank and Gaza. Two solutions are therefore possible: establishing physical means of control – such as customs stations – but in this case, no more quotas is needed, or setting up imports monopolies – which will immediately create a rent close to the tax imposed on the same good in Israel. Expanding quotas is therefore not a viable solution in the long run.

The most desirable solution is obviously that the two partners concert on their common trade policies, to account also for the interests of the Palestinian economy. In case where this last solution is not to be envisaged in the near future, two alternatives then remain, that is a Free Trade Area (FTA), or a non-discriminatory regime (MFN).

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[21] See Erickson von Allmen and Nashashibi (1999) for a discussion on the implications of establishing such mechanisms.

Establishing a FTA will require an administrative control of all goods traded between Israel and the Palestinian economy, to check for its origin. In addition, requirements of origin may encourage Palestinian producers to use inputs from Israel (the reverse is obviously also true) to become eligible for tariff exemption in Israel, even though the least-cost supplier is outside the union.

Implementing a non-discriminatory regime (MFN) would not entail such cost, because it would not require importers and exporters to establish the origin of goods. It would neither bear the risk of creating a very complex set of rules of origin, nor would it undermine future efforts of regional and global integration. On the other hand, the two partners would not in theory benefit anymore from tariff exemption on the other market. However, since the implementation of a non-discriminatory regime is justified on the ground that it permits to lower taxes on imports, Israeli products would not be taxed in this case. The cost for the Palestinian economy would therefore come only from the loss of its preferential access to the Israeli market. This cost may be modeled by reducing the price of exports at which Palestinian exporters can sell their goods on the Israeli market, so as to leave unchanged the price of Palestinian goods inclusive of tariffs (which were previously equal to zero) on this market. This is hence equivalent to a negative terms of trade shock.

We perform two simulations to measure and compare the desirability of the two options, that is FTA versus MFN. First, we simulate the impact of augmenting the price of imports from Israel by 3 percent, which is an estimated cost of obtaining the necessary documents to prove the origin of goods (Krueger, 1995). For the same reason, we reduce by 3 percent the price at which Palestinian exports have access to the Israeli market (Column 5, Table 3). This figure of 3 percent is in line with the cost charged to government by private enterprises in order to control the origin of goods. It is of course arbitrary, in the sense that local conditions, as well as the nature of the agreement, may imply a higher, or lower, cost to prove the origin of goods. Second, we simply apply the average tariff observed on imports from third parties to the Palestinian goods exported to Israel, to simulate the loss of preferential access to the Israeli market (Column 6, Table 3).[22]

These two scenarios incorporate the removal of taxes on imports described previously (abolition of tariffs and purchase taxes on imports

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[22] Given the composition of Palestinian exports to Israel, it is estimated that the average tariff would amount to 9.2 percent.

from third parties, abolition of the purchase tax on imports from Israel) which justifies their likely implementation.

Simulations suggest that the impact of the two reforms on the volume of Palestinian exports to Israel is merely the same, that is a respective decrease of 5.3 and 7.2 percent with respect to the initial situation (Columns 5 and 6, Table 3). On the other hand, implementing a system of rules of origin increases the price of goods imported from Israel while it leaves unchanged the price of imports from third parties. This explains to a large extent why the former reform has a stronger negative effect on imports from Israel than the latter (-9.8 percent against –4.6 percent). This might explain in turn why the increase in investment is smaller in the FTA scenario (6.9 percent) than in the MFN scenario (9.5 percent) since imports from Israel embody a large share of equipment goods. However, these two scenarios remain rather promising it terms of potential capital formation, since they both combine a decrease in the price of investment with an increase in the rate of return of capital.

It is also worth noticing that these two policy packages imply a significant diversification of trade flows, especially in favor of the rest of the world: in the FTA scenario, exports to ROW increase by 24.1 percent, and imports from ROW by 82.4 percent. Corresponding figures for the MFN scenario are respectively +41.6 percent for exports and +71.0 percent for imports. Results therefore strongly suggest that the very high share of trade with Israel is to a significant extent the result of trade policies currently implemented, and not only the consequence of security-related trade barriers.

In sum, welfare gains for households are of the same orders of magnitude, around 3 percent of GDP, and it appears difficult to establish a strict superiority of one option over the other, given the numerous uncertainties associated with this quantitative exercise, and notably the cost of implementing rules of origin. For instance, using a 2 percent premium rather than 3 percent to measure the cost of implementing rules of origin would lead to a welfare gain for household equivalent to 3.8 percent of GDP, instead of 2.9 (results not reported).

Table 3 : Simulations of Trade Reforms (%)

	S1	S2	S3	S4	S5	S6
Welfare gains	3.1	2.2	4.4	5.7	2.9	3.5
Real Private consumption	2.8	2.0	3.7	5.0	2.5	2.9
Real Investment	0.7	3.1	5.8	7.8	6.9	9.5
Export volumes	6.9	3.2	2.4	5.0	-4.3	-4.8
Of which to ALM	7.3	3.0	0.3	1.0	20.7	51.4
Of which to FTA	3.8	0.7	-1.5	-2.6	15.9	45.7
Of which to Israel	6.9	3.2	2.5	5.2	-5.3	-7.2
Of which to ROW	33.7	5.3	-2.6	0.6	24.1	41.6
Import volumes	1.6	0.7	10.0	7.7	2.5	4.7
Of which from ALM	0.9	19.6	-25.7	11.7	14.4	8.1
Of which from FTA	1.1	35.5	-23.9	9.1	13.5	8.5
Of which from Israel	1.8	-22.0	20.1	-1.5	-9.8	-4.6
Of which from ROW	1.0	128.3	-18.3	77.0	82.4	71.0
Real wages	3.5	3.1	-1.2	2.9	2.4	1.7
Real rate of return of capital	2.4	2.5	-1.7	2.1	1.8	2.3

Notes : All the percentages express relative change with respect to the initial situation. All variable are expressed in volumes. Welfare gains are benchmarked with respect to the GDP level in 1998.
S1. Reduced Transaction Costs.
S2. Reduced taxes on imports from third parties
S3. Reduced purchase tax on imports from Israel.
S4. S2+S3
S5. S2+S3 + implementation of rules of origin
S6. S2+S3 + removal of preferential access to the Israeli market for Palestinian exports

V. Concluding remarks.

Results of this quantitative exercise suggest first of all that trade has major implications for the future of the Palestinian economy. It indicates notably that transaction costs play a very important role in the Palestinian trade performance, but also that trade policy matters.

Moving away from the present customs union framework may present advantages, because the current[23] fiscal and trade framework creates harmful distortions, and generates great dependency on Israeli security concerns. Adopting a more neutral regime would allow re-balancing trade flows with the rest of the world, and is likely to generate gains of specialization, additional welfare for the households, and possibly lower transaction costs, at least for the exports which will not anymore be destined to Israel. Other advantages not dealt with in this paper are the possibility to trade new products with new partners, as

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[23] The Israeli Ministry of Finance has recently announced that the rate of purchase taxes on 628 products are to be reduced (Al-Ayyam, August 15, 2000). This reform might significantly reduce the desirability of adopting a more autonomous trade regime in the sake of reducing the same taxes. As of the date of editing this paper, this very last information remains to imprecise to be incorporated, but could represent an important dimension of the future choice of the trade regime for West Bank and Gaza.

well as the opportunity to import goods with lower standards than those required to enter Israel.

Welfare gains estimated here are already high in comparison with the results generally reported in the literature using similar modeling to assess the impact of trade liberalization[24], and illustrates the great dependency of the Palestinian economy on imports, as well as its low degree of industrialization. But they still probably represent lower-bound estimates of the total impact of trade liberalization on welfare and GDP growth. As mentioned earlier, our results suggest that trade liberalization could have a strong deflating impact on the price of investment, and a positive impact on the capital rate of return, which combined should provide strong incentives for further capital formation. Besides, we can observe that trade liberalization has a positive impact on real wages, which could in turn encourage a larger labor participation of the working-age population on the domestic market.[25] Finally, it is likely that an increased diversification in the origin of imports, and therefore a larger variety of accessible inputs, could allow producers to increase productivity through selection of intermediate inputs that match more closely their production requirements (Rutherford and Tarr, 2000). These three effects could magnify the positive impact of trade liberalization that we can observe in this paper with a static model.

However, the overall gains of such a departure from the present system will depend to a very large extent on the design of the new trade policy, and on how the Palestinian Authority decides to cope with the inherent problem of trade deflection. Our analysis suggests that a Free Trade Agreement is not necessarily the unique solution to be envisaged, because the implementation of rules of origin it requires could reduce significantly the potential gains of a trade liberalization. Measuring the effective cost of implementing rules of origin goes beyond the scope of this paper, but this dimension should retain particular attention before deciding on the new trade regime. The alternative could take the form of adopting a more neutral regime, which would not require to impose rules of origin. In both cases, moving away from the present system would bear the cost of lowering access to the Israeli market for Palestinian exports. This cost should, however, diminish in the years to come, given the commitment of Israel to further liberalize its trade regime.

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[24] Applied CGE modelling of the impact of trade liberalisation generally produces welfare gains of about one-half to one percent of GDP, when constant return to scale are assumed, as it is the case here. See Rutherford and Tarr (2000), for a presentation of this literature.

[25] The labor force participation rate is very low in WBG, around 40 percent. According to Ruppert (2000), Palestinian workers may prefer to queue for jobs in Israel, and then remain inactive for a while, if real wages in West Bank and Gaza are to low in comparison to the ones expected in Israel.

Finally, a new regime which departs from the regime put in place with the interim agreement could require customs infrastructures. This physical capacity is presently non-existent.

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Annex 1. Dispersion of Import Taxes Across Economic Activities

The model considers 31 activities and corresponding products. The following table lists those activities, as well as the average tax on imports from third parties (tariff duties plus purchase taxes) and the share of imports from third parties for corresponding goods.

	Product	Average Tax on Imports	Share of imports from 3rd parties
1	Crops	21%	14%
2	Other Agriculture	10%	19%
3	Mining	0%	100%
4	Other Food Products	9%	35%
5	Olive Products	0%	100%
6	Vegetable Products	8%	84%
7	Meat and Dairy Products	0%	100%
8	Animal Food	6%	9%
9	Beverages and Tobacco	49%	18%
10	Textiles	14%	37%
11	Clothes	25%	47%
12	Leather Products	17%	22%
13	Wood Products	8%	21%
14	Paper Products	2%	61%
15	Printing	8%	89%
16	Chemical Products	6%	14%
17	Rubber	11%	37%
18	Non Metallic Products	17%	27%
19	Stones	11%	35%
20	Basic Metal Products	20%	35%
21	Equipment Goods	29%	44%
22	Furniture	4%	82%
23	Other Manufacture	25%	26%
24	Electricity and Water	0%	0%
25	Construction	0%	0%
26	Commerce	0%	0%
27	Tourism	0%	0%
28	Transport	0%	0%
29	Communication	0%	0%
30	Financial Services	0%	0%
31	Other Services	0%	0%

Annex 2. The General Equilibrium Model

This annex provides the technical specification of the computable general equilibrium model used to assess trade policies in the Palestinian Economy. In the equations which follow, the following indices will be used extensively:

i Production sectors. **j** is an alias for **i**. **N** is the total number of sectors/products

r Represents trading partners. R is the total number of trading partners.

O represents the initial situation.

We discuss first the following 40 generic equations which define the theoretical model. We then describe the post-simulation equations which are used to measure the impact of reforms in terms of welfare. We finally list the name and dimension of each variable, the name and value of each elasticity, and describe succinctly calibration mechanisms.

Supply

Production is based on a nested structure of *Constant Elasticity of Substitution* (CES) functions. Each sector produces a gross output, *XP*, which given the assumption of constant returns to scale is undetermined by the producer. It will be determined by equilibrium conditions. The producer therefore minimizes costs subject to a production function. Figure 1 depicts the nested decision process in the choice of production factors: at the first level, the producer chooses a mix of a value added aggregate, *KL*, and an intermediate demand aggregate, *ND*. In mathematical terms, this leads to the following formulation:

$$\min PKL_i KL_i + PN_i ND_i$$

$$\text{s.t.} \quad XP_i = \left[a_{kl,i} KL_i^{\rho_i^p} + a_{nd,i} ND_i^{\rho_i^p} \right]^{1/\rho_i^p}$$

where *PKL* is the aggregate price of value added, *PN*, is the price of the intermediate aggregate, a_{va} and a_{nd} are the CES share parameters, and ρ is the CES exponent. The exponent is related to the substitution elasticity, via the following relationship:

$$\sigma_i^p = \frac{1}{1 - \rho_i^p} \text{ and } \sigma_i^p \geq 0$$

Substitution elasticities reflect adjustment possibilities in the demand for production factors originated from variations in their relative price. Note that in the model, the share parameters incorporate the substitution elasticity using the following relationships:

$$\alpha_{kl,i} = \left(a_{kl,i} \right)^{\sigma_i^p} \text{ and } \alpha_{nd,i} = \left(a_{nd,i} \right)^{\sigma_i^p}$$

Solving the minimization problem above, yields Equations (1) and (2). Equation (1) determines the volume of aggregate intermediate demand, *ND*. Equation (2) determines the level of the value added demand *KL*. The CES dual price of *ND* and *KL*, *PX*, is defined by Equation (3) and determines the aggregate unit cost.

Figure 1: the nested CES production function
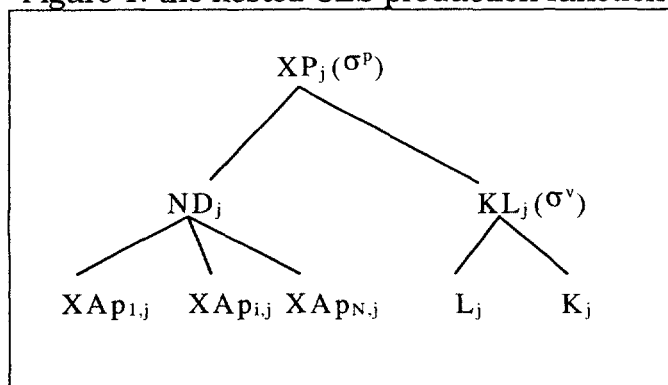
Notes: Each nest represents a different CES bundle. Intermediate demand of the product i by the industry j, XApi,j, is further decomposed by region of origin according to the *Armington* specification (cf. Figure 2).

The next level of the CES nest concerns, on the one side, aggregate intermediate demand, *ND*, and on the other side, the *KEL* bundle. The split of *ND* into intermediate demand is assumed to follow a Leontief specification, in other words a substitution elasticity equal to zero. The demand for intermediate goods is determined by Equation (4). The price of aggregate intermediate demand is given by adding up the unit price of intermediate demand. This is specified in Equation (5). Demand for each good is specified as a demand for the Armington composite (described in more detail below), an aggregation of a domestic good and an import good which are imperfect substitutes. Therefore, while there is no substitution of one intermediate good for another, there will be substitution between domestic demand and import demand depending on the relative prices. The price of the Armington good is given by *PA*.

At the same level, the *KL* bundle is split between labor, *L*, and capital, *K*. The optimization problem is similar to above, i.e. cost minimization subject to a CES aggregation function. If *W* is the wage rate, and *R* is the price of capital, sectoral labor and capital demands are given by Equations (6) and (7). The price of *KL* bundle, *PKL*, is determined by Equation (8), which is the CES dual price. λ_j is the total factor productivity level of sector j. Therefore factor demands are expressed in efficient units.

Factor demand equations

$$ND_j = \alpha_{nd,j} \left[\frac{PX_j}{PN_j} \right]^{\sigma_j^p} XP_j \tag{1}$$

$$KL_j = \alpha_{kl,j} \left[\frac{PX_j}{PKL_j} \right]^{\sigma_j^p} XP_j \tag{2}$$

$$PX_j = \left[\alpha_{nd,j} PN_j^{1-\sigma_j^p} + \alpha_{kl,j} PKL_j^{1-\sigma_j^p} \right]^{1/(1-\sigma_j^p)} \tag{3}$$

$$XAp_{i,j} = a_{i,j} ND_j \tag{4}$$

$$PN_j = \sum_i a_{i,j} PA_i \tag{5}$$

$$L_j = \alpha_{l,j} \left[\frac{PKL_j}{W/\lambda_j} \right]^{\sigma_j^v} KL_j \tag{6}$$

$$K_j = \alpha_{k,j} \left[\frac{PKL_j}{R/\lambda_j} \right]^{\sigma_j^v} KL_j \tag{7}$$

$$PKL_j = \left[\alpha_{l,j} \left(W/\lambda_j \right)^{1-\sigma_j^v} + \alpha_{k,j} \left(R/\lambda_j \right)^{1-\sigma_j^v} \right]^{1/(1-\sigma_j^v)} \tag{8}$$

Demand

Production generates income, both wage and non-wage, which is fully distributed to the representative Palestinian household. Additionally, it receives some net transfers from abroad. Equation (9) defines the disposable household's income, YD. DT is an adjustment parameter that may become endogenous, depending on the macro closure, as we will see below. If exogenous, it is set to zero.

This income is allocated to consumption and savings using the *Extended Linear Expenditure System* (ELES) specification. The consumer problem can be set up as follows:

$$\max U = \sum_{i=1}^{n} \mu_i \ln\left(XAc_i - \theta_i\right) + \mu_s \ln\left(\frac{Hsav}{pi}\right)$$

$$\text{s.t.} \sum_{i=1}^{n} PA_i XAc_i + Hsav = YD \quad \text{and} \quad \sum_{i=1}^{n} \mu_i + \mu_s = 1$$

where U is the utility function, XAc_i is consumption by commodity, S is household saving and PA is the vector of consumer prices. $Hsav$ can be thought of as demand for a future bundle of consumer goods, and its price is the price of investment, pi. Solving the above optimization problem leads to the following demand functions:

$$XAc_i = \theta_i + \frac{\mu_i Y^*}{PA_i}$$

$$Hsav = \mu_s Y^* = YD - \sum_{i=1}^{n} PA_i XAc_i$$

$$Y^* = YD - \sum_{j=1}^{n} PA_j \theta_j$$

Consumption is the sum of two parts, θ, which is often called the *subsistence minima* or *floor consumption*, and a fraction of Y^*, which is often called the *supernumerary income*. Y^* is equal to disposable income less total expenditures on the subsistence minima.

Equation (10) defines supernumerary income, that is disposable income less total expenditures on the subsistence minima. Consumer demand for goods and services is given by Equation (11). Household savings is determined as a residual and is given in Equation (12).

Households' demand equations

$$YD = \sum_j (WL_j + RK_j) + ER\sum_r TR_r^H - DT \tag{9}$$

$$Y^* = YD - \sum_i PA_i \theta_i \tag{10}$$

$$XAc_i = \theta_i + \mu_i Y^* / PA_i \tag{11}$$

$$HSav = YD - \sum_i PA_i XAc_i \tag{12}$$

Other domestic final demands include investment and government expenditures. These final demand vectors are assumed to have fixed expenditure shares. The closure of the final demand accounts will be discussed below. Equations (13) and (14) respectively determine the government and investment demand for each type of good, and equation (15) and (16) the total values of government and investment purchases.

Other final demand equations

$$XAg_i = a_i^G TG \tag{13}$$

$$XAi_i = a_i^I \left(InvExp / \sum_i PA_i a_i^I \right) \tag{14}$$

$$GExp = \sum_i PA_i XAg_i \tag{15}$$

$$InvExp = \sum_i PA_i XAi_i \tag{16}$$

Government

Government aggregate expenditures on goods and services are fixed in real terms, and their total is TG. The Palestinian Government derives most of its revenues from indirect taxes. Equations (17)-(19) list the different indirect taxes paid on the consumption of domestic output and imports : value added taxes (VAT) on domestic goods, duties and purchase taxes on imports, and VAT on imports. The collection of these taxes plus some net transfers from abroad (e.g., the international aid) determine the government revenue (Equation 20). Equation (21) defines the government budget surplus/deficit in nominal terms. A^{vd}, A^{vm}, A^t are adjustment parameters that may become endogenous, depending on the macro closure, as we will see below. If exogenous, there are set to unity.

Government Equations

$$VATd = \sum_i A^{vd} \tau_i^{vd} PD_i XD_i \tag{17}$$

$$YTrade = \sum_r \sum_i A^t WPM_{ri} \tau_{ri}^m XMr_{ri} \tag{18}$$

$$VATm = \sum_i A^{vm} \tau_i^{vm} PM_i XM_i \tag{19}$$

$$GRev = VATd + YTrade + VATm + ER\sum_{r} TR_r^G + DT \tag{20}$$

$$S_G = GRev - GExp \tag{21}$$

Trade

The model assumes imperfect substitution among goods originating from different geographical areas (the so-called Armington assumption). Imported goods are not perfect substitutes for goods produced domestically. The demand for domestic versus imported goods will depend on their relative prices and their degree of substitution. The degree of substitution will depend on the level of disaggregation of the commodities. For example, wheat is more substitutable as a commodity than grains, which in turn are more substitutable than a commodity called primary agricultural products. Actually, the Armington assumption reflects two stylized facts: (i) Trade data shows the existence two-way trade which is consistent with the Armington assumption; (ii) As well, and related, the Armington assumption leads to a model where perfect specialization, which is rarely observed, is avoided.

Import demand results from a CES aggregation function of domestic and imported goods. To allow for the existence of multiple trading partners, the model adopts a two-level CES nesting to represent the Armington specification. At the top level, agents (consumers, firms) choose an optimal combination of the domestic good and an import aggregate which is determined by a set of relative prices and the degree of substitutability. Let XA represent aggregate demand for an Armington composite, with the associated Armington price of PA. Each agent then minimizes the cost of obtaining the Armington composite, subject to an aggregation function. This can be formulated by:

$$\min PDXD + PM\,XM$$

$$\text{s.t.} XA = \left[a_d XD^\rho + a_m XM^\rho \right]^{1/\rho}$$

where XD is demand for the domestic good, PD is the price of obtaining the domestic good, XM is demand for the aggregate imported good, PM is the aggregate import price, a are the CES share parameters, and ρ is the CES exponent. ρ is related to the CES substitution elasticity via the following relation:

$$\rho = \frac{\sigma - 1}{\sigma} \Leftrightarrow \sigma = \frac{1}{1 - \rho}$$

At the second level of the nest, agents choose the optimal choice of imports across regions, again as a function of the relative import prices and the degree of substitution across regions. Note that the import prices are region specific, as are the tariff and purchase tax rates. The second level nest also uses a CES aggregation function. (cf. Figure 2). The CES formulation implies that the substitution of imports between any two pairs of importing partners is identical. The next table lists the solution of the optimization problem described above. Equation (22) determines domestic demand for the Armington aggregate across all agents of the economy, XA. Equations (23) and (24) determine respectively, the optimal demand for the domestic component of the Armington aggregate, XD, and aggregate import demand, XM. Equation (25) defines the price of the Armington bundle, PA, which is the CES dual price. Both the domestic price of domestic goods, and the price of the aggregate import bundle are adjusted to

incorporate a value added tax, whose rate may differ between domestic and import goods.

The next equations describe the decomposition of the aggregate import bundle, *XM* into its components, i.e. imports by region of origin. Each demand component will be a function of the price of the exporting partner, as well as partner-specific import tax rates. Equation (26) determines import volume by sector and region of origin, *XMr*, where *PMr* is the partner specific import price, in domestic currency and inclusive of import taxes (duties plus purchase taxes). Equation (27) defines the price of the aggregate import bundle, *PM*, which is the CES dual price. Equation (28) defines the domestic import price, *PMr*, which is equal to the import price of the trading partner, converted into local currency, and inclusive of the partner-specific import tax rate.

Figure 2: The demand for goods by origin
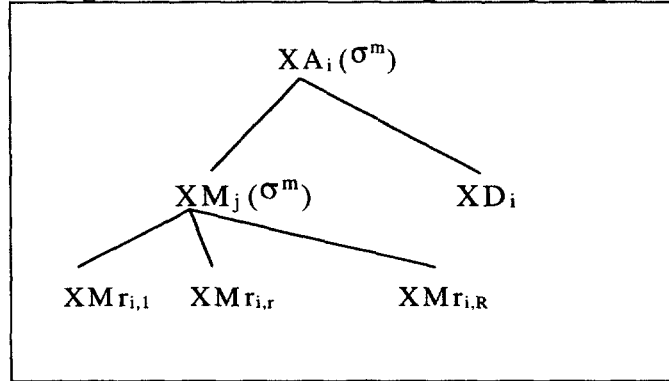
Treatment of domestic production is symmetric to the treatment of domestic demand. Export supply is modeled as a *constant elasticity of transformation* (CET) function. Producers decide to allocate their output to domestic or foreign markets responding to relative prices. Domestic producers are therefore assumed to perceive the domestic market as different from the export market. The reason is similar than for imports: a high level of aggregation. Further, export markets might be more difficult to penetrate, forcing perhaps different quality standards than those applicable for the domestic market, or more simply different tastes. This formulation assumes a production possibilities frontier where each producer maximizes sales, subject to being on the frontier, and influenced by relative prices. The optimization problem is formulated somewhat differently since the object of the local producer is to maximize sales, not to minimize costs. We therefore have:

$$\max PD\,XD + PE\,ES$$

$$s.t.\,XP = \left[\gamma_d XD^{\lambda} + \gamma_e ES^{\lambda}\right]^{1/\lambda}$$

where *XD* is aggregate domestic sales of domestic production, *ES* is foreign sales of domestic production (exports), with a producer export price of *PE*, *XP* is aggregate domestic production with a producer price of *PP*, γ are the CET share parameters, and λ is the CET exponent. The CET exponent is related to the CET substitution elasticity, Λ, via the following relation:

$$\lambda = \frac{\Lambda + 1}{\Lambda} \Leftrightarrow \Lambda = \frac{1}{\lambda - 1}$$

Analogous to the Armington specification, producer supply decisions are assumed to be undertaken it two steps. First, producers choose the optimal combination of domestic supply and aggregate export supply. Then, an additional step which optimizes export supply across trading partners. The top-level producer supply decisions, in reduced form, are given by Equations (29) and (30), where the share parameters are α^t and the CET substitution elasticity is σ^t. Equation (31) is the CET dual price function, which determines sectoral domestic output.

The second-level CET nest determines the optimal supply of exports to individual trading partners, ESr. Equation (32) defines export supply by region of destination. Equation (33) determines the aggregate export price, PE.

The next equation determine export demand by the regional trading partners, and the export market equilibrium condition. Under the small-country assumption the export demand elasticity is infinity, and the exporting country faces a flat demand curve, i.e. the export price is fixed (in dollar terms), to WPINDEX. Equation (34) converts the domestic export producer price into the price in local currency.

Trade equations

$$XA_i = \sum_j XAp_{ij} + XAc_i + XAg_i + XAi_i \tag{22}$$

$$XD_i = \beta_i^d \left(\frac{PA_i}{PD_i \left(1 + A^{vd}\tau_i^{vd}\right)} \right)^{\sigma_i^m} XA_i \tag{23}$$

$$XM_i = \beta_i^m \left(\frac{PA_i}{PM_i \left(1 + A^{vm}\tau_i^{vm}\right)} \right)^{\sigma_i^m} XA_i \tag{24}$$

$$PA_i = \left[\beta_i^d \left(PD_i \left(1 + A^{vd}\tau_i^{vd}\right) \right)^{1-\sigma_i^m} + \beta_i^m \left(PM_i \left(1 + A^{vm}\tau_i^{vm}\right) \right)^{1-\sigma_i^m} \right]^{1/(1-\sigma_i^m)} \tag{25}$$

$$XMr_{ri} = \beta_{ri}^r \left(\frac{PM_i}{PMr_{ri}} \right)^{\sigma_i^w} XM_i \tag{26}$$

$$PM_i = \left[\sum_r \beta_{ri}^r \left(PMr_{ri} \right)^{1-\sigma_i^w} \right]^{1/(1-\sigma_i^w)} \tag{27}$$

$$PMr_{ri} = ERWPM_{ri} \left(1 + A'\tau_{ri}^m\right) \tag{28}$$

$$XD_i = \alpha_{d,i}^t \left(\frac{PD_i}{PX_i} \right)^{\sigma_i^t} XP_i \tag{29}$$

$$ES_i = \alpha_{e,i}^t \left(\frac{PE_i}{PX_i} \right)^{\sigma_i^t} XP_i \tag{30}$$

$$PX_i = \left[\alpha_{d,i}^t PD_i^{1+\sigma_i^t} + \alpha_{e,i}^t PE_i^{1+\sigma_i^t} \right]^{1/(1+\sigma_i^t)} \tag{31}$$

$$ESr_{ir} = \alpha_{ir}^r \left(\frac{PEr_{ir}}{PE_i} \right)^{\sigma_i^t} ES_i \tag{32}$$

$$PE_i = \left[\sum_r \alpha_{ir}^r (PEr_{ir})^{1+\sigma_i^r} \right]^{1/(1+\sigma_i^r)}$$

(33)

$$PEr_{ir} = ERWPINDEX_{ir}$$

(34)

Market equilibrium and macro closures

Labor and capital are fully employed, perfectly mobile, and their amount is fixed. There is therefore a uniform wage rate across sectors, W, as well as a uniform rental rate, R. Equations (34) and (35) define the market equilibrium on each market.

Labor and capital market equilibrium

$$\sum_i K_i = K^s$$

(34)

$$\sum_i L_i = L^s$$

(35)

Three macro closures are considered. Government real savings, RSG, are fixed (Equation 36), as well as are government real expenditures, TG. Public receipts thus adjust endogenously to achieve the predetermined government net position. Four alternative compensating mechanisms are considered in this version of the model: a lump-sum transfer from households to the government, DT, an endogenous shift of the average VAT rate on domestic goods, an endogenous shift of the average VAT rate on imports goods, an endogenous shift of the average import tax rate.[26] Equation (37) is the ubiquitous savings equals investment equation. *InvExp* is the value of private investment expenditures, whose value must equal total resources allocated to the private investment sector: total household savings, government savings, and the sum across regions of foreign capital flows. The last closure rule concerns the balance of payments. First, we make the small country assumption for imports, i.e. local consumption of imports will not affect the border price of imports, *WPM*. Equation (38) is the overall balance of payments equation. The value of imports, at world (border) prices, must equal the value of exports, at border prices plus net transfers and factor payments, and plus net capital inflows.

Macro closures

$$RSg = S_G / P$$

(36)

$$InvExp = Hsav + ER \sum_r S_{fr} + S_G$$

(36)

$$ER \sum_r \sum_i WPM_{ri} XMr_{ri} = \sum_r \sum_i PEr_{ir} ESr_{ir} + ER \sum_r \left(S_{fr} + TR_r^G + TR_r^H \right)$$

(37)

The following equations are used to calculate the investment price and domestic price indexes which are respectively used to inflate real savings and real government savings. The numéraire of the model is the exchange rate, ER.

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[26] The closure rule used to obtain the results presented in the text consists in shifting both the VAT on imports and domestic goods.

Price indexes

$$pi = \frac{\sum_i PA_i XAi_i}{\sum_i PA_{i,0} XAi_i} \tag{39}$$

$$P = \frac{\sum_i WL_i^d + \sum_i RK_i^d}{\sum_i W_0 L_i^d + \sum_i R_0 K_i^d} \tag{40}$$

Finally, we describe below the measure of households' welfare used in this model to assess the impact of simulated reforms. The first formula is derived from the household utility function, and represents the expenditure function at the current level of consumption (i.e. current utility), but at base year prices. Typically, this is written as $E(p_0, u)$. A measure of welfare, EV, is to calculate the difference between the expenditure function at current prices and utility, i.e. $E(p, u)$ and $E(p_0, u)$, once accounted for the change in disposable income.

Welfare measures

$$E(p_0, u) = \sum_i PA_{i,0}\theta_i + \exp\left(\sum_i \mu_i \ln\left(\frac{PA_{i,0}}{\mu_i}(XAc_i - \theta_i)\right) + \mu_s \ln\left(\frac{pi_0}{\mu_s}\frac{HSav}{pi}\right)\right)$$

$$EV = YD - YD_0 + E(p_0, u) - E(p, u)$$

The last table lists the name, definition and dimension of each endogenous variable. N is the number of products and R the number of trading partners.

Variable Name	Description	Dimension
PX_i	Unit production cost	N
PD_i	Domestic producer price	N
PE_i	Export price	N
PN_i	Aggregate price of intermediate demand	N
PKL_i	Price of value added	N
W	Wage	1
R	Rental rate of capital	1
PA_i	Armington price	N
PM_i	Import price	N
PEr_{ir}	Export price by region	NR
PMr_{ir}	Import price by region	RN
cpi	Consumer price index	1
P	Domestic price level	1

XP_i	Sectoral output	N
ND_i	Sectoral aggregate intermediate demand	N
KL_i	Sectoral aggregate value added	N
L_i	Sectoral labor demand	N
K_i	Sectoral capital demand	N
XAp_{ij}	Intermediate demand by product and sector	$N\,N$
XAc_i	Household consumption by product	N
XAi_i	Investment expenditure by product	N
XAg_i	Government expenditure by product	N
XA_i	Armington	N
XM_i	Imports	N
XMr_{ri}	Imports by region	$R\,N$
ES_i	Exports	N
ESr_{ir}	Exports by region	$N\,R$
YD	Household income	1
Y^*	Household supernumerary income	1
$HSav$	Household saving	1
$GExp$	Government nominal expenditures	1
$GExp$	Investment nominal expenditures	1
$VATd$	VAT revenues on domestic goods	1
$VATm$	VAT revenues on imported goods	1
$Ytrade$	Import tax revenues	1
$GRev$	Government revenues	1
S_G	Government saving	1
K^s	Capital supply	1
L^s	Labor supply	1
λ_i	Sectoral productivity level	N

Once dropped the balance of payments equation (the balance of payments constraint is dropped from the model due to Walras' Law), the number of variables/equations equals $N(18+4R+N)+14$. The number of exogenous variables is smaller. It includes world prices of exports and imports by region, $WPINDEX_{ir}$, WPM_{ri}, foreign savings, S_{fr}, net transfers to the government and households, TR_r^G, TR_r^H, real government expenditures and savings, TG, RSg, and VAT and import tax rates, $\tau_i^{vd}, \tau_i^{vm}, \tau_i^m$. In this static model, capital supply, labor supply and sectoral productivity levels are considered exogenous as well.

Elasticities and Calibration

Most CGE models contain many more parameters that can be estimated using traditional statistical inference, and the one used here is of no exception. The calibration of the parameters of the model hence relies on two set of information. The first one is given by the input/output matrix, which reports the values of the flows modeled. The second one is a set of behavioral parameters, such as elasticities, whose values are taken from the relevant theoretical and/or empirical literature. Combining these two sets allows us to calibrate the model.

The following table lists the name, description and value of the elasticities used in the model.

Elasticity	Description	Value
σ_j^p	CES elasticity between ND and KL	0.0
σ_j^v	CES elasticity between K and L	1.0
σ_i^m	First level Armington elasticity	2.0
σ_i^w	Second level Armington elasticity	5.0
σ_i^t	First level CET elasticity	5.0
σ_i^z	Second level CET elasticity	8.0

In addition, we impose the values of income elasticities by product, η_i, which vary from 0.5 for basic products to 1.2 for services.

Fixing the value of these elasticities allows to calibrate the households' expenditure system, as follows. From the demand equation describe previously, we can derive the income elasticities:

$$\eta_i = \frac{\mu_i Y}{PA_i XAc_i}$$

and therefore the values of μ_i and μ_s, if we set the price vector to any given value (the model is homogenous). This in turn allows us to identify the vector of subsistence minima, θ_i, by solving a system of n equations of the type:

$$PA_i XAc_i = \theta_i PA_i + \mu_i \left(YD - \sum_i PA_i \theta_i \right)$$

The second set of parameters to calibrate is the set of share parameters, which appear in the CES and CET functions. We rely again on the property of homogeneity of the model to calibrate these parameters. Let's take the import demand by origin as an example (cf. Equation 26). From the first order conditions of the cost-minimization program we can write:

$$\beta_{ri}^r = \frac{XMr_{ri}}{XM_i} \left(\frac{PMr_{ri}}{PM_i} \right)^{\sigma_i^w}$$

Let's fix the world price of import in local currency to 1. The domestic price of imports by origin, inclusive of import taxes, is therefore equal to $1 + \tau_{ri}^m$. The volume of imports by origin XMr_{ri}, is the one reported in the I/O matrix, which distinguishes by product and origin the values of imports at world prices from the duties collected on it. Now let's fix the average domestic price of imports to 1. XM_i is then equal to $\sum_r (1 + \tau_{ri}^m) XMr_{ri}$. Therefore we have:

$$\beta_{ri}^r = \frac{XMr_{ri}}{\sum_r (1 + \tau_{ri}^m) XMr_{ri}} \left(1 + \tau_{ri}^m\right)^{\sigma_i^w}$$

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