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Trade Liberalisation between the Southern Mediterranean And the EU: The sectoral impact

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TRADE LIBERALISATION BETWEEN THE SOUTHERN MEDITERRANEAN AND THE EU : AN ANALYSIS OF THE SECTORAL IMPACT

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Introduction

As part of its external trade strategy the European Union is currently engaging in liberalising trade and improving economic co-operation between various third countries and groups of countries. This liberalisation is taking the form of accession agreements or negotiations for some countries (largely countries from Central and Eastern Europe), as well as Association Agreements for a number of others. In particular the EU has signed or is in the process of signing Association Agreements with a fairly large and diverse group of southern Mediterranean Countries (SMC's). In addition many of these SMCs are committed (under the WTO) to a substantial reduction in their tariffs with respect to third countries.

The principle aim of this paper is to explore in some detail the potential impact of this process of trade liberalisation on the pattern of manufacturing production in the SMC economies. The model on which the paper is based comprises 10 countries (of which 7 are SMC countries or country groupings) and 11 sectors of which 10 are manufacturing. This level of country and sectoral detail allows us to explore the nature of the impact both across countries but also across sectors. Before going into the details of the experiments modelled it is first important to consider the nature of the liberalisation process.

Many of the SMCs already experience tariff free access to the EU market under the EU's Generalised System of Preferences. A key features of the Association Agreements is that the SMCs will lower their tariff (and non-tariff) barriers on their imports from the EU. In addition the agreements involve provisions for improving SMC's access to EU markets in particular for certain agricultural commodities, harmonisation of standards and regulations, as well as aid.

There have been a number of studies examining the potential impact of these Association Agreements on the SMCs (eg. Deardorff 1996, Ghesquiere 1998). These studies commonly argue that the static welfare gains from the liberalisation of access to SMC markets for the EU are either extremely small or in certain cases negative. The reasoning is straightforward: the Agreements involve a large asymmetric reduction in tariffs which grant the EU access to SMC markets, and the asymmetry arises because the SMCs already have such access to the EU. On the one hand this is likely to lead to a welfare gain for the SMCs as the price of their imports goes down. This arises both as a result of the direct effect of the reduction in tariffs themselves (leading to trade creation), but also because of the indirect effect on the degree of competitive

interaction (and hence on price-cost margins) in SMC markets. On the other hand the elimination of tariffs from what constitutes a major trading partner for the SMCs results in a potentially substantial loss of tariff revenue. Moreover, the reduction in tariffs could also lead to welfare loss through trade diversion.

Given that the static welfare gains from trade liberalisation are perceived to be potentially small the main motivating factor for the SMCs in engaging in such a liberalisation appears to be to reap the benefits from the potential dynamic gains which could arise. Hence, as part of an overall strategy of greater integration into the world economy it is hoped to increase the productivity and long run growth rate of these economies in line with the experience of other countries who have successfully pursued a more outwardly oriented strategy. There are two main aspects to this. First, it is hoped that the increase in allocative efficiency arising a more competitive exposure to world markets will in turn lead to greater technical efficiency (increase in productivity); and secondly that the greater integration into the world economy will encourage substantial flows of foreign direct investment which serve to further improve these countries productivity and hence per capita GDP.

The aim of this paper is to focus on the potential *static* effects of both the liberalisation of manufacturing trade with the EU and of the liberalisation of such trade with the rest of the world. In particular the aim is to examine the sectoral impact, though we do include some information on the overall welfare implications, and on the factor market implications. The methodology is that of computable general equilibrium analysis based on the modern theory of international trade which allows for imperfect competition in product markets, and for the production technology to exhibit increasing returns to scale. In comparison to other work in this field the work presented here does not look at a given country in isolation but provides an empirical model with each of the countries (or country groupings) represented. This therefore allows for the exploration of the interactions not just between the SMCs and the EU but also between the SMCs themselves. A key feature of this paper is that we examine not only the impact of reductions in tariffs, but also the effect of increased access to EU markets, as well as the potential consequences of increases in productivity in the SMC economies.

Several caveats, however, are in order. First, as is always the case with CGE modelling, the paper should not be seen as providing precise predictions as to what will actually happen. Instead the paper should be seen as providing an indication of the possible orders of magnitude of the effects under the different scenarios examined. There is clearly much, however, that is excluded from the scenarios which will impact on the developments and changes in the SMC

economies. Secondly, the paper does not address the issue of changes foreign direct investment which may result as part of this process of liberalisation. Thirdly while we assess the possible impact of increases in productivity there is no underlying data on the size of the increase by sector. Fourthly, the nature of the liberalisation process (in particular with the EU) as discussed above is highly asymmetric. By liberalising access to their markets the SMCs are likely to experience a substantial increase in imports. This increase in imports will require the requisite foreign exchange (from exports). It may well be that the indirect effects of the liberalisation process (on productivity and foreign direct investment) may serve to increase these countries competitiveness in world markets sufficiently for this. However, this may also not be the case. In that event it is possible that adjustment in the countries concerned would also take place via the exchange rate. Finally, in this paper we do not model any reduction in SMC non-tariff barriers. The principal reason for this is simply the lack of reliable data both on the levels of such barriers and on the extent of any reductions.

Given the nature of the proposed trade liberalisation, and the nature of the hoped for impacts the experiments we report on proceed in stages. The purpose of these stages is to try and identify some of the key mechanisms which are likely to impact upon the economies. These results should not be seen as providing prediction, but as providing an indication of both the direction of change, and of the importance of different aspect of the economic environment.

The paper proceeds in the following manner. Section 1 details some key features of the SMR economies focussing on the patterns of production and trade. Section 2 outlines the main features of the CGE model employed (full details are given in the appendix) and of the underlying data requirements. Section 3 focusses on the trade liberalisation with the EU; section allows for the more generalised MFN set of tariff reductions, and section 5 concludes.

1) The SMC economies and integration into the world economy

In the upper panel of Table 1 we list the value added by ISIC industry for selected SMCs, and in the lower panel the share of each sector in manufacturing value added. From the table it can be seen that there are substantial differences, as well as similarities across the countries. The largest economy in terms of the size of the manufacturing sector is Turkey, followed by Israel and Egypt who are of very comparable size. The smallest economies are Cyprus, Jordan and Malta. Within each country the importance of each sector can be seen by looking at the share of value added. For each country the three largest sectors are given in bold italics.

Table 1: Value Added, and Share of Valued Added by Country & Sector

ISIC	Description	Value Added ($ billion)							
		Cypru	**Egypt**	**Israel**	**Jordan**	**Malta**	**Maroc**	**Tunis**	**Turk**
		1996	**1995**	**1995**	**1995**	**1994**	**1995**	**1995**	**1996**
311:314	Food, beverages & tobacco	321.39	1665.12	1649.58	298.88	103.51	1806.18	927.15	5976
321:324	Textiles, clothing, leather &	146.68	740.88	1155.04	65.27	96.81	942.04	1248.58	7802
331:342	Wood, furniture, paper & printing	174.19	206.17	1330.31	96.98	85.00	304.80	348.43	1930
351:356	Chemicals, petrol, rubber &	104.57	2338.43	2260.98	225.33	56.90	895.32	1232.52	12082
361:369	Pottery, glass & other non-met.	106.19	526.47	581.00	158.28	24.71	481.50	446.37	3264
371:381	Iron & steel, non ferr met, metals	72.44	635.92	1791.26	86.50	21.73	297.66	233.79	5255
382	Machinery, except electrical	28.40	153.56	406.54	20.32	11.24	67.80	19.05	2367
383	Machinery, electric	11.94	228.41	3004.47	20.23	88.10	137.94	178.11	2891
384	Transport equipment	11.37	161.00	808.46	11.77	12.78	172.13	95.06	3174
385:390	Prof., scientific & other n.e.s.	19.65	13.02	336.12	5.91	56.07	11.71	51.41	300
	Total manufacturing	996.82	13337.96	13323.75	989.47	556.85	5117.10	4780.47	45042

		Share in Value Added							
311:314	Food, beverages & tobacco	***0.32***	***0.25***	0.12	***0.30***	***0.19***	***0.35***	***0.19***	***0.13***
321:324	Textiles, clothing, leather &	0.15	***0.11***	0.09	0.07	***0.17***	***0.18***	***0.26***	***0.17***
331:342	Wood, furniture, paper & printing	***0.17***	0.03	0.10	0.10	0.15	0.06	0.07	0.04
351:356	Chemicals, petrol, rubber &	0.10	***0.35***	***0.17***	***0.23***	0.10	***0.17***	***0.26***	***0.27***
361:369	Pottery, glass & other non-met	***0.11***	0.08	0.04	***0.16***	0.04	0.09	0.09	0.07
371:381	Iron & steel, non ferr met, metals	0.07	0.10	***0.13***	0.09	0.04	0.06	0.05	0.12
382	Machinery, except electrical	0.03	0.02	0.03	0.02	0.02	0.01	0.00	0.05
383	Machinery, electric	0.01	0.03	***0.23***	0.02	***0.16***	0.03	0.04	0.06
384	Transport equipment	0.01	0.02	0.06	0.01	0.02	0.03	0.02	0.07
385:390	Prof., scientific & other n.e.s.	0.02	0.00	0.03	0.01	0.10	0.00	0.01	0.01

Source: Unido database.

Looking at the shares in valued added it can be readily seen that there a number of similarities across the countries. For all but one of the countries (Israel) Food, Beverages and Tobacco is one of the three most important sectors. Similarly both Textiles, Clothing, Leather and Footwear, and Chemicals, Rubber and Plastic are also one of the three most important sectors for most of these countries. In contrast for only two countries (Israel & Malta) does machinery figure as an important sector, and for only one country does Iron and Steel (Israel) appear as one the three most significant sectors. These figures suggest that many of the SMC economies tend to be highly specialised in certain common sectors, but that others and most notably Israel have a somewhat different industrial structure.

In Tables 1.2 and 1.3 we indicate the pattern of trade for selected country groupings. As discussed in the data section below these are the country groupings that the model works with. These groupings are: Cyprus + Malta; Egypt; Israel; Jordan + Syria; Morocco; Tunisia; Turkey; EUMed (France, Italy, Greece & Spain); EU (the rest of the EU15). In Table 1.2 we show for each economy for the manufacturing sector the shares of apparent consumption. Hence looking down the first column (Cyprus + Malta) it can be seen that of total consumption 40.5% derives from domestically produced goods, 22% from imports from the EUMed countries, and 16% from the rest of the EU.

Table 1.2) Shares in total apparent consumption - 1995

	Cyprus + Malta	Egypt	Israel	Jordon + Syria	Maroc	Tunisia	Turkey	EU Med	EU
Cyprus+Malta	40.550	0.038	0.035	0.043	0.026	0.083	0.025	0.036	0.012
Egypt	0.092	67.006	0.022	0.331	0.149	0.118	0.129	0.027	0.010
Israel	0.518	0.054	69.807	0.002	0.034	0.002	0.134	0.071	0.102
Jordon + Syria	0.355	0.035	0.002	79.191	0.167	0.227	0.153	0.043	0.017
Morocco	0.033	0.009	0.001	0.051	65.050	0.269	0.045	0.055	0.013
Tunisia	0.039	0.041	0.000	0.107	0.161	64.050	0.033	0.086	0.021
Turkey	0.448	0.449	0.245	1.409	0.346	0.486	75.039	0.106	0.146
EU Med	22.112	5.024	4.359	4.179	13.904	17.068	4.658	59.908	8.329
EU	16.425	7.940	11.995	5.598	7.612	9.685	8.053	31.787	59.513
RDM	19.429	19.403	13.534	9.088	12.550	8.013	11.732	7.882	31.836
Total	100	100	100	100	100	100	100	100	100

Several interesting features emerge from this table. The first is that except for Cyprus and Malta each of the SMC economies have a very high share in apparent consumption of manufactured goods produced domestically. The domestic share in apparent consumption ranges from 40% for Cyprus + Malta to 79% for Jordan + Syria. Looking at the source of imports it is clear that the SMC economies import very little from each other and that for all but one (Egypt) the primary source of manufacturing imports is the EU; though for each of the economies the ROW remains an import source of imports. For three of the SMC economies (Cyprus+Malta, Morocco, and Tunisia) it is the EUmed countries which are the primary source of imports.

Table 1.3 is analogous to the above, except here we are looking at the distribution of sales across countries. Hence, looking along the first row it can be seen that Cyprus+Malta sell 69.6% of their production domestically, 12.8% to the EUmed countries, and 7.7% to the rest of the EU.

Table 1.3) Distribution of sales across markets - 1995

	Cyprus + Malta	Egypt	Israel	Jordon + Syria	Maroc	Tunisia	Turkey	EU Med	EU	RDM	Total
Cyprus+Malta	69.613	0.199	0.490	0.186	0.088	0.264	0.479	12.778	7.731	8.172	100
Egypt	0.041	90.512	0.077	0.367	0.130	0.097	0.646	2.505	1.692	3.932	100
Israel	0.071	0.022	76.935	0.001	0.009	0.001	0.206	2.020	5.040	15.696	100
Jordon + Syria	0.162	0.048	0.007	90.191	0.149	0.192	0.786	4.103	2.825	1.536	100
Morocco	0.021	0.019	0.006	0.083	81.987	0.322	0.325	7.370	3.087	6.780	100
Tunisia	0.026	0.082	0.001	0.175	0.207	78.034	0.247	11.854	4.909	4.466	100
Turkey	0.045	0.137	0.199	0.352	0.068	0.090	84.882	2.211	5.334	6.683	100
EU Med	0.126	0.087	0.200	0.059	0.154	0.179	0.298	71.008	17.204	10.685	100
EU	0.054	0.079	0.318	0.046	0.049	0.059	0.298	21.798	71.117	6.182	100

In many respects this table reinforces the message from table 1.2 – the SMC economies tend to sell most of their production domestically, they export very little to each other, and for all but one of the economies (Israel) the principal source of their exports are all the EU countries, with the Eumed countries being the principal export market for five of the seven SMC country groupings.

Table 1.4 gives the import weighted tariffs by ISIC sector for a selected group of SMC countries, as well as for the EU, Japan and the US. What is immediately striking is both the disparities in tariffs across countries, and related to this the very high levels of tariffs in certain of the countries. Hence, all the SMC economies listed below except for Israel tend to have high tariffs across all sectors. The sectors with the highest tariffs tend to be ISIC 311:314 (food, beverages & tobacco), and ISIC 321:324 (textiles, clothing, leather and footwear). The countries with the highest tariffs are Algeria, Egypt, Morocco and Algeria, with the lowest tariff being 12.2% and the highest 54.4%. In contrast tariffs in the EU range from 2.7% to 9%. Both the

high level of tariffs and the disparities across countries are important in understanding the empirical results reported in this paper.

Table 1.4) Tariffs by Industry and Country

ISIC	Algérie 1993	Egypte 1995	Israel 1993	Maroc 1995	Tunisie 1995	Turquie 1995	EU 1995	USA 1995	Japon 1995
311:314	30.2	30.7	5.5	47.5	36.4	17.3	7.2	2.6	8.9
321:324	41.2	54.4	18.3	30.1	37.4	11.5	9	10.3	8.9
331:342	28.6	33.9	8.7	26.7	35.4	7.6	4.5	2	2.2
351:356	13.6	16.7	3.3	12.2	21.4	7.4	5.5	3.6	3.1
361:369	30.8	36.7	6.7	22.4	32.1	7.3	3.8	4.9	1.6
371:381	20.2	24.2	4.6	15.3	26.1	8.6	3.3	4.1	2.4
382	15.1	13.4	4.2	17.1	24.5	5.2	2.7	2.8	0
383	20.6	32.4	6.3	16.7	30.3	7.8	4.3	4	0.3
384	16.1	24.8	3.5	19.7	26.2	6.9	4.5	4.3	0
385:390	27.1	30.6	8	22.8	29.7	8.3	4	4	1.8

2) CGE model and data

The underlying theoretical model is based on imperfect competition and increasing returns to scale. Details of the model are outlined in the Appendix to this paper, and more details are given in Gasiorek, Smith and Venables (1992). The base year on which the data are based is 1995, which is the latest year for which a complete set of data was available.

The model has 10 countries, 7 of which are Southern Mediterranean Countries (SMCs), or country groupings, plus the Mediterranean EU countries (EUmed), the rest of the EU (EU), and the rest of the world (ROW). The SMCs modelled here are Cyprus+Malta (treated as a single country), Egypt, Israel, Jordon+Syria (treated as a single country), Morocco, Tunisia and Turkey. The remaining SMCs are not modelled here due to the paucity of available data. The EUmed countries are France, Spain, Italy and Greece. Each country is endowed with three primary factors of production - capital, and manual and non-manual labour. Capital is assumed to be perfectly mobile internationally, and available at a constant price. Other factors are

internationally immobile, so in the long run their prices adjust to equate demands to endowments.

The commodity structure is defined by the ISIC 3-digit classification. In practice, largely for pragmatic reasons associated with the data, we work with the 10 industry aggregates given earlier in Table 1, with the rest of each economy aggregated into a single perfectly competitive composite. The perfectly competitive sector composite is treated as tradeable and is taken as the numeraire. Each of the manufacturing industries is assumed to be imperfectly competitive, with a number of firms producing differentiated products, production being subject to increasing returns to scale.

Demand for differentiated products is modelled as a two-stage process, where the demand for a product aggregate depends on a price index for that aggregate, while demand for an individual variety depends on the price of the variety relative to that of the product aggregate. We assume that firms act as quantity competitors in segmented markets. Each firm chooses sales in each country market, taking as constant the sales of all its rivals in each market. Optimisation requires the equation of marginal revenue to marginal cost in each market, where the slope of each firm's perceived demand curve depends on the extent of product differentiation, and on the share of the firm in that market. A key feature of the model is that price-cost margins depend on firms' market shares, and increased import penetration causes firms to behave more competitively, lowering their price-cost margins.

2.1) Calibration

Numerical specification of the model is undertaken first by setting some key parameters and variables, notably those describing concentration and returns to scale on the basis of literature estimates, and then calculating the values of remaining parameters and endogenous variables so that the 1995 base year observations support an equilibrium.

The overall utility function is Cobb-Douglas. The price elasticities of demand for individual varieties depend on the elasticities of substitution in the CES aggregators. For final products we assume that the base data set represents a long run equilibrium in which profits are zero. Technology and firm scale imply a relationship between average cost and marginal cost, and, with the assumption of long run equilibrium, this also gives a relationship between price and marginal cost. This price cost margin is supported at equilibrium by two considerations;

product differentiation and market power stemming from the degree of concentration in the industry and the form of interaction between firms. We assume that the base case is a segmented market Cournot equilibrium. The number of varieties and the elasticity of demand for an individual variety are then chosen so that the price cost mark-up is consistent with the assumed scale economies. The final stage of calibration involves positioning demand curves so that consumption of products in each country is consistent with the matrix of production and consumption.

2.2 Data

Trade data was obtained from the ??? data bank, and production data from the UNIDO industrial database. Data on returns to scale derive from the survey by Pratten (1988). Data on numbers of firms in each industry and country, or more accurately data on the number of equivalent firms is extremely hard to come by. Ideally one would like data on the number of firms by different size classes in order to calculate a Herfindahl index, the reciprocal of which gives the number of equivalent sized firms. For the EU we used data based on Davis and Lyons (1996) who have calculated such indices themselves. For the SMCs the only country for which we could get data on the size distribution of firms by industry was for Morocco. Herfindahl indices were thus calculated for Morocco and then firm numbers for the remaining SMC economies were interpolated on the basis of the Moroccan ratio of production to firm numbers.

Other industry specific data required include the share of value added in production; the share of each factor in value added; the elasticity of substitution between different factors of production; and the share of final demand in the output of each industry. A wide variety of both national and international statistical sources were used for these data. For the share of value added in production and the share of capital and labour in value added we used the UNIDO industrial database. The elasticity of substitution between different factors of production was taken from secondary sources (Whalley, 1988). For the share of manual and non-manual labour in value added the following procedure was employed. For the EU countries data is available from the Chronos database, SES: Statistics on the Structure and Distribution of Earnings, 1995. For our category “EU” we used the average shares for Belgium, Denmark, the Netherlands, Sweden, and the United Kingdom; for our category “EUmed” we used the average for France, Italy & Spain; for the SMCs as no data was available from the SMC countries themselves we used the

Greek share, except for the case of Israel for which we took the EUmed share. The Chronos database enabled us to calculate the shares of manual and non-manual labour for both the imperfectly and the perfectly competitive sector. Appendix 2 gives the underlying sectoral data used in the model.

Finally data on tariffs was obtained from the TRAINS database. The tariff rates used are those discussed earlier in Table 1.4. As can be seen from that table here again data were not available for each of our countries or country groupings. Hence for those countries for which data was not available the following procedure was employed. For Cyprus+Malta the Israeli tariff rates were employed, and for Jordan+Syria the Egyptian tariff rates were used.

3) The impact of trade liberalisation with the EU

In presenting the results we proceed in stages. The purpose of the stages is not simply to provide results for lots of different outcomes / experiments. As we argue in this paper the proposed liberalisation of trade by the SMC economies represents a substantial change in policy (at least for several of the economies), and a change which may therefore have substantial impacts. As discussed earlier, it is clearly hoped that the liberalisation of trade will not simply bring about welfare gains per se, but that the liberalisation itself will stimulate structural changes in the SMC economies leading to economic growth and welfare gain. It is in order to try and understand the significance of each of these factors that the analysis proceeds in stages, and more can be learnt from the comparison of the different results, as opposed to from any one set of results themselves.

The experiments we report on are: the complete liberalisation of SMC tariffs on EU imports; tariff liberalisation and increased SMC access to EU markets; tariff liberalisation and increases in SMC productivity; and more generalised “WTO” trade liberalisation. In all of the experiments we allow firm numbers and factor prices to be flexible. When detailing the impact of each of the experiments we report on the changes in sectoral production for each of the economies, as well as the changes in welfare and the changes in factor prices.

Table 3.1 illustrates the impact of the full reduction of tariffs by the SMC economies on imports from the EU. The changes that are reported in this table are substantial – just looking at the changes in overall manufacturing production there are four country groupings (Egypt, Jordan & Syria, Morocco, and Tunisia) who experience a decline in manufacturing production of over 50%. Looking at the sectoral breakdown in particular for these country groupings it is clear that two sectors (food, beverage and tobacco; and textiles) are almost completely eliminated. These results are clearly "unrealistic". However, unrealistic here can be taken to mean one of two things. Either the results are wrong because the underlying modelling procedure is flawed and the results should simply be ignored; or the modelling procedure is sound but results are unrealistic because they fail to capture other changes in the economic environment which ideally we would like to capture.

Table 3.1) Impact of a 100% reduction in SMC import tariffs

	Cyp. & Malta	Egypt	Israel	Jordan & Syria	Maroc	Tunisia	Turkey	EU Med	EU
	% change in sectoral production								
FBT	-47.83	-97.93	-9.95	-89.69	-96.93	-96.74	-41.87	4.52	4.29
Tex	-42.49	-97.81	-79.24	-98.42	-87.65	-96.22	-15.13	10.33	5.88
Wood	-10.68	-57.53	-18.43	-90.69	-63.05	-91.95	-10.55	1.46	0.95
Chem	-36.82	-42.56	-6.96	-27.32	-46.50	-50.19	-11.57	1.65	1.09
Pott	-2.16	-18.63	-0.79	-18.31	-20.70	-22.01	-4.65	1.65	1.01
I&S	-14.33	0.04	-6.72	-49.27	-1.24	-24.21	-14.66	1.44	0.42
Mach	-14.46	-25.19	-18.71	-31.43	-73.03	-23.04	-33.94	1.63	0.85
Elec	-8.37	-38.35	-15.00	-20.57	-22.96	-24.20	-24.67	1.76	1.10
Transp	-21.20	-24.36	-16.32	-25.18	-45.04	-75.84	-25.73	1.15	0.78
Prof	-18.20	-18.71	-8.08	-45.94	-20.13	-23.14	-8.42	2.57	0.08
Manuf	-25.15	-59.21	-10.27	-66.38	-66.39	-71.74	-19.83	2.78	1.70
	% change in welfare (CV as a proportion of base GDP)								
Welfare	-1.92	1.23	-0.25	4.88	10.70	-0.78	-0.57	0.05	0.03
	% change in factor prices								
Non-Man	2.14	2.65	0.73	3.89	4.21	4.69	0.89	-0.14	-0.08
Manual	-6.15	-7.85	-2.17	-11.18	-11.93	-13.27	-2.65	0.51	0.39

Not surprisingly our view is that the latter is the correct interpretation, and the reasons for this are quite simple and lie with the underlying asymmetry of the proposed trade liberalisation. That asymmetry manifests itself in two ways. First, the association agreements largely involve a one-way reduction in tariffs – the EU exports to the SMC economies. Secondly, there are large differences in the tariff levels across the SMC economies. Tariff levels in Egypt, Jordan & Syria, Morocco & Tunisia are extremely high at the base. Clearly these markets are highly protected at the base. Liberalising tariffs from 30% to 7% (as is the case for Egypt in food, beverages and tobacco) represents a huge change in the economic environment. It is not therefore surprising that, with no compensating changes in the economic environment, we see a substantial decline in production in these sectors.

If we look at the changes in welfare it can be readily seen that it is those countries that have experienced the larger (negative) changes in manufacturing production that tend to experience a welfare gain, while the other countries tend to experience a small welfare loss. The primary explanation for this lies with classical trade theory – trade creation. It is the most protected economies that have the most to gain from importing goods from the most efficient suppliers.

In the subsequent experiments we explore the potential significance of other changes either in policy, or in the economic environment which might change the nature of the impact. Table 3.2 – 3.4 explore more fully the nature of the impact of the Association Agreements themselves. In each case we reduce the SMC import tariffs with respect to the EU, but we also allow for other changes. In Table 3.2 we report on the result of the SMC economies having better access to the EU markets. This improved access to EU markets should be seen as capturing the effect of 'deeper integration' arising from the harmonisation of standards and policies. We model this is a 10% decrease in the (non-tariff) costs of trade with the EU. In Table 3.3 we allow for the liberalisation of trade with the EU to have an impact on the efficiency of the SMC economies. This is modelled by the adjustment of the Hicks neutral technology parameter in the cost function. For those economies who already have relatively low tariffs on EU imports (Cyprus & Malta, Israel, Turkey) we allow for a 5% increase in productivity; for the other economies we assume a 10% increase in productivity.

Table 3.2 reports on the results of allowing for better access to EU markets. Clearly the increased access serves to offset some of the declines in manufacturing production seen earlier. These declines are most significant for the three SMC country groups that initially had the lower tariffs (Cyprus & Malta, Israel & Turkey). Each of these countries now experiences an expansion of overall manufacturing sector production. The remaining four countries, still experience a substantial loss of manufacturing production, though to a lesser extent than previously, and this is particularly so for Tunisia..

Table 3.2) Impact of 100% SMC tariff reduction + increased access to EU markets

	Cyp. & Malta	Egypt	Israel	Jordan & Syria	Maroc	Tunisia	Turkey	EU Med	EU
	% change in sectoral production								
FBT	-46.40	-97.90	-1.41	-89.27	-94.31	-94.36	-37.65	4.32	4.20
Tex	7.24	-95.97	-26.94	-97.86	-1.34	39.05	104.17	3.21	-2.06
Wood	-11.55	-55.61	-16.32	-91.77	-61.01	-91.64	-6.92	1.46	1.04
Chem	-17.91	-38.71	33.45	1.37	-22.89	-42.64	-7.65	0.85	0.77
Pott	-11.70	-17.49	0.48	-16.44	-14.70	-17.73	4.96	1.07	0.53
I&S	-15.68	9.73	-3.43	-49.89	1.88	-13.57	-7.56	1.27	0.40
Mach	72.77	-24.17	16.73	151.01	-67.10	569.24	-17.69	1.01	0.36
Elec	370.02	-38.00	4.21	-14.59	-2.89	22.86	-4.50	-0.64	0.28
Transp	-1.95	-23.71	-7.83	-9.69	-39.19	-69.08	-11.72	0.91	0.70
Prof	201.53	9.96	131.90	-39.19	20.97	6.87	11.11	2.00	-0.39
Manuf	59.92	-56.62	2.44	-59.15	-44.48	-24.83	10.29	1.68	1.04
	% change in welfare (CV as a proportion of base GDP)								
Welfare	-1.11	1.29	-0.09	5.03	10.82	-0.59	-0.38	0.07	0.03
	% change in factor prices								
Non-Man	-3.76	2.49	-0.27	3.75	1.84	0.11	-0.90	-0.09	-0.04
Manual	10.66	-7.14	0.79	-10.50	-5.19	-0.64	2.62	0.31	0.18

There are some interesting changes also when looking at the sectoral distribution of the changes. Food, beverages and tobacco is still an industry which is clearly adversely affected by the liberalisation; and to a large extent so is textiles. But whereas previously the textile industry in Tunisia was virtually wiped out, the increased access to EU markets strongly reverses this, and this sector now experiences an expansion of production of nearly 40%. Similarly, with just the reduction in tariffs the textile industry in Turkey declined by just over 15%, it now expands by over 100%. Other sectors where the increases access seems to make a non-negligible difference for several of the countries are machinery, and electrical goods.

In Table 3.3 we drop the assumption of improved access to EU markets and instead allow for changes in productivity in the SMC economies. The overall magnitude of the changes for manufacturing are fairly similar to those reported in the previous experiment. Except for Tunisia, all the high tariff countries find the productivity increase serves to boost their manufacturing sector by more than the change in market access. It should be noted that the fact that the change in overall manufacturing output is greater for the high tariff countries in comparison to the low tariff countries arises from the differential nature of the experiment imposed here.

The change in productivity also appears to have quite different effects across the manufacturing sectors, although this does vary across countries. For example the decline in food beverages and tobacco is largely only offset slightly, and this is also true of textiles. Nevertheless whereas Tunisia and Turkey benefitted substantially from better access to EU markets, Morocco tends to benefit more from the change in productivity in this sector. It can also be seen that the change in productivity tends to have more substantially positive impact on chemicals, petrol, rubber & plastic; on iron and steel; and particularly on machinery.

Table 3.3) Tariff reduction + increased productivity

	Cyp. & Malta	Egypt	Israel	Jordan & Syria	Maroc	Tunisia	Turkey	EU Med	EU
	% change in sectoral production								
FBT	-4.51	-95.99	6.56	-83.87	-91.95	-95.40	-13.25	3.92	3.65
Tex	-8.73	-78.16	-44.95	-91.88	17.06	-69.70	37.61	5.99	2.21
Wood	5.52	-43.51	-1.90	-64.53	-54.86	-90.18	4.38	1.19	0.77
Chem	16.29	-1.23	40.74	25.24	68.37	-43.93	4.14	0.11	0.04
Pott	-2.96	-13.60	0.86	-9.03	-8.43	-18.12	3.69	1.20	0.52
I&S	13.25	14.95	6.03	-19.76	5.02	-16.14	6.03	0.77	0.17
Mach	53.95	-7.91	51.90	225.00	-37.27	149.19	18.77	0.57	-0.04
Elec	145.45	-32.96	37.11	-4.94	-1.81	-5.10	5.79	0.38	0.20
Transp	26.82	-17.69	91.22	13.66	-35.97	-69.65	10.07	0.62	0.32
Prof	92.04	40.43	151.14	-32.15	32.68	-8.52	9.92	1.59	-0.16
Manuf	34.29	-41.67	12.34	-44.61	-21.53	-59.61	9.48	1.62	0.89
	% change in welfare (CV as a proportion of base GDP)								
Welfare	-1.05	0.57	-0.08	3.82	9.75	-1.32	-0.52	0.05	0.02
	% change in factor prices								
Non-Man	-2.76	1.48	-1.15	2.60	-0.01	3.34	-0.87	-0.09	-0.04
Manual	8.05	-4.15	3.39	-7.26	0.07	-9.24	2.64	0.30	0.20

In table 3.4 we combine all three of the above experiments and the results here are quite interesting. Previously we saw that either increased access or increased productivity can overturn some of the decline in manufacturing output which is prima facie implied by the decline in SMC tariffs. Combining both increased access and increased productivity clearly has substantially more than a simple additive effect. With solely increased productivity Cyprus and Malta saw an increase in manufacturing production of 34%; with increase access to EU markets the increase in production was 59%. Combining the two gives an increase of 458%. These are perhaps the most (and possibly overly) dramatic numbers, but this "super-additivity" can be seen when looking at the output changes for the other economies too.

Table 3.4) SMC Tariff liberalisation + increased access + productivity

	Cyp. & Malta	Egypt	Israel	Jordan & Syria	Maroc	Tunisia	Turkey	EU Med	EU
	% change in sectoral production								
FBT	-18.41	-95.80	21.70	-82.55	-85.77	-91.59	-3.84	3.51	3.73
Tex	-43.78	86.35	71.49	-72.78	577.16	312.00	463.58	-21.23	-29.13
Wood	-9.34	-40.77	-1.25	-72.34	-52.30	-89.59	17.05	1.25	1.14
Chem	28.10	18.63	141.64	112.82	161.86	-28.31	16.15	-2.18	-0.87
Pott	-10.41	-9.77	-0.90	-2.35	-1.07	-9.09	25.45	0.32	0.58
I&S	-12.98	47.64	7.62	-18.35	12.09	-0.23	26.45	0.40	0.30
Mach	113.97	-4.52	148.49	6819.04	-33.18	5284.04	70.37	-2.30	-2.66
Elec	2562.87	-31.50	82.33	6.16	26.40	55.07	47.44	-13.55	-2.83
Transp	-21.03	-16.34	127.55	45.16	-27.34	-61.54	38.20	0.05	0.58
Prof	607.50	91.10	1183.89	-19.18	69.43	25.61	31.90	-2.11	-2.66
Manuf	458.17	-10.07	40.54	0.84	97.60	93.23	111.02	-2.65	-1.43
	% change in welfare (CV as a proportion of base GDP)								
Welfare	10.29	0.75	0.82	4.36	13.50	0.54	0.61	0.15	0.04
	% change in factor prices								
Non-Man	-25.31	-0.94	-5.41	0.59	-14.31	-10.55	-7.25	0.18	0.18
Manual	130.64	3.10	18.45	-2.39	60.26	39.00	25.38	-0.61	-0.81

What is striking about these changes is that they are clearly not evenly distributed across sectors. For most of the countries the combined impact of increased access with improved productivity appears to have particularly strong results in certain sectors. Hence, Cyprus and Malta witness an expansion of electrical machinery of over 2000%; Israel sees Professional, scientific and other expand by over 1000% and so on. Morocco, Tunisia and Turky all experience a substantial (between 300%-600%) increase in textile production (with the EU med seeing a decline of 21%). Clearly these results need to be interpreted extremely carefully, in particular concerning the sectoral distribution of the impacts. The main reason for this is that we simply do not have reliable data or estimates on the possible changes in productivity arising from the process of trade liberalisation, and in particular on the possible changes by sector. What the results do show, however, is that *if* the SMC economies can realise changes in productivity that these coupled with better access to EU markets could have a substantial impact on certain sectors.

4) Broadening the trade liberalisation agenda

In this section of the paper we consider the implications of trade liberalisation which goes further or wider than that considered so far. In particular there has been some debate as to the nature of the relationship between the integration of the SMC economies with the EU, with their integration more broadly under the auspices of the WTO; and indeed of the potential virtues of closer integration among the SMC (or a sub-group of the SMC) economies themselves.

Table 4.1 allows for the liberalisation of SMC tariffs on imports from the EU as well as (i) the complete liberalisation of trade between themselves; (ii) a reciprocal 50% reduction of tariffs between the SMC economies and the rest of the world. Clearly these reductions in tariffs are merely meant to be illustrative of the potential impact of wider liberalisation as opposed to predictions regarding particular forms of liberalisation. The nature of the impact can be seen both by looking at the table itself, but also in comparing this table with table 3.1.

Table 4.1) EU + WTO liberalisation

	Cyp. & Malta	Egypt	Israel	Jordan & Syria	Maroc	Tunisia	Turkey	EU Med	EU
	% change in sectoral production								
FBT	-42.51	-98.70	-3.74	-93.89	-95.27	-96.99	-61.32	10.78	2.42
Tex	-47.20	-97.81	-71.08	-99.45	-89.88	-97.20	-0.44	27.40	20.47
Wood	-8.31	-74.10	-23.07	-95.83	-64.45	-94.23	-12.92	3.66	-0.41
Chem	-13.21	-41.53	18.50	-24.43	-46.94	-49.18	-15.60	5.48	-0.51
Pott	-1.42	-28.46	1.43	-23.13	-22.92	-25.97	-1.61	4.27	0.94
I&S	-10.34	-10.63	-9.47	-79.87	-4.63	-30.51	-15.52	3.12	-0.05
Mach	-14.58	-29.44	-15.58	-33.21	-73.25	-14.65	-39.62	11.82	0.78
Elec	24.14	-48.01	-1.27	-34.78	-23.07	-27.73	-26.94	9.75	-1.99
Transp	-22.79	-32.61	27.39	-27.80	-45.95	-78.12	-33.85	14.66	2.79
Prof	-14.86	-7.19	66.85	-49.23	-14.19	-24.40	-2.12	15.17	-2.20
Manuf	-16.26	-62.28	-3.60	-71.69	-66.84	-72.76	-22.00	9.69	1.60
	% change in welfare (CV as a proportion of base GDP)								
Welfare	-1.81	19.63	0.01	21.50	24.12	5.85	0.47	0.19	-0.01
	% change in factor prices								
Non-Man	1.63	2.67	0.22	4.13	4.07	4.65	0.82	-0.46	-0.12
Manual	-4.90	-7.97	-0.68	-11.99	-11.78	-13.35	-2.49	1.73	0.57

The overall pattern of the output changes in table 4.1 is extremely similar to that reported in table 3.1. This is true both of the distribution of the changes across countries, and the distribution of the changes across industries. The main difference is that the extent of the decline in manufacturing is on the whole less with the more global process of liberalisation than previously. Indeed it is the similarity of the results which is of interest and which is striking. These results appear to suggest that even if the SMC economies completely liberalise trade among themselves as well as integrating further into the wider world economy the impact will not be substantially dissimilar to that with the liberalisation of trade solely with the EU. This arises largely because of the base pattern of trade in which the SMC economies trade little with

each other and for most of them it is the EU which is the major trading partner in particular with regard to their exports. These results again would appear to reinforce the earlier message regarding the magnitude of the proposed trade liberalisation, but also suggest that given existing trade flows the potential for substantial gains from intra-SMC trade liberalisation appear to be small.

Table 4.2) Generalised trade liberalisation + increased access + increased productivity.

	Cyp. & Malta	Egypt	Israel	Jordan & Syria	Maroc	Tunisia	Turkey	EU Med	EU
	% change in sectoral production								
FBT	-11.52	-96.71	31.33	-87.36	-80.92	-91.63	-9.62	11.01	1.57
Tex	-65.92	115.80	60.37	-97.04	508.80	232.28	487.81	-3.42	-10.26
Wood	-8.26	-59.10	-7.05	-93.53	-52.80	-92.55	17.39	4.43	-0.42
Chem	69.97	19.13	214.84	121.81	220.39	-33.09	12.36	2.43	-2.99
Pott	-9.69	-18.87	1.03	-10.50	-0.69	-13.58	30.22	3.48	0.51
I&S	-11.10	29.36	0.89	-62.68	9.98	-6.19	30.82	2.87	-0.09
Mach	87.61	-8.47	157.54	6399.79	-34.75	5363.37	62.47	10.75	-3.38
Elec	2839.06	-41.25	131.77	-9.55	25.78	49.66	48.41	-3.82	-7.54
Transp	-24.46	-23.88	236.56	50.87	-28.21	-64.37	29.86	15.80	1.68
Prof	550.50	109.56	1726.64	-21.34	80.89	25.49	36.91	13.07	-6.56
Manuf	507.54	-10.25	56.19	-12.90	98.31	69.89	114.01	5.56	-1.79
	% change in welfare (CV as a proportion of base GDP)								
Welfare	12.01	18.92	1.53	20.60	26.78	6.72	1.31	0.35	-0.01
	% change in factor prices								
Non-Man	-27.02	-1.26	-7.26	1.62	-13.39	-8.35	-7.51	-0.35	0.16
Manual	144.89	4.13	25.55	-5.58	55.19	29.08	26.23	1.38	-0.69

In Table 4.2 we now allow for the full EU and WTO liberalisation as in the preceding experiment, but now also allow for the changes in EU market access and productivity discussed earlier. The results in this table are best compared with those of table 3.5. but again we see on

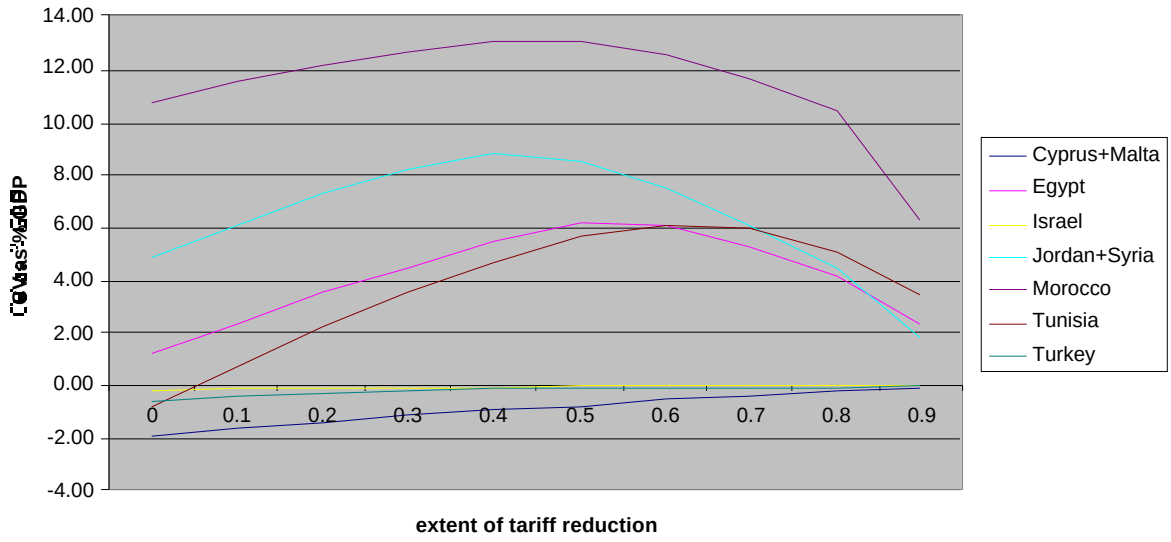
the whole a very similar pattern of results both by country, and within each country by sector. Note that this is not uniformly so – for example Jordan & Syria experienced a decline in manufacturing as a whole of 0.84% with the full EU trade liberalistion, but now experience a decline of manufacturing of 12.9%. In contrast Israel previously experienced an expansion of manufacturing in the order of 40%, which now rises to 56%.

There is one important respect in which the results are however different in tables 4.1 and 4.2 in comparison to the earlier results, and this concerns the welfare changes. In particular if one looks at the welfare changes for the high tariff economies one can see that with the EU trade liberalisation programme (table 3.1) the high tariff countries tended to experience a welfare gain, while the low tariff countries a welfare loss. With the full WTO liberalisation (table 4.1) the change in welfare for the low tariff countries is fairly similar to that experienced under the EU liberalisation programme. Hence Cyprus and Malta have a fall in welfare of –1.92% in the former experiment, and a fall in welfare of –1.81 in the latter experiment; for Israel the corresponding figures are –0.25% and 0.01%, and for Turkey –0.57% and 0.47%. In contrast the high tariff economies see a much larger change in the overall welfare effects. Thus trade liberalisation with the EU resulted in a welfare gain of 1.23% for Egypt, while the WTO liberalistion programme gave a welfare gain of 19.63%. Similar large differences in changes can be seen for Jordan & Syria, Morocco, and Tunisia.

The explanation for this can be seen with reference to Figure 4.1, below: In the figure we trace out the welfare impact of progressive trade liberalisation with the EU but with no changes in productivity or market access. Along the horizontal access we measure the extent of the tariff reduction. Thus on the very left hand side of the graph we have the welfare impact of the full 100% tariff reduction with the EU (as given earlier in table 3.1). As you move rightward from this position the extent of the tariff reduction declines. Hence on the very right-hand side we have a 10% reduction in the EU-SMC tariffs.

A clear pattern of welfare changes emerges from this figure and in particular for the high tariff economies. For these economies the initial reduction in tariffs clearly leads initially to a rising welfare gain, but as tariffs are further reduced for each of these economies those welfare gains start to decline. Hence Jordan and Syria experiences a maximum welfare gain of 8.525 of GDP with a 50% reduction in tariffs; but this welfare gain goes down to 4.8% with the full tariff liberalisation with the EU.

Figure 4.1: Path of welfare changes



The reason underlying this pattern of changes lies with the changing balance between trade creation and trade diversion. The initial reduction in (high) trade barriers results in trade creation and the associated welfare gains. However, as trade barriers are reduced further and the price difference between EU and rest of the world imports rises, there is more trade diversion and this serves to lessen the extent of the welfare gain. Similarly, it is for this reason that the low tariff economies tend to experience a small welfare loss. However, when we move to the EU plus WTO trade liberalisation scenario (as in table 4.1), precisely because of the global nature of the trade liberalisation there is considerably less trade diversion, and consequently considerably more welfare gain arising from trade creation.

5) Conclusions

This paper has provided a computable general equilibrium analysis of the liberalisation of trade between the Southern Mediterranean Countries and the EU. A number of different simulations have been run in order to try and separate out the potential impact of different plausible effects arising from the liberalisation of trade which is planned. The caveats discussed in the introduction to this paper should be borne in mind in considering the results. Nevertheless a number of important and clear results emerge from our analysis.

The first is that the asymmetric reduction of tariffs by the SMC economies is represents a large impact (shock) to their economies, and if unaccompanied by other measures or other changes in the economic environment is likely to imply a dramatic degree of industrial restructuring and could results in a welfare loss for certain of the economies. Secondly, the sectoral impact of the trade liberalisation could be very significant if the liberalisation goes ahead with no other changes in the economic environment. Of particular importance is the extent to which the SMC economies obtain improved access to EU markets, and the extent to which the process of trade liberalisation results in any productivity improvments. Thirdly, there is nevertheless clearly substantial potential for welfare gains from such a process of closer integration with the EU and these welfare gains are likely to be bigger (a) for those countries with initially higher tariff levels (giving greater scope for trade creation and for the pro-competitive impact of liberalisation); (b) for those countries who trade more with the EU; (c) for those countries that engage in a more widespread process of trade liberalistion under the auspices of the WTO

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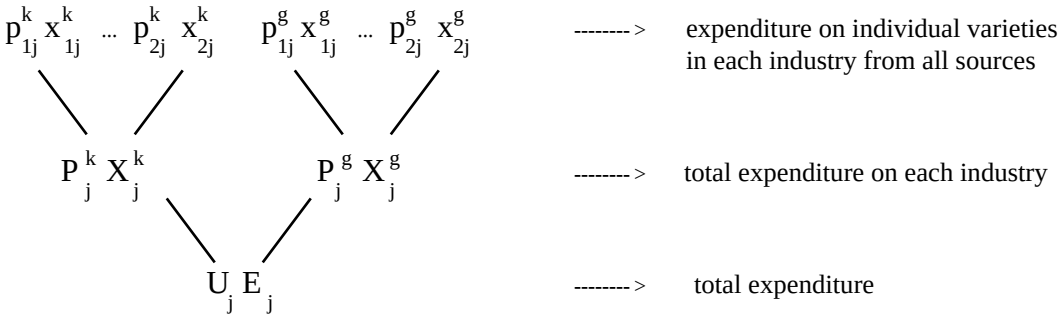
APPENDIX 1: MODEL DETAILS

The aim of the model is to apply theoretical developments in trade theory since the late 1970's which identified the importance of economies of scale and imperfect competition. These theoretical developments were in part stimulated by the observed high levels of intra-industry trade between advanced industrialised economies, such as between the countries of the European Community [Grubel and LLoyd (1975)].

A1) Demand

Demand is divided between final demand and intermediate demand each of which are treated analogously. In each country there is a single representative consumer with homothetic preferences, and each industry demands a composite amount of intermediates. Consider first final demand. A two-stage budgeting procedure is adopted which is shown schematically in Figure 5.1[1].

Table A.1 Final Demand



The overall budget constraint, M_j in country j is given by,

1) $$M_j = U_j E_j$$

[1] For a detailed discussion of functional seperability and two-stage budgeting see Green (1976) chapter 10, or Varian (1992) chapter 9.

where U_j is the utility function, and E_j is the unit expenditure function in country j. Each of these is represented by a Cobb-Douglas aggregator and takes the following form,

2) $$U_j = \subseteq_k \left(X_j^k\right)^{\beta_j^k}$$

3) $$E_j = \subseteq_k \left(P_j^k\right)^{\beta_j^k}$$

where X_j^k represents the sub-utility function over individual product varieties, and P_j^k represents the aggregate price index. In the first stage consumers maximise their utility subject to their overall budget constraint, and allocate expenditure between different industries, denoted by superscripts. The β_j^k's represent the share of industry k in total expenditure in country j. In the second stage consumers maximise the sub-utility function over individual product varieties, given by X_j^k , subject to the budget allocated to that industry. Hence, expenditure is divided within each group on individual product varieties.

The sub-utility function over individual product varieties is assumed to be a constant elasticity of substitution aggregator, with elasticity of substitution common to all countries denoted ε^k. The sub-utility function takes the following form,

3) $$X_j^k = \sum_{i=1}^{j} \sum_{l=1}^{n_i} \sum_{m=1}^{m_{li}} \left(a_{ijlm}^k\right)^{1/\varepsilon^k} \left(x_{ijlm}^k\right)^{\frac{\varepsilon^k-1}{\varepsilon^k}} \frac{\varepsilon^k}{\varepsilon^k-1}$$

x_{ijlm}^k is the output of a single variety, m, of a good in industry k, produced in i and sold in j by firm *l* (and a_{ijlm}^k is the associated demand parameter). Hence consumers demand each variety produced from all sources. Each industry contains a number of firms, with n_i^k denoting the number of firms in industry k located in country i. Each firm produces a number of varieties of differentiated products (used in both final demand and as an intermediate), where m_{li}^k denotes the number of varieties produced by firm *l* in industry k based in country i. In order to simply the above it is assumed that for a particular industry and country all firms are symmetric: for each k and each i, the n_i^k firms produces the same number of varieties and the same quantity of each variety ($m_{li}^k = m_i$, $\forall\, l$ and $x_{ijlm}^k = x_{ij}^k$, $\forall\ l, m$). Within each country and industry there are therefore $n_i^k\ m_i^k$ such varieties, and because of the symmetry, we do not need to introduce a notation for individual varieties. Equation 3 can then be simplified to,

4) $$X_j^k = \sum_{i=1}^{j} n_i^k m_i^k (a_{ij}^k)^{1/\varepsilon^k} (x_{ij}^k)^{\frac{\varepsilon^k-1}{\varepsilon^k}} \frac{\varepsilon^k}{\varepsilon^k-1}$$

Consumer demands for the aggregate quantity indices are derived (by Shephard's lemma) by partial differentiation of the expenditure function. The sub-utility function over differentiated products can then be interpreted as a quantity index. Analogously, and dual to the quantity index, P_j^k, represents the aggregate price index for all varieties of industry k consumed in country j. The form of P_j^k is given by,

5) $$P_j^k = \sum_{i=1}^{j} n_i^k m_i^k a_{ij}^k (p_{ij}^k)^{1-\varepsilon^k}^{\frac{1}{1-\varepsilon^k}}$$

p_{ij}^k and x_{ij}^k denote the price and quantity of a single product variety of industry k produced in country i and used (as a final demand) in country j. The expenditure function over differentiated products is then given by,

6) $$E_j^k = X_j^k P_j^k$$

Demand for individual varieties of any given product, x_{ij}^k, is again given by Shephard's Lemma, by differentiation of the expenditure function with respect to individual prices, p_{ij}^k,

7) $$x_{ij}^k = X_j^k \left(\frac{P_j^k}{p_{ij}^k}\right)^{\varepsilon^k} a_{ij}^k$$

Intermediate demand is treated analogously to final demand. The quantity of a single product variety of industry k produced in i and used as an intermediate good in j is denoted y_{ij}^k with price q_{ij}^k. Technology is supposed to be such that the following aggregation procedure is possible. First, varieties within an industry and country of sale are aggregated into a quantity index Y_j^k with associated price index Q_j^k. (Once again, they are not separately nested by geographical source). Second, the quantity and price indices are aggregated into a composite intermediate commodity whose price index in country j is F_j [2]. This implies that there is a single composite intermediate commodity, so that the proportions in which each industry uses the products of other industries are assumed to be the same.

A2) Production

On the producer side, in each economy, the model distinguishes between a tradable perfectly competitive sector and a tradable imperfectly competitive sector. The imperfectly competitive sector is composed of ten manufacturing industries based on the ISIC classification scheme. Production is both for final demand and for

[2] The parameters ε, β, and a_{ij} are of course different than in final demand.

intermediate input but no distinction between products as to their final use is made. It is assumed that capital is perfectly mobile internationally, and available at a constant price. Other factors are internationally immobile, so their prices adjust to equate demands to endowments.

Each industry in the imperfectly competitive sector produces under increasing returns to scale. The costs of a firm in industry k of country i are given by a cost function c_i^k ,

8) $$c_i^k = m_i^k c_i^{h^k} \left[h^k(z_i^k) G_i^k(w_i^K, w_i^{L1}, w_i^{L2}, w_i^{L3}, w_i^{L4} \right]$$

9) $$\text{where } z_i^k = \sum_j \left[x_{ij}^k + y_{ij}^k \right]$$

z_i^k is the total output per variety of a country i firm in industry k. The function h^k describes the returns to scale in industry k. Increasing returns to scale means that $h^k(z_i^k)/z_i^k$ is decreasing in z_i^k, and we employ a functional form for h^k that permits decreasing marginal cost as well as decreasing average cost,

10) $$h^k(z_i^k) = \left[c_0^k + c_1^k z_i^k + c_2^k (z_i^k)^{c_3^k} \right]$$

Returns to scale depend on the parameters, $c_o^k \ldots c_3^k$. Thus, $c_0^k > 0$ is a fixed cost; $c_2^k > 0$, $c_3^k < 1$ implies decreasing marginal cost. The technology available to all firms in a given industry is the same across countries, so the function h^k is not country specific. Furthermore, there are no economies of scope, since c_i^k is linear in m_i^k, and returns to scale are associated with output per variety, z_i^k . The function G_i^k aggregates input prices into cost per unit h,

11)
$$G_i^k = (1 - va^k) F_i + va^k D_i^k$$
$$D_i^k = d^{K^k} (w_i^K)^{r^{K^k}} + \left(d^{L1^k} (w_i^{L1})^{r^{L1^k}} + \ldots + d^{L4^k} (w_i^{L4})^{r^{L^k}} \right)^{r^{K^k}/r^{L^k}}$$

Its arguments are the intermediate price index, F_j , and the prices of the five primary factors of production, w_i^K, $w_i^{L1} \ldots w_i^{L4}$; the share of value added in production is given by va^k; the elasticity of substitution between capital and labour in industry k, by $(1 - r^{K^k})$, and the substitution elasticity between different types of labour in industry k by $(1 - r^{K^k})$; d^{K^k} and $d^{L1^k} \ldots d^{L4^k}$ represent technological parameters related to the share of each factor in final output. If $r^{K^k} = r^{L^k}$ then these parameters give the share of each factor in value added. The functions G_i^k differ by country, but only by a scalar, $c_i^{h^k}$ implying Hicks neutral technical differences between countries. All countries are thus assumed to face identically shaped isoquants but the

distance of the isoquant from the origin is given by $c_i^{h^k}$. If factor prices were identical across countries this would imply that all firms in each country would be producing at the same point on their respective isoquants.

As has been noted above, each firm produces a number of varieties of product, m_i^k . It is assumed throughout this paper that these numbers are constant. Furthermore, it is assumed that, at the base, output per variety, z_i^k, is the same for all firms. m_i^k should therefore be thought of as a scaling device; with different firm sizes in the base data set attributed to differences in the number of varieties firms produce, not differences in output per variety. The effect of this assumption is to ensure that all firms have the same degree of unexploited economies of scale.

Production in the perfectly competitive sector is under conditions of constant returns to scale. The form of the cost function is again given by 8 but with h^k defined to give constant returns to scale. Perfectly competitive sector output is tradable, and is taken to be the numeraire with its price normalised at one.

A3) Firm behaviour

The profits of firms are given by

12) $$\pi_i^k = m_i^k \sum_j \left[p_{ij}^k x_{ij}^k + q_{ij}^k y_{ij}^k \right]\left[1-\tau_{ij}^k\right] - t_{ij}^k \left[x_{ij}^k + y_{ij}^k \right] - c_i^k$$

where τ_{ij}^k and t_{ij}^k are respectively the ad valorem tariff and transaction costs of shipping a unit of industry k output from economy i to economy j.

It is assumed that firms act as quantity competitors in segmented markets. Each firm in industry k and country i then chooses sales in market j, x_{ij}^k , taking as constant the sales of all its rivals in each market. Optimisation requires the equation of marginal revenue to marginal cost in each market, where the slope of each firm's perceived demand curve depends on the extent of product differentiation, and on the share of the firm in that market. The first order condition for profit maximisation takes the form,

13) $$p_{ij}^k (1-\tau_{ij}^k) \left(1 - \frac{1}{e_{ij}^k}\right) = \frac{1}{m_i^k} \frac{fc_i^k}{fz_i^k} + t_{ij}^k$$

where e_{ij}^{k} is each firm's the perceived elasticity of demand for an individual product variety,

14) $$e_{ij}^{k} = \frac{f x_{ij}^{k}}{f p_{ij}^{k}} \frac{p_{ij}^{k}}{x_{ij}^{k}}$$

Equation 7 can be rewritten in terms of p_{ij}^{k}. Similarly equation 5.1 can be rearranged in terms of P_{j}^{k} and substituted in, which gives,

15) $$p_{ij}^{k} = (X_{j}^{k})^{(1-\varepsilon^{k})/\varepsilon^{k}} (a_{ij}^{k})^{1/\varepsilon^{k}} (x_{ij}^{k})^{-1/\varepsilon^{k}} \phi_{ij}^{k}$$

where, $\phi_{ij}^{k} = M_{j}^{1/\beta} / \sum_{h=1}^{k-1} P_{j}^{h} X_{j}^{h}, \qquad h \neq k$

Where ϕ_{ij}^{k} is assumed to be constant. Taking the derivative with respect to x_{ij}^{k} yields:

16) $$\frac{f p_{ij}^{k}}{f x_{ij}^{k}} = -\frac{1}{\varepsilon^{k}} \frac{p_{ij}^{k}}{x_{ij}^{k}} + \left(\frac{1}{\varepsilon^{k}} - 1\right) \frac{f X_{j}^{k}}{f x_{ij}^{k}} \frac{p_{ij}^{k}}{X_{j}^{k}}$$

Hence,

17) $$\frac{1}{e_{ij}^{k}} = \frac{1}{\varepsilon^{k}} + \frac{1-\varepsilon^{k}}{\varepsilon^{k}} \frac{f X_{j}^{k}}{f x_{ij}^{k}} \frac{x_{ij}^{k}}{X_{j}^{k}}$$

Now for any given industry k and hence dropping superscripts,

18) $$\frac{f X_{j}}{f x_{ij}} = \frac{X_{j}}{\sum_{h} a_{hj}^{1/\varepsilon} n_{h} m_{h} x_{hj}^{(\varepsilon-1)/\varepsilon}} \left[(1-v_{i}) a_{ij}^{1/\varepsilon} n_{i} m_{i} x_{ij}^{-1/\varepsilon} + v_{i} \sum_{h} a_{hj}^{1/\varepsilon} n_{h} m_{h} x_{hj}^{\varepsilon-1/\varepsilon} \right]$$

where for $h \neq i$, $v_{i} = \frac{f x_{hj}}{f x_{ij}} \frac{x_{ij}}{x_{hj}}$

Therefore, where s_{ij}^{k} is the share of a single firm from country i in the country j market for industry k.

19) $$\frac{f X_{j}}{f x_{ij}} \frac{x_{ij}}{X_{j}} = (1-v_{i}) s_{ij} + v_{i}$$

With firms behaving as quantity competitors, $v_{i}^{k} = 0$, hence,

20) $$\frac{1}{e_{ij}^k} = \frac{1}{\varepsilon^k} + \frac{1-\varepsilon^k}{\varepsilon^k}\sqrt{s_{ij}^k}$$

Firms' choice of intermediate sales quantities, y_{ij}^k,, is less straightforward. It is possible that purchasers of inputs have some monopsony power, to be combined with the monopoly power of sellers. Further, and perhaps more importantly, even if purchasers of intermediates are input price takers, the demand for intermediates is a derived demand, and establishing the elasticity of the derived demand curve is not straightforward. For these reasons it is assumed that the price of a good sold as an intermediate equals the price of the same good sold to final demand. Furthermore, the number of varieties of intermediate goods entering the price indices Q_j^k is held constant, so abstracting from any variety effects on the users of intermediate goods.

A4) Completing the model

Input demands, which in equilibrium equal factor supplies, v_i^l , are partial derivatives of the cost functions discussed previously. So we have,

21) $$v_i^l = \sum_k n_i^k m_i^k c_i^{h^k} h^k(z_i^k) \frac{fG_i^k(F_i, w_i^K, w_i^{L1}, w_i^{L2}, w_i^{L3}, w_i^{L4})}{fw_i^l} \qquad (l = K, L1, .., L4)$$

All that remains to complete the description of the model is the determination of income. Income accruing to factor l in economy i is $w_i^l v_i^l$. National income is factor income accruing to the five factors, plus the profits of firms and tariff revenue

A5) Demand & Calibration:

The price elasticity of demand for the industry aggregates, X_j^k and Y_j^k , with respect to the associated price indices, are unity, by the Cobb-Douglas assumption. The price elasticities of demand for individual varieties depend on the elasticities of substitution in the CES aggregators. For intermediate products we assume that this elasticity of substitution is the same for all industries, and equal to 5.

For final products we assume that the base data set represents a long run equilibrium in which profits are zero. Technology and firm scale imply a relationship between average cost and marginal cost, and, with the assumption of long run equilibrium, this also gives a relationship between price and marginal cost. This price cost margin is supported at equilibrium by two considerations; product differentiation and market power stemming from the degree of concentration in the industry and the form of interaction between firms.

We assume that the base case is a segmented market Cournot equilibrium. The price cost margin then implies a measure of product differentiation, from which we obtain a value of the elasticity of substitution, ε^k. Calibrated values of are to be interpreted as the price elasticity of demand for an individual product variety, holding prices of other varieties and the overall industry price index, P_i^k, constant.

In assessing the methodology of CGE models it is probably with respect to the calibration procedure that there is frequently the most misgiving. For example, a key feature of our model is the calibrated elasticity of substitution, ε, between different product varieties which depends crucially on the degree of concentration in the industry, and on the extent of any returns to scale. These calibrated elasticities are typically fairly high and imply elasticities of import demand which are somewhat lower but still considerably above econometrically estimated trade elasticities. These elasticities are very high in food, and textiles; and are relatively low (so products are quite highly differentiated) in industries such as paper, and chemicals. This method of calibration does of course depend on the form of the base equilibrium. Sensitivity analysis over equilibrium concepts is undertaken in Venables (1990).

The final stage of calibration involves positioning demand curves (i.e., finding parameters of a_{ij}^k , of the aggregators) such that consumption of products in each country is consistent with the matrix of production and consumption.