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DIFFERENTIATED PRODUCTS

by

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Abstract: In a small open economy model where imports (exports) are differentiated by region of origin (destination), the welfare effects of a preferential trade agreement (PTA) are considered. Trade creation is found to be a concave function of pre-union partner trade shares. This contrasts with earlier results in the homogeneous goods case whereby the smaller the pre-PTA volume of trade with a potential partner the smaller is trade diversion and the more beneficial is a PTA. An applied general equilibrium model of Egypt demonstrates the theoretical findings for a PTA with the European Union. As Egypt's trading patterns are not heavily focused on the EU, gains from a PTA would likely be modest.

Keywords: preferential trade agreements, trade shares, differentiated products, computable general equilibrium, Egypt

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1. Introduction

The outcome of a preferential trading arrangement (PTA) follows a well-known theory of second best. By favoring partner countries with preferential tariff rates the possibility of trade diversion arises. Imports from the partner may displace more efficient suppliers elsewhere at the cost of tariff revenues – trade diversion. This negative impact may be offset by trade creation as domestic consumers substitute away from inefficient domestic goods in favor of imports from the partner. In light of this welfare ambiguity, international economists have attempted to develop theory-based rules-of-thumb to guide and inform policy. One example of this attempt is the debate on the relationship between the initial share of trade with a potential partner and the prospects for gains or losses in a PTA agreement (see Schiff 1996).

A traditional view set forth by Lipsey (1970) holds that a PTA between countries that already trade in large volumes with one another is less likely to be trade diverting as the potential partner is already a low cost supplier. In contrast, Riezman (1979) found that a sufficient condition for partners to gain from a customs union is that their mutual volume of trade is relatively small. In a three-country, three-good model, the more relatively similar are countries (hence, smaller is Heckscher-Ohlin volume of trade) of a union the greater the potential to improve joint terms of trade vis-à-vis the rest of the world. Likewise, in the model of Panagariya (1996) and Bhagwati and Panagariya (1996) where a country is large (i.e., influences the terms of trade) relative to the potential partner but is a small price taker in the rest of the world, the smaller is the initial trade share with the partner the lower are trade diversion losses.2

A key assumption of these models is that products are homogeneous. We assume, instead, imports and exports are imperfect substitutes for domestically produced goods. Products are differentiated across countries in an Armington fashion.3 Initial trade shares depend not only on efficiency (terms of trade) conditions but also on underlying preferences. An initially small volume of trade with a potential partner indicates a combination of comparative cost and relative preference disadvantages. No clear predictions emerge as the magnitude of trade creation hinges on the elasticity of substitution between differentiated imports. Thus the question becomes an empirical one.
We illustrate the issue by developing a computable general equilibrium (CGE) model of Egypt. The European Union (EU) is in the process of negotiating bilateral Euro-Mediterranean Agreements (EMA) with several nations of the Middle East and North Africa (MENA), having already reached agreements with Turkey and Tunisia (Hoekman and Djankov 1996). The case of Egypt is particularly interesting as its trading pattern is much less focused on the EU than some of its African neighbors. In this paper we examine the potential for Egypt to gain from participation in the EMA initiative and the importance of Egypt’s share of trade with the EU for trade creation.

The paper proceeds as follows. A theoretical model of trade creation and diversion is developed in Section 2 for a small country (Egypt) where goods are differentiated by region of import origin and export destination. Comparative statics reveal an ambiguous relationship between the initial share of trade with a PTA partner (EU) and trade creation. In Section 3 the theoretical model is extended to provide the framework for a three region, 38 sector computable general equilibrium (CGE) model of the Egyptian economy. Data and the empirical implementation of the CGE model are discussed in Section 4. Counterfactual experiments are conducted on several MFN and preferential trade reform scenarios. Comparative static simulations consider the relationship between the initial volume of trade with a PTA partner and trade creation, diversion and welfare. Simulation results are reported in Section 5. The final section provides summary comments.

2. Trade Creation and Diversion with Differentiated Products

In this section a simple model of a small country is developed to demonstrate the importance of benchmark trade shares in the formation of a PTA. While simple in dimension, this model illustrates important features of the more complicated Egypt CGE model that is described in the next section. Assume that a small country (Egypt) trades with two regions: a potential partner (EU) and the rest of the world (ROW). Egyptian importable goods are differentiated by region of origin: imports from the EU, \( M_{EU} \), and imports from ROW, \( M_{ROW} \). These imports are imperfect substitutes and are purchased at exogenous
prices. Likewise, Egyptian exportables are differentiated by region of destination for the EU, $X_{EU}$, and the rest of the world, $X_{ROW}$. Exports are produced under constant returns to scale conditions, are imperfectly transformable across region of destination, and are sold at constant terms of trade.

The basic implications of an EU-PTA are illustrated in Figure 1 for the Egyptian import market. At an initial MFN tariff of $t = P_{EU}^* - P^*$ within a sector (sector $i$ subscript dropped for simplicity) Egypt imports quantities $M_{EU}^*$ and $M_{ROW}^*$. Suppose Egypt moves to an EU-PTA that eliminates the EU import tariff but maintains the tariff on ROW. Consumer surplus in the $M_{EU}$ import market increases by the area $P_{EU}^* ACP_{EU}^*$ while tariff revenues on EU imports fall by $P_{EU}^* ABP_{EU}^*$, resulting in a net welfare gain of area $ABC$ – defined as import trade creation. As $M_{EU}$ and $M_{ROW}$ are Armington substitutes, the fall in the price of the EU import implies a fall in the Egyptian demand for $M_{ROW}$ or a shift in Hicksian demand from $D_{ROW}^1$ to $D_{ROW}^2$. This results in trade diversion welfare losses of area $EFGH$. The net welfare effect of an EU-PTA in the import market, measured as the area $ABC - EFGH$, depends on several key factors. First, the own-price elasticity of compensated demand for $M_{EU}$ determines the magnitude of the movement from $M_{EU}^*$ to $M_{EU}^*$. A second determinant, the elasticity of substitution between EU and ROW imports ($\eta$) determines the size of the shift in demand for $M_{ROW}$. Third, the share of total import expenditures originating from the EU initially or $s_{EU} = P_{EU}^* M_{EU}^* / (P_{EU}^* M_{EU}^* + P_{ROW}^* M_{ROW}^*)$ determines the relative magnitude of the elasticity effects.

Suppose the representative consumer's preference orderings are separable such that her constant elasticity of substitution ($\eta>1$) import subutility function is given by

$$u(M_{EU}, M_{ROW}) = (s_{EU} M_{EU}^* + s_{ROW} M_{ROW}^*)^{\frac{1}{\eta-1}}.$$  (1)

It is shown in the Appendix that the trade creation (TC) generated by a preferential removal of the EU tariff $t_{EU}$ is given by

$$TC = \frac{-1}{1-\eta} \ln \left[ 1 - s_{EU} \left( 1 - (1 + t_{EU})^{-1+\eta} \right)^{-1+\eta} \right] - R_{EU} s_{EU}$$  (2)
\( I \) indicates a fixed amount of income \( I \) to the purchase of imports. The first term of equation 2 is the increase in consumer surplus in the EU imports market and the second term represents the loss of EU tariff revenue.\(^5\)

Note that trade creation also depends on the own price elasticity which is a function of \( \eta \) and \( s \).\(^6\) The derivative of the trade creation function with respect to \( s_{EU} \) is given by

\[
\frac{\partial TC}{\partial s_{EU}} = \frac{I}{1-\eta} \left[ 1 - \frac{1 - (1 + t_{EU})^{-1-\eta}}{s_{EU}} \right] - I t_{EU}
\]  

(2)

The first term on the right-hand side is positive, indicating that the consumer surplus generated by removing the EU tariff is increasing in the pre-reform share of imports originating from the EU. However, the loss of EU import tariff revenues is increasing in \( s_{EU} \) (the second right-hand side term is negative) rendering the sign of \( \partial TC/\partial s_{EU} \) ambiguous. Thus a marginal increase in the initial share of total import expenditures originating from the EU may either raise or lower the value of trade creation generated by a removal of the EU tariff. The second derivative \( \partial^2 TC/\partial s_{EU}^2 \) is negative, indicating that the trade creation consumer surplus measure is a concave function of the initial share of total imports originating from the EU.

Trade diversion TD is a function of the pre and post-PTA share of total import expenditures originating in ROW, \( s_{ROW} \) and \( s^2_{ROW} \) respectively, which in turn are functions of \( \eta \).\(^7\)

\[
TD = \frac{R_{ROW}}{(1 + t_{ROW})} \left[ s_{ROW} - s^2_{ROW} \right]
\]  

(3)

Consider the impact of an EU-Egyptian PTA on a representative Egyptian export market, Figure 2. Assume Egypt receives MFN access at terms of trade \( P_{EU}^* \) and \( P_{ROW}^* \) in EU and ROW export markets respectively. Given supply conditions, Egypt initially exports \( X_{EU}^* \) and \( X_{ROW}^* \). Let Egypt enter in to an EU-PTA that affords Egypt preferential access to EU markets. A small economy relative to the EU, Egypt faces the same post-tariff price as domestic-EU producers, \( P_{EU}^{EGY} \). Egyptian export supply to the EU increases to \( X_{EU}^{EGY} \) and export revenues increase by the area \( P_{EU}^{EGY} A X_{EU}^{EGY} X_{EU}^* C P_{EU}^* \). A portion of these revenue gains (area \( ABC \)) are dissipated in increased world inefficiency or dead-weight loss as Egyptian
production cost rises. As $X_{EU}$ and $X_{ROW}$ are substitutes in production, an increase in $X$ sales to the EU implies a decrease in $X$ supply to the ROW or a shift from $S_{ROW}^1$ to $S_{ROW}^2$. At constant ROW terms of trade, exports to ROW fall to $X_{ROW}^2$. The cost of ROW production erosion is captured by the dead-weight loss triangle (area $ABC$). Thus the net increase in Egyptian export producer surplus, export trade creation, and welfare is given by area $P_{EU}^{BOY} ACP_{EU}^*$. The larger is the benchmark trade volume with the EU, the greater the potential for export trade creation.

3. The Egypt CGE-TL Model

In this section a simple model of a small country (Egypt) is developed to demonstrate the importance of benchmark trade shares in the formation of a PTA. The Egyptian CGE trade liberalization (CGE-TL) model is capable of computing the welfare implications of various trade liberalization policy changes, including preferential arrangements with the EU and unilateral tariff cuts. In part, welfare responses of PTAs may be decomposed into trade creation and diversion effects. Our interest is in the responsiveness of trade creation, trade diversion, and welfare to changes in benchmark trade share and elasticity assumptions. The algebraic model is presented in its entirety in Table 1. In this section we highlight some of the main features of the model.

3.1. Consumer preferences

Egypt is modeled as a small open economy (SME) in which household and production decisions follow standard neoclassical assumptions of optimization. Of particular interest is the regional and sectoral aspects of Egypt’s international trade. In this version of the CGE-TL model, bilateral trade flows with the European Union (EU - including Turkey) and the rest of the world (ROW) are distinguished for each of 38 sectors (three in agriculture, two in mining and quarrying, 21 in manufacturing, and 12 in services).

Final demand by a Representative Agent (RA) is determined by a nested CES utility function for given prices and budget constraint. The model is presented schematically in Figure 3. In the first stage of
the multi-level budgeting problem, the RA decides on aggregate purchases per sector according to a Cobb-Douglas subutility function.

\[ U = \Pi_i C_i^{a_i} ; \quad \Sigma \lambda_i = 1. \]  \hspace{1cm} (4)

Given the first-stage allocation of income per sector, the RA decides how much to spend on domestic and imported goods of each sector according to a CES subutility function.

\[ C_i = [\phi_{\text{DI}} M_{\text{DI}}^{(\eta-1)/\eta} + \phi_{\text{IC}} M_{\text{IC}}^{(\eta-1)/\eta}]^{\eta/\eta-1}. \]  \hspace{1cm} (5)

Egyptian importables in sector \( i \) are differentiated by region of origin: importables from the EU, \( M_{\text{EU}} \), and importables from ROW, \( M_{\text{ROW}} \). These imports are imperfectly substitutable and are purchased at exogenous prices. The constant elasticity of substitution (\( \eta > 1 \)) import subutility function is given by

\[ M_{\text{IC}} = (\delta_{\text{EU}} M_{\text{EU}}^{(\eta-1)/\eta} + \delta_{\text{ROW}} M_{\text{ROW}}^{(\eta-1)/\eta})^{\eta/(\eta-1)}. \]  \hspace{1cm} (6)

In keeping with the static nature of this model, two closure rules are required: savings-investment balance, and current account balance. The saving-investment rule assumes that the capital stock is exogenously fixed at the benchmark level and financed by forced (exogenous) consumer savings that act as a lump-sum transfer. The interest rate of capital is endogenously determined by factor-demand conditions.

Second, the current account balance \( B \) is exogenously fixed at the benchmark deficit level. As external terms of trade \( (p^*_n, r = \text{EU}, \text{ROW}) \) are fixed by the small country assumption,\(^{10}\) Egypt’s real exchange rate, \( e \), or shadow price of foreign currency will adjust to offset changes in the Egyptian domestic import prices \( (p^*_n, r = \text{EU}, \text{ROW}) \).

\[ B = \Sigma (1/e)(p_{\text{EU}} X_{\text{EU}} + p_{\text{ROW}} X_{\text{ROW}}) - p_{\text{EU}} X_{\text{EU}} - p_{\text{ROW}} X_{\text{ROW}}. \]  \hspace{1cm} (7)

The RA household receives income from factors of production (endowments of labor, \( \overline{E}_L \), and capital, \( \overline{E}_K \) valued at factor prices \( w_L \) and \( w_K \) respectively). Supplemental income is obtained with foreign borrowing through a current account deficit \( B \), valued at the real exchange rate \( e \). The Agent must also pay for government borrowing \( (D) \) and investment for fixed capital formation and inventory investment \( (I^F) \), discussed below. Thus the RA’s budget constraint is:

\[ \Sigma p_i C_i = w_K \overline{E}_K + w_L \overline{E}_L + eB - \Sigma p_i^I I^F - D. \]  \hspace{1cm} (8)
The term, \( \bar{p}_t^C (\bar{p}_t^F) \), indicates the domestic price index of consumption (investment) across home prices \( [p_t^j = (1 + \tau_C)p_t] \) and imported prices \( [p_t^j = (1 + \tau_C)(1 + t_n)p_t^m] \) where \( \tau_C \) denotes a consumption tax, \( p_t \) the domestic producer price, \( t_n \) a tariff on imports from region \( r \), and \( j = C, IF \).

### 3.2. Production and exports

Production in each of 38 sectors requires labor, capital, and intermediate inputs. Firms maximize profits under perfectly competitive conditions given constant returns to scale production. Figure 3 gives a schematic overview of the nested structure of production and consumer preferences. The first production combines composite intermediate goods \( (z_{ij}) \) and a composite value-added input \( (V_i) \) with Leontief technology, where \( a_{ij} \) is the unit requirement for input \( j \).

\[
Y_i = \min[z_{i1}/a_{i1}, \ldots, z_{in}/a_{in}, V_i/a_{i1}] \tag{9}
\]

In this version of the CGE-TL model, all primary factors are assumed to be perfectly mobile across sectors but internationally immobile. Value added is further disaggregated into labor and capital in a constant elasticity of substitution (CES) production function.

\[
V_i = [a_{i1}L_i^{(\alpha_i-1)/\alpha_i} + a_{ik}K_i^{(\alpha_i-1)/\alpha_i}]^{\alpha_i/\alpha_i-1} \tag{10}
\]

The composite intermediate good \( (z_{ij}) \), input \( j \) to sector \( i \) is a CES aggregate of domestic \( (d_{ij}) \) and imported goods \( (m_{ij}) \). Imported intermediates are further disaggregated into a CES nest of EU and ROW imports.

\[
M_{ij} = [\delta_{ij}m_{EU}^{(\eta_{ij}+1)/\eta_{ij}} + \beta_{ij}m_{ROW}^{(\eta_{ij}+1)/\eta_{ij}}]^{\eta_{ij}/\eta_{ij}+1} \quad (M_{ij} = \sum m_{ij}) \tag{11}
\]

Production \( (Y_i) \) is transformed into domestic \( (D_i) \) and exportable \( (X_i) \) output in a constant elasticity of transformation (CET) nest.

\[
Y_i = [\alpha_{ij}D_i^{(\alpha_i-1)/\alpha_i} + \alpha_{ij}X_i^{(\alpha_i-1)/\alpha_i}]^{\alpha_i/\alpha_i-1} \tag{12}
\]

while exportables are further transformed into EU-bound and ROW-bound exports in a subsequent Armington CET nest.

\[
X_i = [\beta_{EU}X_{EU}^{(\eta_{ij}+1)/\eta_{ij}} + \beta_{ROW}X_{ROW}^{(\eta_{ij}+1)/\eta_{ij}+1}] \tag{13}
\]
Perfect competition and constant returns to scale imply that price equals marginal cost, defined by

\[ c_i Y_i = \sum p_j d_j + (1 + u_j + t_{eq}) p_{eq} m_{eq} + (1 + u_j + t_{row}) p_{row} m_{row} + (1 + r_k) w_k K_i + w_i L_i \]  

(14)

where \( c_i \) is a price index on sector \( i \) output, \( p_j \) and \( p_{eq} \) are prices of domestic and imported intermediate goods, and \( r_k \) indicates the capital tax rate in sector \( i \). The zero profit condition implies \( p_i D_i + p_{eq} X_{eq} + p_{row} X_{row} = c_i Y_i \).

A few equilibrium conditions remain. Sector \( i \) product markets clear according to \( S_i = \sum a_i Y_i + G_i + I_i^c + I_i^c + C_i \) and market clearing in factors implies \( \Sigma K_i = \bar{E}_K; \Sigma i L_i = \bar{E}_L \). Finally the value of supply equals the value of demand, where \( M_{eq} \) indicates government imports from region \( r \).

\[ \bar{p}_i S_i = \bar{p}_i \sum \sigma a_i Y_i + (1 + \tau_c)(\bar{p}_i^C D_{eq} + \bar{p}_i^F D_{eq}^F) + \bar{p}_i^G D_{eq} \]
\[ \bar{p}_i^F I_i^c + \Sigma_i (1 + \tau_c)(1 + t_o) p_{eq}^m (M_{eq} + M_{eq}^F) + \Sigma_i (1 + t_o) p_{eq}^m M_{eq} \]  

(14)

3.3. Government Financing

As trade reform will directly alter tax collections, a detailed treatment of Egyptian public finance is critical. On the expenditure side, the public consumes a fixed bundle of goods and services evaluated at endogenous prices. We assume that the government maintains a fixed real budget deficit and endogenously adjusts domestic tax instruments to counteract tariff reforms.

\[ \Sigma_i \bar{p}_i^G G_i = D + \Sigma \tau_c k w_k K_i + \Sigma_i \tau_c (\bar{p}_i^C C_i + \bar{p}_i^F I_i^F) + \Sigma \Sigma (1 + \tau_c) k p_{eq}^m (M_{eq} + M_{eq}^F) \]  

(14)

The primary replacement tax mechanism is assumed to be a goods and service tax (GST) which acts as a sales tax on final consumption, \( \tau_c \). In practice the government also taxes capital usage, defined as operating surplus less depreciation. Capital taxes, \( \tau_c \), vary substantially across sectors and these rates are held fixed in counterfactual simulations.

4. Empirical Implementation

The Egyptian data set consists of a Social Accounting Matrix (SAM) and a variety of policy, trade, and technology parameters for the benchmark year of 1990. Intermediate demand, final demand, and
valued added relationships are largely defined by the 1989/90 Input-Output (IO) table for Egypt (CAPMAS 1994a,b), which distinguishes 38 production sectors listed in Table 2. To account for recent reform activities in Egypt we undergo an exercise to update policy parameters to a second benchmark year 1994, a process that is described in detail in Konan and Maskus (1996).

Sectoral production and trade characteristics are summarized in Table 2 for the 1989/90 benchmark year. Egypt provides an interesting Mediterranean case-study as its trade structure is strongly diversified on a regional basis. Regional trade shares data in 1994 are aggregated from collections data on 8-digit HS line using the authors’ concordance. Table 2 presents the share of imports (Column 5) originating from the EU (including Turkey) and exports (Column 7) destined to that region. Less than half of all merchandise import and export trade is with the EU. Egypt’s trading relations are much less focused on the EU than are those of other North African countries, such as Morocco (Rutherford, et al 1993). While no data are available on regional service trade, we assume services trade is equivalent to each region’s total merchandise import or export share. Columns (4) and (6) give import and export shares of total trade for each sector as computed from the trade data reported in the 1989/90 IO table. Major Egyptian import sectors include machinery, food processing, vegetable foodstuffs, and chemicals while export flows are dominated by transportation (largely the Suez Canal), oil, and textiles.

Among the most important Egyptian sectors, in terms of shares of total output, are vegetable food products, animal products, food processing, trade, transport, social services, construction, and cotton textiles [Table 2, Column (1)]. Of these, services employ a disproportionate share of the labor force (Column 2) while capital tends to be concentrated in agricultural sectors (Column 3).

The 1989/90 IO Table is supplemented with data on government policy parameters. We apply effective capital, or operating surplus, tax rates calculated by the World Bank (1995) for 1990: There is no tax levied on agriculture, an approximate 18% tax on manufactures (including mining and crude oil sectors), and approximately a 23% tax on services. The 1989/90 IO Table provides sectoral information on indirect taxes and subsidies levied on production [Table 3 column (1)]. As part of a reform effort, by
1993 Egypt phased in a new goods and services tax (GST) and phased out indirect production taxes and most subsidies (World Bank, 1995). The GST is applied on the sales of goods and services, with rates that vary across industries as reported in Table 3, Column (2). As tax credits are generally provided for purchases of intermediate inputs, the GST operates much like a value-added tax.\textsuperscript{15} We treat the GST as a tax on domestic final demand (excluding government purchases). One element of our updating exercise entails introducing the GST and phasing out indirect taxes as policy instruments in our 1994 benchmark.

We undergo a similar exercise to update our 1990 benchmark with 1994 trade data. Import-weighted tariff rates are computed from information on 1994 trade and tariff collections data by 8-digit Harmonized System (HS) classification. Currently, tariffs are levied on a most-favored nations basis. We aggregate these legal tariff rates to the IO sectors by developing import weights consistent with a concordance developed by the authors. Various tariff exemptions, such as duty drawback provisions, imply that Egypt does not collect full revenue on its legal tariff rates. We scale the weighted legal tariff rates down by approximately 20\% to be consistent with total 1994 collections. It is difficult to obtain information on trade barriers in Egyptian services. While little published information is available, conversations with Egyptian experts indicate that the service sector is largely closed to foreign competition. A conservative implicit service tariff rate of 15\% is assumed and the resulting import-weighted tariff rates are reported in Table 3, Column (4).

Despite an extensive literature survey, we were unable to obtain formal empirical estimates of various Egyptian elasticities of substitution and transformation. A survey of previous Egyptian CGE elasticity assumptions is provided by Lofgren (1994). We select benchmark parameters consistent with the ranges reported in Lofgren. The elasticity of substitution between labor and capital is assumed to vary across sectors, as taken from Harrison et al (1993) [Table 3, Column (5)]. The various trade substitution elasticities correspond to the central cases in Rutherford, et al (1993).\textsuperscript{16}
5. Simulation Results

In this section we analyze five trade liberalization scenarios for Egypt: two MFN reforms and three preferential trade agreements. Section 5.1 describes the results of the baseline counterfactual experiments. As discussed in Section 2 above, the initial volume of trade with the EU is an important determinant of the potential gains from an Egypt-EU PTA. To illustrate the importance of initial bilateral trade shares with discriminatory tariff reform, we perform detailed sensitivity analysis on trade shares in Section 5.2.

5.1 Baseline Trade Liberalization Simulations

Our baseline counterfactual experiments involve a set of trade liberalization exercises, the results of which are reported in Table 4. In Column (1) we report the results of a unilateral tariff reform (TARREF) in which Egypt sets a uniform tariff rate of ten percent on all imports. This generates estimated welfare gains (WELFARE) of 0.51 percent over benchmark 1994 levels. The real exchange rate (EXCHANGE) or shadow price of foreign currency increases by nearly 1.1 percent in order to maintain the benchmark current account deficit. As the reformed tariffs become more efficient tax collection tools, the GST consumption taxes (GST) may be lowered by approximately 33 percent across the board while maintaining revenue neutrality. Real returns to both factors, labor (WAGE) and capital (RENT), increase by around 2 percent, reflecting enhanced efficiency in the economy due in part to a reduction of the distortionary GST.

Two possible outcomes of an EU partnership agreement, which is currently under negotiation, are reported in Columns (2) and (3). Scenario EUAT considers an agreement whereby Egypt eliminates all tariffs on EU products while maintaining existing tariffs on ROW. The EU responds by providing improved access in agriculture (VG1, VG2, ANI) and textiles (TX1, TX2, CLO). Based on the estimates of Harrison, Rutherford, and Wooton (1989), the benefit of inclusion in the EU’s common agricultural policy program and multi-fibre arrangement is approximated as an 8 percent terms of trade improvement in
these sectors. We estimate trade creation (CREATION) gains from this assessment at approximately 440 million ELs and trade diversion (DIVERSION) losses of 550 million ELs.\textsuperscript{20} Note that trade creation less diversion does not exactly equal the estimated change in welfare. This is due to other underlying distortions in the Egyptian economy that interact with trade reform and strengthen the impact of trade creation and diversion (Konan and Maskus, 1997). In particular, the domestic tax structure is highly distortionary. To maintain government revenue neutrality, any change in collections from a tariff reform must be offset with an appropriate scaling of an alternative tax instrument, in our case the GST. When EU tariffs are removed, the Egyptian government may lower consumer taxes by nearly 2.5 percent, implying an added gain in welfare. That is, despite a decrease in the average tariff rate to 4.52\% government neutrality implies a reduction in the GST as resources and consumption flow into high-taxed sectors in response to the fall in the EU tariff.\textsuperscript{21} Overall, EUAT provides a modest 0.13 percent static gains in welfare over 1994 benchmark levels. The exchange rate depreciates by over one percent (an increase in EXCHANGE) to maintain the benchmark current account imbalance. Returns to labor and capital rise by 2.5 and 2.3 percent, respectively.

In the second preferential trade agreement scenario, EUTOT, the EU offers the concessions in textiles and agriculture as described by the EUAT scenario and, in addition, recognizes Egyptian inspection practices and production standards. We assume this generates an across the board 1\% reduction in EU non-tariff barriers on Egyptian exports, yielding an equivalent improvement in Egyptian terms of trade with the EU. Trade creation and diversion estimates are comparable to those observed in the EUAT scenario. Resulting welfare gains are estimated at roughly double the gains available under the EUAT in percentage terms at 0.27 percent. The consumer tax is reduced by nearly three percent and the real exchange rate depreciates slightly. All factors gain.

The scenario FTAREF, reported in Column (4), involves a combination of TARREF and a PTA with the EU. Egypt eliminates all tariffs with the EU and imposes a common ten percent tariff on ROW imports. The EU responds by removing non-tariff barriers on Egyptian exports, improving Egyptian terms
of trade with the EU by one percent across the board. Egyptian welfare rises by an estimated 0.59 percent, in part due to a 3.64 percent decrease in the distortionary GST. Finally, the LIBALL scenario, Column (5), appears to provide the greatest potential welfare gain the trade reforms under consideration. In the LiBALL reform, Egypt unilaterally eliminates tariffs against all trading partners. The EU grants no market concessions, thus Egyptian terms of trade are unchanged. Yet, static welfare gains are approximately 0.81 percent of benchmark 1994 GDP. As no tariff revenues are collected, the GST must rise by over 24 percent to maintain revenue neutrality.

5.2. Bilateral Trade Share: Sensitivity Analysis

We also explore the impact of Egypt's regionally diversified trade structure on trade creation and diversion measures of a European partnership agreement. In a sensitivity exercise we simulate the impact of discriminatory trade reform under the supposition that Egypt's imports and exports are more or less concentrated with the EU than is actually observed. That is, a (fictitious) new benchmark is created in which sectoral benchmark European trade flows are assumed to be a multiple on a range from 0.5 (half of observed import and export EU flows) to 1.5 of actual flows. Sectoral ROW trade flows are redefined as the residual of the total imports (or exports) less simulated EU imports (or exports). Note that for trade multipliers exceeding one it is possible for simulated EU imports (exports) to exceed total imports (exports) in some sectors. Trade in these cases is characterized as a corner solution whereby all benchmark imports (exports) are assumed to originate (be destined to) the EU and ROW trade flows are set to zero. The preferential trade arrangement counterfactual experiments, EUAT and EUTOT, are run against this backdrop of contrived EU trade.

Consider the impact of the EUAT tariff reform under the (false) presumption that Egyptian imports from and exports to the EU are initially half of observed benchmark levels. An estimated 329 million ELs rise in welfare is attributed to import and export trade creation with the EU, while trade diversion losses are approximately 483 million ELs. Trade creation, diversion, and welfare are graphed as functions of EU
trade multipliers in Figure 4. Confirming our theoretical results of equations 2 and 3, trade creation and trade diversion are concave functions of the benchmark EU trade share multipliers. Aggregate welfare changes, however, cannot be decomposed into purely creation and diversion effects. As described above, government revenue neutrality requires that any change in tariff collections be offset by GST collections. Figure 4 distinguishes between the aggregate change in welfare (WELFARE) in response to the EUAT preferential reform and the welfare change attributed directly to trade creation and diversion (NET_WEL). Although they are highly correlated, aggregate welfare changes everywhere exceed NET_WEL, implying that trade creation and diversion interact positively with endogenous domestic tax changes. EUAT reforms generally result in an estimated rise in aggregate welfare (with the exception of multipliers 0.5 and 0.6). If we focus instead on purely trade creation and diversion measures of welfare change (NET_WEL), the economy stands to suffer a fall in welfare unless benchmark trade is 1.5 times more heavily focused on the EU than that observed in our 1994 benchmark. Nonetheless, a larger simulated trade share with the EU appears to be associated with greater welfare gains (or smaller welfare losses).

In general, similar observations emerge when performing EU trade flow sensitivity analysis on the EUTOT reform scenario, shown in Figure 5. Trade creation and trade diversion measures are concave with respect to the EU trade share multiplier. Welfare, both in the aggregate and from net trade creation, increase as the share of trade with the EU is scaled up. As the EUTOT reform assumes that the Egypt’s terms of trade with the EU will improve by more, both welfare measures are higher relative to the EUAT reforms. Yet welfare gains attributed directly to net trade creation (NET_WEL) are positive only for EU trade multipliers at or above 1.4. Thus, aggregate welfare gains in both the EUAT and EUTOT reforms are largely a remnant of the interaction between tariff reforms and the domestic tax structure rather than net trade creation.
6. **Concluding Remarks**

This paper considers the welfare implications of a discriminatory preferential trading arrangement in a general equilibrium model where imports (and exports) are differentiated by region of origin (destination). The relationship between the initial (pre-reform) volume of trade with the potential partner and welfare changes is shown to be theoretically ambiguous. Trade creation is a concave function of the partner’s pre-union import share. This result contrasts with an emerging conventional wisdom (Riezman 1979, Panagariya 1996, and Bhagwati and Panagariya 1996) that the smaller is the initial volume of trade with a potential union member, the smaller are trade diversion losses and the more beneficial (less harmful) is a PTA.

Simulations with an applied general equilibrium model of Egyptian trade illustrate the relationship between trade shares and welfare when trade flows are regionally differentiated. In addition to several MFN trade reform packages, two forms of a PTA with the EU are considered. In comparison to MFN trade liberalization, Egyptian welfare gains from a European PTA appear to be modest. If Egypt is to gain from a preferential trading arrangement with the EU, our simulations indicate that those gains are largely due a reduction in distortionary domestic taxes in response to tariff reform pressures.

We also considered how sensitive the PTA results are to pre-reform regional trade shares. Relative to neighboring Mediterranean countries, Egyptian trade tends not to be heavily focused on the EU. Counterfactual experiments alter the composition of Egyptian trading patterns to be more or less concentrated with Europe than actual shares. Consistent with our theoretical findings, trade creation (as well as diversion) is a concave function of the benchmark share of trade with EU, the PTA-partner. Given the structure of the numerical model, however, the larger is the initial volume of trade with the partner the greater are the gains from a PTA.
References


APPENDIX: Derivation of Trade Creation and Diversion

We assume that utility is separable into import and domestic commodity groups such that conditional orderings on goods in a group is independent of consumption levels outside the group. The representative agent allocates a fixed amount of income \( I \) to the purchase of imports. Her constant elasticity of substitution import subutility function is given by

\[
u(M_{EU}, M_{ROW}) = [\delta_{EU} M_{EU}^{(\eta+\gamma)} + \delta_{ROW} M_{ROW}^{(\eta+\gamma)}]^{\gamma}.
\]

(A1)

Given the import budget constraint the standard procedure for deriving the constrained maximum gives the Marshallian demand function for imports from region \( i \)

\[
m_i(p, I) = \frac{\delta_{EU}^{\eta} p_i^{1-\eta} I}{\sum_j \delta_{EU}^{\eta} p_j^{1-\eta} p_i}.
\]

(A2)

The own-price elasticity is \( \xi_i = -1 + (1 - \eta) s_i \). Marshallian consumer surplus generated from preferential removal of the EU tariff \( (t_{EU} = p_{EU}^{EUG} - p_{EU}^{*}) \) is derived by integrating over demand.

\[
CS = \int_{p_{EU}}^{p_{EU}^{*}} \frac{\delta_{EU}^{\eta} p_{EU}^{1-\eta} I}{\delta_{EU}^{\eta} p_{EU}^{1-\eta} + \delta_{ROW}^{\eta} p_{ROW}^{EUG(1-\eta)}} dp_{EU}.
\]

Let \( \nu = \delta_{EU}^{\eta} p_{EU}^{1-\eta} + \delta_{ROW}^{\eta} p_{ROW}^{EUG(1-\eta)} \) and \( d\nu = (1 - \eta) \delta_{EU}^{\eta} p_{EU}^{\eta} \). Then A3 is rewritten as

\[
CS = \int_{p_{EU}}^{p_{EU}^{*}} \frac{d\nu}{(1 - \eta) \nu} = \frac{-I}{(1 - \eta)} \left( \log \nu \right)_{p_{EU}}^{p_{EU}^{*}}
\]

\[
= \frac{-I}{(1 - \eta)} \log \frac{\delta_{EU}^{\eta} p_{EU}^{1-\eta} + \delta_{ROW}^{\eta} p_{ROW}^{EUG(1-\eta)}}{\delta_{EU}^{\eta} p_{EU}^{1-\eta} (1 + t_{EU})^{1-\eta} + \delta_{ROW}^{\eta} p_{ROW}^{EUG(1-\eta)}}.
\]

(A4)

But

\[
1 - \frac{\delta_{EU}^{\eta} p_{EU}^{1-\eta} + \delta_{ROW}^{\eta} p_{ROW}^{EUG(1-\eta)}}{\delta_{EU}^{\eta} p_{EU}^{1-\eta} (1 + t_{EU})^{1-\eta} + \delta_{ROW}^{\eta} p_{ROW}^{EUG(1-\eta)}} = s_{EU} [l - (l + t_{EU})^{t_{\gamma}/n}]
\]

(A5)

Substituting A5 into A4 gives

\[
CS = \frac{-I}{1 - \eta} \log \{1 - s_{EU} [l - (l + t)^{t_{\gamma}/n}]\}
\]

(A6)
Import trade creation TC is defined as consumer surplus less tariff revenue losses on EU imports generated by a preferential removal of the import tariff \( t_{EU} \) or

\[
TC = \frac{-I}{1 - \eta} \log \left[ 1 - s_{EU} \left( 1 - (1 + t_{EU})^{1+\eta} \right) \right] - I t_{EU} s_{EU}
\]  

(A7)

Import trade diversion TD measures the lost tariff revenues on ROW imports that are displaced by the EU-PTA or \( TD = t_{ROW} p^*_{ROW} (m^1_{ROW} - m^2_{ROW}) \), where \( m^1_{ROW} \) indicates pre-PTA imports and \( m^2_{ROW} \) indicates post-PTA imports from ROW. By definition, \( m^1_{ROW} = s^1 I P^*_{ROW} (1 + t_{ROW}) \). Import trade diversion may be rewritten as a function of pre and post-PTA share of total import expenditures originating in ROW, \( s^1_{ROW} \) and \( s^2_{ROW} \) respectively.

\[
TD = \frac{I t_{ROW}}{(1 + t_{ROW})} \left[ s^1_{ROW} - s^2_{ROW} \right]
\]  

(A8)
Figure 1: Import Markets
Figure 2: Export Markets
Figure 3: Nested Production and Utility Structure

Output

Leontief (linear)

Value Added

CES

Labor

Capital

Intermediate Inputs

Leontief (linear)

Composite Intermediate (i)

CET

Domestic

Export

EU

ROW

Utility

Cobb Douglas

Sector (1)

......

Sector (i)

......

Sector (n)

CET

Domestic

Import

CES

EU

ROW
TABLE 1: MODEL EQUATIONS AND NOTATION

I. EQUATIONS

A. Production

1. Value Added Function

\[ V_i = \left[ a_i \bar{L}_i^{(n_i-1)\gamma_i} + a_{i0} \bar{K}_i^{(n_i-1)\gamma_i} \right] \]

\[ M_N = \left[ \sum \delta_{ni} \bar{m}_{ni}^{(n_i-1)\gamma_i} \right] \gamma_i/n_i \]

2. Imported Intermediates

\[ z_i = \left[ \gamma_i \bar{p}_i^{(n_i-1)\gamma_i} + \gamma_{i0} \bar{p}_i^{(n_i-1)\gamma_i} \right] \gamma_i/n_i \]

\[ Y_i = \min \left[ z_i / a_{i0} ; z_i / a_{i0} ; V / \bar{V} \right] \]

3. Composite Intermediate

\[ Y_i = \left[ \alpha_{i0} \bar{D}_i^{(n_i-1)\alpha_i} + \alpha_{i0} \bar{X}_i^{(n_i-1)\alpha_i} \right] \alpha_i/n_i \]

\[ x_i = \left[ \sum \beta_{ni} \bar{X}_i^{(n_i-1)\beta_i} \right] \beta_i/n_i \]

4. Final Goods Technology

\[ c_i Y_i = \sum \bar{p}_i d_i + \sum \bar{p}_i \left( 1 + \bar{w}_i + t_0 \bar{p}_i \right) \bar{m}_i + \sum \left( 1 + \tau_{i0} \right) \bar{w}_i \bar{K}_i + \bar{w}_l \bar{L}_i \]

5. Domestic & Foreign Sales

\[ U = \Pi(\bar{C}_i) ; \sum \lambda_i = 1 \]

\[ C_i = \left[ \theta_{i0} \bar{D}_i^{(n_i-1)\gamma_i} + \theta_{i0} \bar{M}_i^{(n_i-1)\gamma_i} \right] \gamma_i/n_i \]

\[ M_i = \left[ \sum \delta_{ni} \bar{m}_{ni}^{(n_i-1)\gamma_i} \right] \gamma_i/n_i \]

\[ \bar{M}_i = \left[ \sum \delta_{ni} \bar{m}_{ni}^{(n_i-1)\gamma_i} \right] \gamma_i/n_i \]

B. Utility

6. Utility Function

\[ U = \Pi(\bar{C}_i) ; \sum \lambda_i = 1 \]

\[ C_i = \left[ \theta_{i0} \bar{D}_i^{(n_i-1)\gamma_i} + \theta_{i0} \bar{M}_i^{(n_i-1)\gamma_i} \right] \gamma_i/n_i \]

\[ M_i = \left[ \sum \delta_{ni} \bar{m}_{ni}^{(n_i-1)\gamma_i} \right] \gamma_i/n_i \]

\[ \bar{M}_i = \left[ \sum \delta_{ni} \bar{m}_{ni}^{(n_i-1)\gamma_i} \right] \gamma_i/n_i \]

C. Constraints and Balancing Items

7. Marginal Cost Condition

\[ \Sigma_i \bar{p}_i^C \bar{C}_i = w_K \bar{E}_K + w_L \bar{E}_L + \alpha B - \Sigma_i \bar{p}_i^F I_i^F - \Sigma_i \bar{p}_i^I I_i^I - D \]

\[ \Sigma_i \bar{p}_i^D G_i = D + \Sigma_i \tau_{i0} w_{i0} \bar{K}_i + \Sigma_i \tau_{i0} \left( \bar{p}_i^C C_i + \bar{p}_i^F I_i^F \right) \]

\[ + \sum_i \bar{p}_i^D (1 + \tau_{i0}) t_0 \bar{p}_i^D \left( M_i + M_i^F \right) \]

\[ B = \sum_i \left( 1 / \bar{c}_i \right) \left( \bar{p}_i^C M_i - \bar{p}_i^C M_i \right) \]

\[ S_i = \Sigma_i \bar{p}_i^D Y_i + G_i + I_i^F + I_i^I + C_i \]

\[ \Sigma_i \bar{K}_i = \bar{E}_K ; \Sigma_i \bar{L}_i = \bar{E}_L \]

\[ \Sigma \bar{p}_i^D + \Sigma \bar{p}_i^D \bar{X}_i = \Sigma \bar{Y}_i \]

\[ \bar{p}_i^S \bar{S}_i = \bar{p}_i^D \bar{p}_i^D \bar{S}_i + \left( 1 + \tau_{i0} \right) \left( \bar{p}_i^C \bar{D}_i + \bar{p}_i^F \bar{D}_i + \bar{p}_i^I \bar{D}_i + \bar{p}_i^D \bar{D}_i + \bar{p}_i^I \bar{D}_i \right) + \sum_i \left( 1 + \tau_{i0} \right) \left( 1 + t_0 \bar{p}_i^D \bar{M}_i + M_i \right) + \sum_i \left( 1 + \tau_{i0} \right) \left( 1 + t_0 \bar{p}_i^D \bar{M}_i + M_i \right) \]

\[ D_i = D_i + D_i^F + I_i^F + D_i^I \]

\[ M_i = M_i^N + M_i^C + M_i^F + M_i \]

\[ \bar{p}_i^N = \left( 1 + t_0 \right) \bar{p}_i^N \]

\[ \bar{p}_i^C = \left( 1 + \tau_{i0} \right) \bar{p}_i^C \]

\[ \bar{p}_i^C = \left( 1 + \tau_{i0} \right) \bar{p}_i^C \]

\[ \bar{p}_i^C = \left( 1 + \tau_{i0} \right) \bar{p}_i^C \]

\[ \tau_{K1} + w_{K1} = \ldots = \tau_{Kn} + w_{Kn} \]

D. Price Relationships and Identities

8. Components of Domestic Sales

\[ D_i = D_i + D_i^F + I_i^F + D_i^I \]

\[ M_i = M_i^N + M_i^C + M_i^F + M_i \]

\[ \bar{p}_i^N = \left( 1 + t_0 \right) \bar{p}_i^N \]

\[ \bar{p}_i^C = \left( 1 + \tau_{i0} \right) \bar{p}_i^C \]

\[ \bar{p}_i^C = \left( 1 + \tau_{i0} \right) \bar{p}_i^C \]

\[ \tau_{K1} + w_{K1} = \ldots = \tau_{Kn} + w_{Kn} \]
II: LIST OF VARIABLES

$L_i$, $K_i$  
Labor and capital inputs, sector $i$ ($i=1,...,38$)

$V_i$  
Value added

$M_i$  
Total imports

$M_{ri}$  
Imports from region $r$ ($r = \text{EU, ROW}$)

$M_{ri}$  
Imports of commodity $i$ for intermediate use

$m_{ri}$  
Imports for intermediate use from region $r$

$z_i$  
Composite intermediate input of $j$ into $i$ ($j=1,...,38$)

$d_i$, $m_i$  
Intermediate usages of domestic and imported goods

$Y_i$  
Output of good $i$

$D_i$, $X_i$  
Output for domestic sales and exports

$D_{ri}$, $D_{ri}$  
Domestic sales for private consumption, public consumption, and fixed capital formation

$D_i^f$  
Domestic sales for fixed capital formation

$X_{ri}$  
Exports of good $i$ to region $r$

$c_i$  
Index of marginal cost of production

$p_i$  
Domestic producer price index

$\bar{p}_i^Z$, $\bar{p}_i^C$, $\bar{p}_i^{RF}$, $\bar{p}_i^G$  
Domestic price indexes (home and imported prices)

$w_K$, $w_L$  
Factor price indexes

$U$  
Utility

$\bar{p}$  
Composite price index for total domestic supply

$C_i$, $G_i$  
Private and public consumption

$I_i^f$, $I_i^I$  
Fixed capital formation and inventory investment

$M_{ri}$, $M_{ri}$  
Imports for private and public consumption

$M_i^f$  
Imports for fixed capital formation

$M_{ri}$, $M_{ri}$  
Imports for private and public consumption from region $r$

$M_{ri}$  
Imports for fixed capital formation from region $r$

$e$  
Real exchange rate (price index for foreign exchange)

$B$  
Current-account balance

$D$  
Government budget deficit (held fixed)

$S_i$  
Supply on domestic market ($D_i + M_i$)

$p_i^N$  
Domestic price index for intermediate imports

$p_i^C$, $p_i^G$  
Domestic price indexes for imports for private and public consumption

$p_i^F$  
Domestic price index for imports for gross capital formation

$p_i^C$, $p_i^F$  
Price index for private consumption/fixed capital of domestic goods

$p_i$  
Producer price index for goods exported to region $r$
III: LIST OF PARAMETERS

\( \sigma_i \)  
Substitution elasticity between capital and labor

\( \eta_s \)  
Substitution elasticity between intermediates and value added

\( \eta_i \)  
Armington elasticity between EU and ROW imports

\( \eta_j \)  
Substitution elasticity between domestic and imported intermediates

\( \varepsilon_i \)  
Transformation elasticity between domestic and exported output

\( \varepsilon_i \)  
Transformation elasticity between EU and ROW exports

\( \psi_i \)  
Substitution elasticity between domestic and imported consumption

\( \tau_{Ki} \)  
Tax rate on operating surplus ("capital tax")

\( \tau_{Ci} \)  
Tax rate on consumption ("goods and services tax")

\( t_i \)  
Tariff rate on imports from region \( r \)

\( E_K, E_L \)  
Endowment of capital, labor

\( p^{m}_i \)  
Price of imports from region \( r \)

\( p^{x}_i \)  
Price of exports in region \( r \)

Modified from Konan and Maskus (1996a)
## TABLE 2: BENCHMARK OUTPUT, FACTOR SHARES, AND TRADE SHARES

<table>
<thead>
<tr>
<th>SECTOR</th>
<th>Output (1)</th>
<th>Labor (2)</th>
<th>Capital (3)</th>
<th>Import Total (4)</th>
<th>EU Total (5)</th>
<th>Export Total (6)</th>
<th>EU Total (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AGRICULTURE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Vegetable products, foodstuffs (VG1)</td>
<td>12.4</td>
<td>11.3</td>
<td>21.4</td>
<td>13.3</td>
<td>11.7</td>
<td>2.6</td>
<td>27.0</td>
</tr>
<tr>
<td>2. Vegetable products, non-foodstuffs (VG2)</td>
<td>1.7</td>
<td>1.7</td>
<td>2.9</td>
<td>0.0</td>
<td>37.0</td>
<td>0.1</td>
<td>49.3</td>
</tr>
<tr>
<td>3. Animal products (ANI)</td>
<td>8.0</td>
<td>5.6</td>
<td>10.5</td>
<td>0.8</td>
<td>82.7</td>
<td>0.3</td>
<td>35.2</td>
</tr>
<tr>
<td><strong>MINING AND QUARRYING</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Crude petroleum and natural gas (OIL)</td>
<td>2.7</td>
<td>0.7</td>
<td>2.3</td>
<td>1.2</td>
<td>52.0</td>
<td>18.5</td>
<td>30.6</td>
</tr>
<tr>
<td>5. Other extractive industries (MIN)</td>
<td>0.9</td>
<td>0.5</td>
<td>2.0</td>
<td>2.0</td>
<td>17.7</td>
<td>0.2</td>
<td>56.8</td>
</tr>
<tr>
<td><strong>MANUFACTURING</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Food processing (FOO)</td>
<td>7.7</td>
<td>2.8</td>
<td>4.3</td>
<td>15.1</td>
<td>40.3</td>
<td>1.3</td>
<td>20.1</td>
</tr>
<tr>
<td>7. Beverages (BEV)</td>
<td>0.6</td>
<td>0.3</td>
<td>0.3</td>
<td>0.0</td>
<td>41.7</td>
<td>0.0</td>
<td>1.2</td>
</tr>
<tr>
<td>8. Tobacco products (TOB)</td>
<td>1.9</td>
<td>0.4</td>
<td>0.7</td>
<td>1.0</td>
<td>27.0</td>
<td>0.0</td>
<td>0.4</td>
</tr>
<tr>
<td>9. Cotton ginning and pressing (TX1)</td>
<td>1.2</td>
<td>0.1</td>
<td>0.1</td>
<td>0.5</td>
<td>36.9</td>
<td>4.2</td>
<td>33.7</td>
</tr>
<tr>
<td>10. Cotton spinning and weaving (TX2)</td>
<td>5.2</td>
<td>4.9</td>
<td>3.0</td>
<td>2.4</td>
<td>33.4</td>
<td>10.3</td>
<td>72.4</td>
</tr>
<tr>
<td>11. Clothing: assembled and pieces (CLO)</td>
<td>1.4</td>
<td>1.5</td>
<td>1.1</td>
<td>1.0</td>
<td>12.4</td>
<td>1.2</td>
<td>34.7</td>
</tr>
<tr>
<td>12. Leather products, excl. shoes (LEA)</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
<td>0.0</td>
<td>25.7</td>
<td>0.1</td>
<td>48.8</td>
</tr>
<tr>
<td>13. Shoes (SHO)</td>
<td>0.4</td>
<td>0.4</td>
<td>0.2</td>
<td>0.0</td>
<td>16.0</td>
<td>0.0</td>
<td>20.5</td>
</tr>
<tr>
<td>14. Wood, wood products, excl. furniture (WOO)</td>
<td>1.1</td>
<td>0.3</td>
<td>0.9</td>
<td>0.5</td>
<td>39.8</td>
<td>0.1</td>
<td>1.5</td>
</tr>
<tr>
<td>15. Furniture (FUR)</td>
<td>1.4</td>
<td>0.8</td>
<td>1.5</td>
<td>0.0</td>
<td>57.0</td>
<td>0.5</td>
<td>14.9</td>
</tr>
<tr>
<td>16. Paper and printing (PAP)</td>
<td>1.5</td>
<td>0.8</td>
<td>0.9</td>
<td>0.3</td>
<td>46.8</td>
<td>0.9</td>
<td>1.6</td>
</tr>
<tr>
<td>17. Chemicals and products, excl petroleum (CHE)</td>
<td>3.1</td>
<td>1.7</td>
<td>1.6</td>
<td>10.8</td>
<td>62.6</td>
<td>1.8</td>
<td>31.3</td>
</tr>
<tr>
<td>18. Petroleum refining (PET)</td>
<td>2.7</td>
<td>0.8</td>
<td>3.2</td>
<td>1.2</td>
<td>48.4</td>
<td>3.3</td>
<td>58.5</td>
</tr>
<tr>
<td>19. Rubber, plastics and products (RPL)</td>
<td>0.3</td>
<td>0.2</td>
<td>0.2</td>
<td>0.4</td>
<td>47.4</td>
<td>0.1</td>
<td>42.2</td>
</tr>
<tr>
<td>20. Porcelain, china, pottery (POR)</td>
<td>0.3</td>
<td>0.2</td>
<td>0.4</td>
<td>0.5</td>
<td>63.3</td>
<td>0.1</td>
<td>9.3</td>
</tr>
<tr>
<td>21. Glass and products (GLA)</td>
<td>1.7</td>
<td>1.0</td>
<td>1.8</td>
<td>0.4</td>
<td>61.6</td>
<td>0.0</td>
<td>48.2</td>
</tr>
<tr>
<td>22. Mineral products, n.e.i. (MPD)</td>
<td>2.8</td>
<td>1.4</td>
<td>2.5</td>
<td>0.6</td>
<td>35.3</td>
<td>0.8</td>
<td>68.3</td>
</tr>
<tr>
<td>23. Iron, steel, other base metals (MET)</td>
<td>3.5</td>
<td>2.7</td>
<td>1.7</td>
<td>23.1</td>
<td>59.4</td>
<td>4.6</td>
<td>9.5</td>
</tr>
<tr>
<td>24. Machinery and appliances (MAC)</td>
<td>1.0</td>
<td>0.9</td>
<td>0.5</td>
<td>0.5</td>
<td>33.8</td>
<td>0.4</td>
<td>3.6</td>
</tr>
<tr>
<td>25. Transportation equipment (TRA)</td>
<td>0.1</td>
<td>0.1</td>
<td>0.0</td>
<td>0.5</td>
<td>47.6</td>
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<td>26. Other manufacturing (OMF)</td>
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<td>5.6</td>
<td>44.7</td>
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<td>1.8</td>
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<td>44.6</td>
<td>5.0</td>
<td>44.7</td>
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<td>31. Transport and storage (TRN)</td>
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<td>0.2</td>
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<td>35. Real estate, business, housing services (HSG)</td>
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<td>2.1</td>
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<td>36. Social and community services (SER)</td>
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<td>38. Personal services (PER)</td>
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<td>44.6</td>
<td>0.0</td>
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* 1989/90 Data, CAPMAS (1994a)

* 1994 Data, World Bank Data and authors’ concordance.
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<th>SECTOR</th>
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<th>K Tax-94</th>
<th>Tariff-94</th>
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<td>4. Crude petroleum and natural gas (OIL)</td>
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<td>18.0</td>
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<td>6. Food processing (FOO)</td>
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<td>7. Beverages (BEV)</td>
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<td>11. Clothing: assembled and pieces (CLO)</td>
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<td>53.7</td>
<td>1.19</td>
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<td>12. Leather products, excl. shoes (LEA)</td>
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<td>10.0</td>
<td>18.0</td>
<td>34.8</td>
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<td>13. Shoes (SHO)</td>
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<td>15. Furniture (FUR)</td>
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<td>18.0</td>
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<td>17. Chemicals and products, excl petroleum (CHE)</td>
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<td>19. Rubber, plastics and products (RPL)</td>
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<td>10.0</td>
<td>18.0</td>
<td>15.6</td>
<td>0.97</td>
</tr>
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<td>20. Porcelain, china, pottery (POR)</td>
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<td>10.0</td>
<td>18.0</td>
<td>43.5</td>
<td>0.93</td>
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<td>18.0</td>
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<td>22. Mineral products, n.e.i. (MPD)</td>
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<td>18.0</td>
<td>18.1</td>
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<td>23. Iron, steel, other base metals (MET)</td>
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<td>18.0</td>
<td>17.2</td>
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<td>24. Machinery and appliances (MAC)</td>
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<td>18.0</td>
<td>17.9</td>
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<td>25. Transportation equipment (TRA)</td>
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<td>18.0</td>
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<td>1.19</td>
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<td>SERVICES AND OTHER</td>
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<td>27. Electricity, gas, and water (ELE)</td>
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<td>15.0</td>
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<td>28. Construction (CON)</td>
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<td>23.0</td>
<td>15.0</td>
<td>1.88</td>
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<td>32. Communications (COM)</td>
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<td>23.0</td>
<td>15.0</td>
<td>1.99</td>
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<td>-14.49</td>
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<td>23.0</td>
<td>15.0</td>
<td>1.99</td>
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<td>1.99</td>
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<td>35. Real estate, business and housing services (HSG)</td>
<td>1.53</td>
<td>8.0</td>
<td>23.0</td>
<td>15.0</td>
<td>1.99</td>
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<td>8.0</td>
<td>23.0</td>
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<td>1.99</td>
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<td>37. Recreational and cultural services (REC)</td>
<td>0.28</td>
<td>10.0</td>
<td>23.0</td>
<td>15.0</td>
<td>1.99</td>
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<tr>
<td>38. Personal services (PER)</td>
<td></td>
<td></td>
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</table>

World Bank (1995),
*World Bank Data and authors’ concordance.*
Table 4—Baseline Trade Liberalization Scenarios (% change)

<table>
<thead>
<tr>
<th></th>
<th>TARREF (1)</th>
<th>EU_AT (2)</th>
<th>EU_TOT (3)</th>
<th>FTAREF (4)</th>
<th>LIBALL (5)</th>
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<tr>
<td>WELFARE</td>
<td>0.51</td>
<td>0.13</td>
<td>0.27</td>
<td>0.59</td>
<td>0.81</td>
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<td>EXCHANGE</td>
<td>1.07</td>
<td>1.22</td>
<td>0.92</td>
<td>0.63</td>
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<td>GST</td>
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<td>-2.76</td>
<td>-3.64</td>
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<td>AVGTAR</td>
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<td>4.52</td>
<td>4.53</td>
<td>4.65</td>
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<td>WAGE</td>
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<td>2.50</td>
<td>2.64</td>
<td>2.37</td>
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<td>RENT</td>
<td>2.21</td>
<td>2.30</td>
<td>2.43</td>
<td>2.57</td>
<td>3.07</td>
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<tr>
<td>CREATION*</td>
<td>0.44</td>
<td>0.45</td>
<td>0.45</td>
<td>0.55</td>
<td>0.54</td>
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<tr>
<td>DIVERSION*</td>
<td>0.55</td>
<td>0.54</td>
<td>0.54</td>
<td>0.55</td>
<td>0.54</td>
</tr>
</tbody>
</table>

* Measured in billion Egyptian pounds (ELs).

Scenarios

TARREF is a unilateral tariff reform in which Egypt sets a uniform tariff rate of ten percent on all imports.

EU_AT is a PTA with the EU in which Egypt eliminates all tariffs on EU products. In turn, the EU provides improved access in agriculture (VG1, VG2, ANI) and textiles (TX1, TX2, CLO) resulting in an 8 percent rise in the Egyptian export price to the EU.

EU_TOT extends scenario 2 (EU_AT). Egypt eliminates all tariffs on EU imports. The EU responds by providing more liberal access to domestic markets resulting in a one percent increase in all export prices to the EU, with an 8 percent price increase in agriculture and textiles.

FTAREF involves a PTA with the EU and unilateral tariff reform with ROW. Egypt eliminates all tariffs with the EU and imposes a common ten percent tariff on all ROW imports. The EU responds by allowing improved access to European markets, raising EU export prices by one percent across the board.

LIBALL involves unilateral tariff elimination by Egypt against all trading partners. EU grants no concessions and export prices are unchanged.

Variable Estimates

WELFARE is the percentage change in real benchmark 1994 GDP measured in equivalence variation.

EXCHANGE is the percentage change in the real exchange rate, or shadow price of foreign currency, necessary to maintain the benchmark current account imbalance.

GST is the percentage change in the consumer tax (or GST) required for government revenue neutrality.

AVGTAR is the post-reform weighted average tariff rate.

WAGE is the percentage change in real returns to labor.

RENT is the percentage change in real returns to capital (operating surplus).

CREATION is the real increase in GDP (in billion Egyptian pounds) due to trade creation.

DIVERSION is the real decrease in GDP (in billion Egyptian pounds) due to trade diversion.
Figure 4: EUAT Share Sensitivity Analysis

Money Metric Utility

EU Trade Share Multipliers

- WELFARE
- CREATION
- DIVERSION
- NET_WEL
Figure 5: EUTOT Share Sensitivity Analysis

Money Metric Utility vs. EU Trade Share Multipliers

- ▲ WELFARE
- ▲ CREATION
- ▲ DIVERSION
- ▲ NET_WEL
Endnotes

1 Lloyd (1982) summarizes these results in a unified framework.

2 Note that no opportunity for trade creation exists as partner prices are driven up to the world price plus the tariff.

3 Indeed, this was the original concept of Lipsey. Bhagwati and Panagariya recognize this but do not consider the role of trade shares in this context.

4 See Vousden (1990, chapter 10) for a detailed graphical treatment.

5 Consumer surplus is a valid measure of the change in welfare as the CES subutility function is homothetic.

6 See Appendix.

7 The trade diversion equation is derived in the Appendix.

8 The Egypt CGE-TL model is described in detail in Konan and Maskus (1996).

9 We assume that this demand structure also characterizes government consumption and investment spending.

10 The Armington (regional product differentiation) assumption is not inconsistent with the assumption that Egypt faces fixed terms of trade. At the given level of aggregation, Armington implies that the components of a composite Egyptian vegetable product, for example, differ from those of the EU or ROW composite. Yet Egypt is not a price-maker in, say, the market for tomatoes.

11 Simulations with a constant elasticity of substitution technology yield similar results.

12 Konan and Maskus (1996) also consider models with sector-specific capital in all sectors or selected resource-constrained sectors.

13 The Egyptian government has indicated a clear preference for using the GST as a replacement tax.

14 Sectoral trade share data for the U.S. and the Middle East - North African region are given in Konan and Maskus (1996).

15 Important tax credit exemptions exist, largely for the purchase of investment goods and some services.

16 The Armington elasticity of substitution between regional imports is 5.0 and between imported and domestic consumption is 2.0. The Armington transformation elasticity between regional exports is 8.0 and between exported and domestic output is 5.0.
17 The CGE model is generated with a program written in GAMS (Brooke, Kendrick, and Meeraus 1988) and solved with the MPS/GE software developed by Rutherford (1989).

18 Throughout the counterfactual simulations the beverage tariff is not changed to reflect Egypt’s social policy for maintaining rigorous barriers on imported alcoholic beverages.

19 Welfare is measured as Hicksian equivalent variation.

20 Trade creation is computed as a change in consumer surplus less EU tariff revenue losses. As preferences are homothetic, this measure is a monotonic transformation of Hicksian equivalent variation.

21 For an explanation of why government revenues may increase with a piecemeal tariff reform, see Konan and Maskus (1997).

22 Commodity vectors may be partitioned in to groups as group subutility functions are homothetic. See Deaton and Muellbauer for further discussion of separability.