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Regulation, Market Structure and Service Trade Liberalization: A CGE Analysis

Denise Eby Konan
University of Hawaii at Manoa

and

Ari Van Assche*
University of California, Davis

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Abstract

In this paper, we analyze the importance of regulation and market structure on the welfare impact of service trade liberalization. For this purpose, we incorporate an imperfectly competitive services sector that can take on various market structures into a standard CGE model for a small open economy. We assume that in the benchmark a domestic incumbent monopolizes the services sector. In the counterfactuals, the services sector is liberalized and a license is provided to a single foreign service provider. If regulations can enforce competition between the domestic and foreign firm, then the telecommunications market structure turns into a Cournot duopoly. If regulations are weak, then the domestic and the foreign firm can form a cartel. We apply our framework to analyze the welfare impact of telecommunications liberalization in Tunisia. We find that if regulation guarantees competition, Tunisia's welfare can improve up to 1.7 percent. If a cartel is formed, however, Tunisia's welfare can drop 0.15 percent. These results emphasize the importance of market structure and the regulatory environment on the success of telecom liberalization in Tunisia.

JEL classification: F12, F13, F23

Keywords: service trade liberalization, regulation, market structure, imperfect competition, CGE.

*UC Davis, Department of Economics, One Shields Avenue, Davis, CA 95616. Tel: (530)754-6592; Fax: (530)752-9382; E-mail: avanassche@ucdavis.edu.

1 Introduction

Trade in services, far more than trade in goods, is affected by domestic regulations. Unlike physical goods, which can be traded across borders, services often require commercial presence of foreign providers. They need to set up local establishments through foreign direct investment or move professional personnel across borders to provide services to local customers. This has important consequences for the type of trade barriers that governments put into place to protect a domestic services sector. While barriers to goods trade are primarily tariffs and quotas, service trade barriers predominantly take the form of domestic regulations such as entry barriers to local markets, rules on conducts and rules of competition (Whalley, 2003).

Domestic regulations that affect service trade can be classified into discriminatory and non-discriminatory regulatory policies. Discriminatory barriers to services trade are imposed only on foreign services. These include restrictions to the number or market share of foreign providers that are allowed to establish, and restrictions on foreign equity investment. Non-discriminatory restrictive regulations are imposed equally on both domestic and foreign services. These may consist of limitations on the number of firms allowed to contest a market, or on the nature of their operations.

Service trade liberalization entails the reduction of discriminatory trade barriers against foreign service providers. As recent work by Francois and Wooton (2001) demonstrates, the potential gains from service trade liberalization are tied closely to issues of non-discriminatory regulation and market structure. When service trade liberalization goes hand-in-hand with pro-competitive regulatory reforms, foreign entrants will compete against the domestic incumbents, thus bringing about important pro-competitive gains from service trade liberalization. When limited foreign market access is allowed in conjunction with inadequate market regulation, however, it can induce foreign entrants to join a cartel with the domestic incumbents. In that case, anti-competitive conduct can undermine any potential gains of service trade liberalization.

For this reason, the General Agreement of Trade in Services (GATS) recognizes that the assessment of services commitments should not only focus on improving market access to foreign services, but should also take into account market structure and regulatory issues that affect the degree of competition (Mattoo and Sauv , 2003). An important role for the GATS is identifying

pro-competitive regulatory practices and principles that governments should consider adopting, as well as criteria or necessary conditions that must be met before certain reforms should be undertaken (Hoekman and Kostecki, 2001). During the 1997 WTO Telecommunications Negotiations, this has led to a first important achievement. As part of the WTO Agreement on Basic Telecommunications Services, member states agreed upon a “Reference Paper” that listed pro-competitive regulatory principles necessary to ensure that monopolistic or dominant suppliers would not undermine market access commitments (Cowhey and Klimenko, 2001).¹ For member states that signed the “Reference Paper”, the principles became binding commitments and enforceable through dispute settlement under WTO.

Empirical research has identified a strong positive relation between domestic services regulation, the performance of a services sector and economy-wide growth. Mattoo, Rathindran and Subramanian (2001) created policy-based indices of the openness of a country’s services regime in the telecommunications sector and the financial sector. The indices were a combination of the degree of competition, extent of foreign ownership and nature of regulation in the industries. The authors found that market openness in the financial and telecommunications sector positively influences the long run growth performance of a country. Wallsten (2002) and Fink, Mattoo and Rathindran (2004) found that establishing a regulatory authority prior to telecommunications privatization is significantly and positively correlated with the performance of the telecommunications sector. Fink, Mattoo and Neagu (2001) found that breaking up private anti-competitive carrier agreements in the maritime sector would cause maritime transportation prices to decline 25 percent.

Several country-specific studies in recent years have attempted to quantify the effects of services trade liberalization on developing countries in a computable general equilibrium (CGE) framework. Hoekman and Konan (1999), for instance, showed that Egyptian output stood to rise by as much as 4 percent should service sectors become more open to competition. Konan and Maskus (2004) showed that services liberalization in Tunisia could provide welfare gains equivalent to 5.3 percent of GDP. Jensen, Rutherford and Tarr (2004) estimate that Russia will gain about 5.2 percent of the value of Russian consumption from the reduction in discriminatory taxes on multinationals in the service sectors.

¹The Reference Paper deals with six regulatory principles including competitive safeguards, interconnection, universal service, licensing, allocation and use of scarce resource and creation of independent regulator.

However, none of these studies have explicitly addressed the importance of market structure and the regulatory environment on service trade liberalization. The problem lies in the way that services trade liberalization is modelled (Whalley, 2003). Barriers to service trade are first converted into their tariff equivalents by estimating the price-cost margins in each service sector. Services trade liberalization is then modelled as the partial or complete removal of these tariff-equivalent service trade barriers. Throughout the liberalization process, the market structure in the services sectors is assumed to remain unchanged.

This study uses a CGE model to provide a quantitative analysis of the importance of regulation and market structure on the success of service trade liberalization. For this purpose, we incorporate a services sector with an imperfectly competitive market structure into a standard CGE framework for a small open economy. We assume that in the benchmark a domestic incumbent monopolizes the services sector. In the counterfactuals, the services sector is liberalized and a license is provided to a single foreign service provider. If regulations can enforce competition between the domestic and foreign firm, then the telecommunications market structure turns into a Cournot duopoly. If regulations are weak, then the domestic and the foreign firm can form a cartel.

The paper is organized as follows. In Section 2, we describe a standard CGE model of a small open economy. In Section 3, we explain how an imperfectly competitive services sector with various market structures can be introduced into the CGE model. In Section 4, we then derive the various welfare effects associated with service trade liberalization. In Section 5, we provide an application of telecommunications liberalization in Tunisia. Section 6 concludes.

2 Model Structure

In this section, we describe what is, in most respects, a standard CGE model of a small open economy. The nesting structure of the model is presented in figure 1, and the full list of model equations can be found in Appendix A. Our contribution lies in the way that we allow an imperfectly competitive service sector Z to take on different market structures in the benchmark and the various counterfactuals. In the benchmark, we assume that restrictions on domestic and foreign entry lead to a domestic monopoly in services sector Z . In the counterfactual scenarios, the services sector is liberalized and one foreign firm is allowed to enter the market. If a pro-competitive regulatory

environment is in place, the domestic and foreign firm strategically compete in quantities (international duopoly). Otherwise, competition is not ensured and the two firms form an international cartel. As such, this setup allows us to analyze the impact of regulation and market structure on the success of service liberalization in the imperfectly competitive sector.

We assume that the domestic and foreign firms in services sector Z provide differentiated products. For this purpose, we choose total service output Z to be a CES function of composite services provided by the domestic provider z_d and the multinational provider z_m .

$$(1) \quad Z = (z_d^\epsilon + z_m^\epsilon)^{\frac{1}{\epsilon}}$$

The elasticity of substitution between the domestic and foreign provider is $\sigma = \frac{1}{1-\epsilon}$. We require that σ exceeds unity.

We assume that services sector Z is part of a select group of producer services that can have a significant impact on productivity.² Similar to Jensen, Rutherford and Tarr (2003), we introduce this idea by modelling composite producer services PS as an imperfect substitute to value added $L_i^{\alpha_i} K_i^{\beta_i}$.

$$(2) \quad PS_i = \min \left[\frac{x_{1i}}{b_{1i}}, \dots, \frac{x_{m-1,i}}{b_{m-1,i}}, \frac{Z_i}{b_{zi}} \right]$$

$$(3) \quad V_i = \left[(L_i^{\alpha_i} K_i^{\beta_i})^\gamma + PS_i^\gamma \right]^{\frac{1}{\gamma}}$$

The elasticity of substitution between value added and producer services is $\rho = \frac{1}{1-\gamma}$.

In all sectors, production functions are approximated with Leontief technologies using composite intermediate inputs x_{ji} for all sectors except for producer services $j = 1, \dots, n$, and the CES combination of real value added and composite producer services V_i mentioned above.

$$(4) \quad Y_i = \min \left[\frac{x_{1i}}{a_{1i}}, \dots, \frac{x_{ni}}{a_{ni}}, \frac{V_i}{a_{VAi}} \right]$$

Intermediate inputs and final goods are differentiated by country of origin according to the Armington assumption, so that export and import prices differ across regions. In each sector, demand

²We treat the following sectors as producer services: Telecom, Finance, Insurance, Business

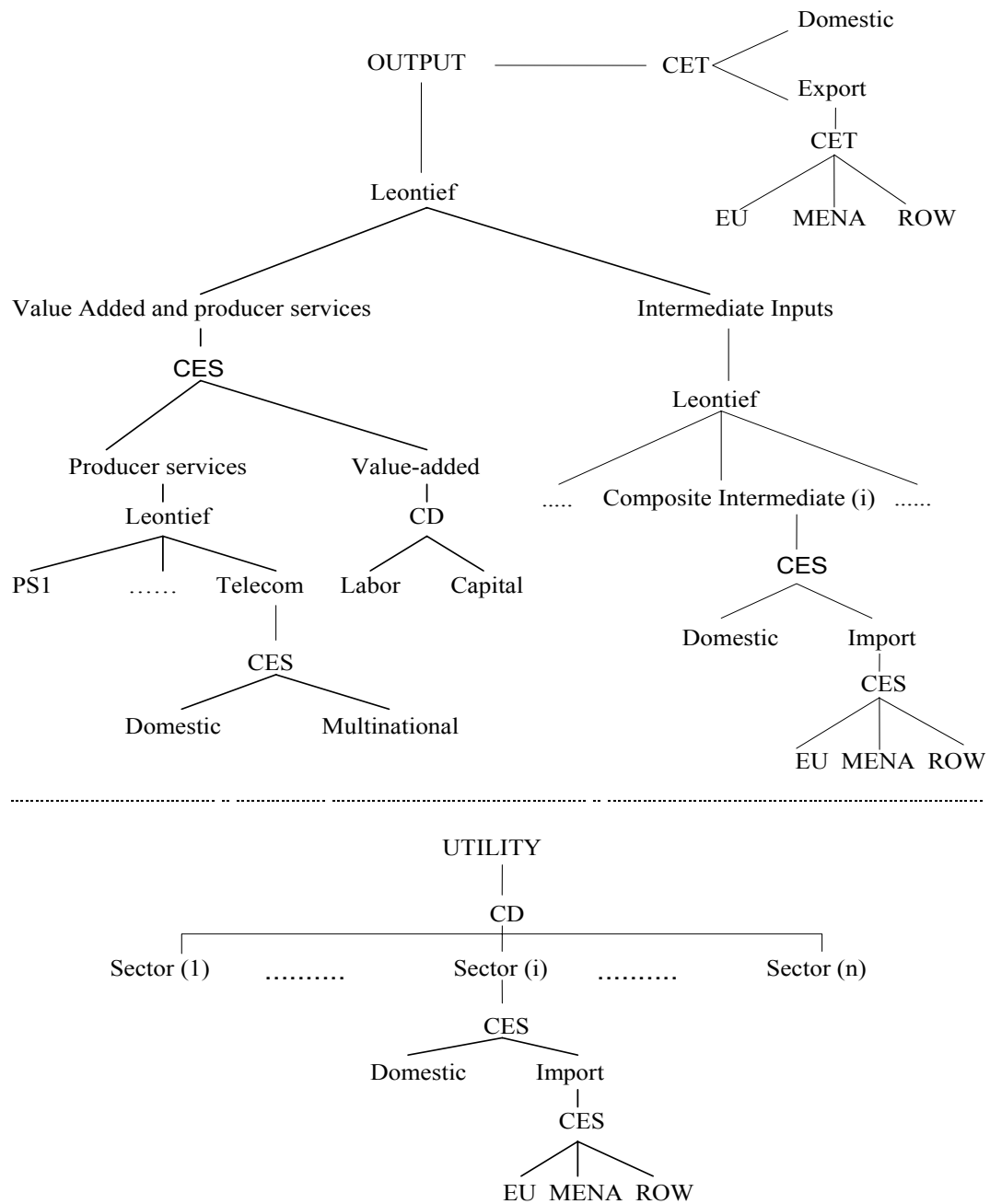


Figure 1: Nesting Structure of a standard CGE Model of a small open economy

for domestically produced and imported goods is represented by a CES function, and intermediate imports are also differentiated across regional sources of supply in a CES structure. Similarly, industries supply regionally differentiated goods to both domestic and foreign markets (exports). Production follows a nested two-stage constant elasticity of transformation (CET) function. Total output is first calculated as the sum of domestic supply and total exports, with the latter then being allocated across the same destination regions according to a sub-CET function. Capital and labor are assumed to be freely mobile across sectors, implying that our simulations pertain to long-run outcomes of liberalization.

Finally, preferences of the representative consumer are represented by a Cobb-Douglas utility function.

$$(5) \quad U(C) = \sum_i \kappa_i \log(Y_i^c) + \kappa_z \log(Z^c)$$

The implication of this setup is that services Z are used by all sectors i as an intermediate good and by the representative consumer as a final good.

3 Market Structure and Lerner Markup Conditions

Firms in the imperfectly competitive services sector Z are assumed not to price discriminate. They sell their services to all sectors in the economy and to the representative agent at the same price. Since each buyer might have a different elasticity of demand for service Z , a question then arises which markup rule the service provider will choose to maximize profits. Hoffmann (2003) illustrates that the general equilibrium Lerner markup condition for a service provider j in that case is a weighted average of the perceived demand elasticities for the different buyers:³

$$(6) \quad \frac{p_{zj} - c_j}{p_{zj}} = \frac{1}{\theta_u \phi_{uj} + \sum_i \theta_i \phi_{ij}}$$

where θ_u equals the share of firm j 's services that is sold to the representative consumer; θ_i equals the share of firm j 's services that is sold to sector i ; ϕ_{uj} equals firm j 's perceived demand elasticity from the representative consumer; θ_i equals the share of firm j 's services that is sold to sector i ;

³In appendix 1, we derive Hoffmann's (2003) optimal markup condition.

and ϕ_{ij} is firm j 's perceived demand elasticity from sector i .

To compute the Hoffmann general equilibrium markup condition for each firm j , we need to derive the perceived demand elasticity from intermediate good user i , ϕ_{ij} , and the perceived elasticity of demand from the representative consumer, ϕ_{uj} , for each market structure. In this section, we will first derive the perceived demand elasticity for intermediate inputs i under the various market structures and then calculate the perceived demand elasticity for final demand under the different market structures. Finally, we will combine all elasticities to derive the Hoffmann general equilibrium Lerner markup condition.

3.1 Demand Elasticity for Intermediate Inputs

To determine a firm's perceived demand elasticity from each sector i under the various market structures, we need to first derive the price p_{zj} that service provider j charges under each market structure. Let p_{yi} denote the domestic price of final good output Y_i in sector i and p_{zj} denote the price received by provider j . Note that p_{zj} does not differ from sector to sector since we assume that there is no price discrimination. Since final Y_i production is assumed perfectly competitive in our model, p_{zj} is the value of the marginal product of z_j in producing Y_i . The price of service p_{zj} can thus be derived from the chain rule:

$$(7) \quad p_{zj} = p_{yi} \frac{\partial Y_i}{\partial z_{ij}} = p_{yi} \frac{\partial Y_i}{\partial Z_i} \frac{\partial Z_i}{\partial z_{ij}}$$

From (2) and (4), we know that output for each sector Y_i and composite producer services PS_i are Leontief. As a result, the cost share of V_i in the production of Y_i is a_{VAi} and the cost share of Z in the production of PS_i is b_{zi} . Therefore,

$$(8) \quad Y_i = \frac{V_i}{a_{VAi}}$$

$$(9) \quad PS_i = \frac{Z_i}{b_{zi}}$$

By plugging (9) and (3) into (8):

$$(10) \quad Y_i = \frac{\left[(L_i^{\alpha_i} K_i^{\beta_i})^\gamma + \left(\frac{Z_i}{b_{zi}} \right)^\gamma \right]^{\frac{1}{\gamma}}}{a_{VAi}}$$

From (13), we can derive $\frac{\partial Y_i}{\partial Z_i}$:

$$(11) \quad \frac{\partial Y_i}{\partial Z_i} = \frac{1}{a_{VAi} b_{zi}} \left[(L_i^{\alpha_i} K_i^{\beta_i})^\gamma + \left(\frac{Z_i}{b_{zi}} \right)^\gamma \right]^{\frac{1-\gamma}{\gamma}} \left(\frac{Z_i}{b_{zi}} \right)^{\gamma-1}$$

Next, we need to derive $\frac{\partial Z_i}{\partial z_{ij}}$. This will depend on the market structure. In a monopoly, the domestic firm is the sole service provider and thus $\frac{\partial Z_i}{\partial z_{ij}} = 1$. In a duopoly, each firm assumes that the other firm will leave output unchanged when it changes its output. We can thus use (1) to derive $\frac{\partial Z_i}{\partial z_{ij}}$. In a cartel, both firms set prices to maximize joint profits. We assume that the firms collude by setting the same price $p_{zd} = p_{zm}$. Since there is a constant elasticity of substitution between both telecom services, this implies that both firms also provide the same amount of telecommunication services, i.e. $z_d = z_m$. From (1), we can then derive $\frac{\partial Z_i}{\partial z_{ij}}$. In summary:

$$(12) \quad \frac{\partial Z_i}{\partial z_{ij}} = \begin{cases} 1 & \text{if monopoly} \\ (z_{id}^\epsilon + z_{im}^\epsilon)^{\frac{1-\epsilon}{\epsilon}} z_{ij}^{\epsilon-1} & \text{if international duopoly} \\ 2^{\frac{1}{\epsilon}} & \text{if international cartel} \end{cases}$$

By plugging (11) and (12) into (7), we can derive the price that firm j charges to sector i . Using the price function, we can then derive the inverse of the perceived elasticity of demand from sector i for firm j under each market structure:

$$(13) \quad \frac{1}{\phi_{ij}} = \frac{-\partial p_{zj}}{\partial z_{ij}} \frac{z_{ij}}{p_{zj}} = \begin{cases} s_{VAi}(1-\gamma) & \text{if monopoly} \\ 1-\epsilon-s_j[1-\epsilon-s_{VAi}(1-\gamma)] & \text{if international duopoly} \\ s_{VAi}(1-\gamma) & \text{if international cartel} \end{cases}$$

where $s_{VAi} = \frac{(L_i^{\alpha_i} K_i^{\beta_i})^\gamma}{(L_i^{\alpha_i} K_i^{\beta_i})^\gamma + P S_i^\gamma}$ and the market share of firm j equals $s_j = \frac{z_j^\epsilon}{z_d^\epsilon + z_m^\epsilon}$.⁴. Noting that the

⁴For modelling purposes, it is important to derive the market share of value added s_{VAi} and firm j 's market share s_j in terms of prices. By solving for the cost minimization problem for V_i and Z_j , $s_{VA} = \frac{p_{va}^{1-\rho}}{p_{va}^{1-\rho} + p_{ps}^{1-\rho}}$ and $s_j = \frac{p_{zj}^{1-\sigma}}{p_{zd}^{1-\sigma} + p_{zm}^{1-\sigma}}$

inverse of the perceived demand elasticity under an international duopoly reduces to $s_{VA_i}(1 - \gamma)$ when $s_j = 1$, we can generalize the inverse of the perceived demand elasticity to:

$$(14) \quad \frac{1}{\phi_{ij}} = 1 - \epsilon - s_j[1 - \epsilon - s_{VA_i}(1 - \gamma)]$$

where firm j treats $s_j = 1$ under a monopoly and an international cartel.⁵

3.2 Demand Elasticity for Final Demand

We next derive firm j 's perceived demand elasticity from the final consumer. Since preferences of the representative consumer are represented by a Cobb-Douglas utility function, the industry demand elasticity equals to one. As a result, the perceived demand elasticity for the domestic and foreign firm equals to 1 under a domestic monopoly and an international cartel. Head and Mayer (1999) demonstrate that under an international duopoly, the perceived final demand elasticity for firm j is:

$$(15) \quad \frac{1}{\phi_{uj}} = 1 - \epsilon(1 - s_j)$$

Equation (13) can once again be seen as a generalized equation for all market structures. Under a domestic monopoly and international cartel, firm j treats $s_j = 1$.⁶

3.3 Hoffmann General Equilibrium Lerner Markup Condition

We can now plug (14) and (15) into (6) to find the Hoffmann general equilibrium Lerner markup condition for each firm under each market structure:

$$(16) \quad \frac{p_{zj} - c_j(w, r)}{p_{zj}} = \underbrace{\left[\frac{\theta_u}{1 - \epsilon(1 - s_j)} + \sum_i \frac{\theta_{yi}}{(1 - s_j)(1 - \epsilon) + s_{vai}s_j(1 - \gamma)} \right]^{-1}}_{\Omega_j^{-1}}$$

Under international duopoly, the encompassing general equilibrium Lerner markup condition holds

⁵The demand elasticity ϕ_{ij} for firm j 's services from sector i is increasing in ϵ and γ , and decreasing in s_{VA_i} . It is decreasing in s_j as long as $\epsilon + s_{VA_i}(1 - \gamma) > 1$.

⁶The demand elasticity ϕ_{uj} for firm j 's services from the representative consumer is increasing in ϵ and decreasing in the firm's market share s_j .

for each firm, with $s_j = \frac{p_{zj}^{1-\sigma}}{p_{zd}^{1-\sigma} + p_{zm}^{1-\sigma}}$. Under domestic monopoly, $s_d = 1$. Under international cartel, both firms treat $s_j = 1$.

From (16), we can now compute derive prices p_{zj} :

$$(17) \quad p_{zj} = \frac{\Omega_j}{\Omega_j - 1} c_j(w, r)$$

The price of the composite service Z then becomes:

$$(18) \quad p_Z = \left(\sum_j p_{zj}^{1-\sigma} \right)^{\frac{1}{1-\sigma}} = \left(\sum_j \frac{\Omega_j}{\Omega_j - 1} c_j(w, r)^{1-\sigma} \right)^{\frac{1}{1-\sigma}}$$

3.4 Allocation of Profits

To close the CGE system, we need to determine where firm j allocates its profits. We assume that the domestic firm always shifts its profits to the domestic representative agent. The foreign firm, on the other hand, might shift its profits abroad.

4 Costs and Benefits of Service Trade Liberalization

By incorporating the Hoffmann general equilibrium Lerner markup conditions for firms z_j into the CGE model and determining where the firms shift their profits, we are able to quantify the welfare impact of regulation and market structure on service trade liberalization in a CGE framework. As we will demonstrate, the welfare impact will depend on four welfare effects: a love-of-variety effect, a pro-competitive effect, an efficiency effect and a profit shifting effect.

Since the domestic representative consumer treats domestic services z_d and foreign services z_m as imperfect substitutes, service trade liberalization leads to a positive *love-of-variety effect* through a reduction in the price of composite service Z . We can demonstrate this by assuming that an equally efficient foreign firm enters the market, forms a cartel with the domestic incumbent and shifts all its profits to the domestic representative agent. From (17) and (18), we know that in this case, both colluding firms will price their services the same as the domestic incumbent would have under a monopoly. However, since consumers have a love-of-variety for services Z , (18) illustrates that the price of composite services Z in that case will be lower in a cartel than in the initial monopoly. In particular, p_Z in that case will equal $2^{\frac{-1}{\sigma-1}} p_{zd}$, which is smaller than $P_z = p_{zd}$ under monopoly.

The love-of-variety effect is a decreasing function of the elasticity of substitution between varieties σ . In other words, the closer substitutes are the domestic and foreign variety, the less beneficial is an international cartel over a domestic monopoly.

A second positive welfare impact associated with service trade liberalization is a *pro-competitive effect*. If the domestic and the foreign firm strategically compete instead of colluding, the price of the composite service P_z will be lower as long as $\epsilon + s_{VA_i}(1 - \gamma) > 1$.

A third positive welfare effect is an *efficiency effect*. This will occur under service trade liberalization if the foreign entrant is more efficient than the domestic incumbent. If the foreign firm faces a marginal cost $c_m < c_d$, then this will reduce the price of composite services Z .

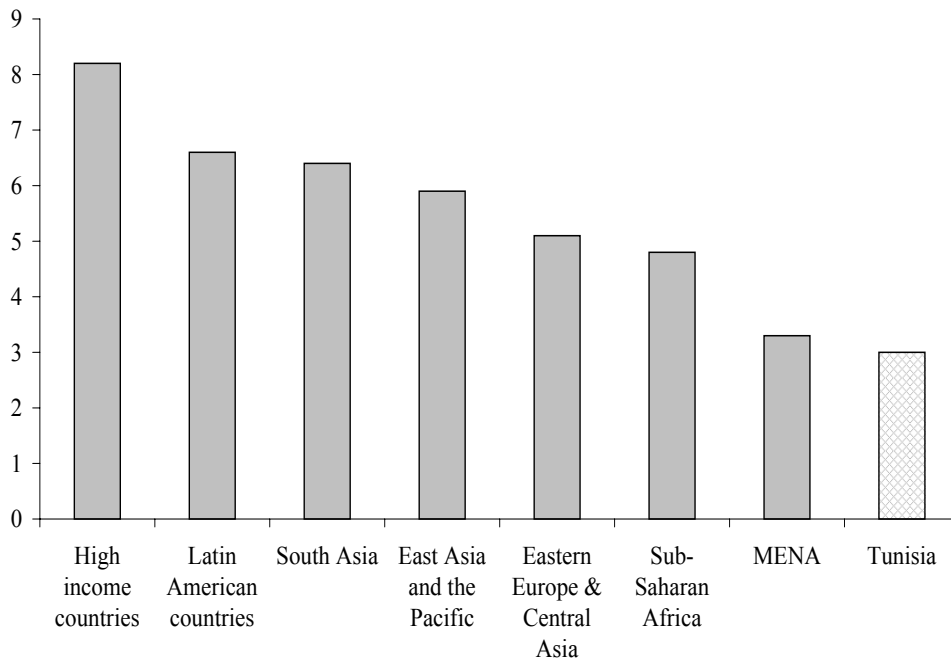
Finally, there is also a negative welfare impact associated with service trade liberalization. If the foreign firm shifts its profits abroad rather than to the domestic representative agent, then this leads to a negative *profit-shifting effect*.

The opposing welfare effects imply that in theory the welfare impact of service trade liberalization is ambiguous and depends on the parameters of the model. In the next section, we will apply our model to telecommunications liberalization in Tunisia to demonstrate the magnitudes of the various effects.

5 An Application: Telecommunications Liberalization in Tunisia

Tunisia represents a good case study to investigate the impact of regulation and market structure on the success of telecommunications liberalization. Reforms in its telecommunications industry have lagged behind those in countries with similar income levels (figure 2), and the resulting absence of competition has limited the growth of both fixed and mobile networks (figure 3). While between 1980 and 1994, Tunisia's fixed line penetration rate was similar to Lower Middle-Income Countries, it has lagged behind since. In addition, the mobile phone penetration rate in Tunisia has continuously remained below that of other Lower Middle-Income Countries. For these reasons, telecom liberalization holds a considerable potential for improving not only Tunisia's sectoral performance, but also its overall economic performance.

The Tunisian government has recognized this potential and has committed to a cautious program of telecommunications liberalization. In 1997, it was one of the 56 signees of the World Trade



Source: Varoudakis and Rossotto (2004)

Figure 2: Telecommunications Liberalization Index (1999)

Organization Agreement of Basic Telecommunications Services, thus committing itself to gradually opening up its telecommunications sector to foreign competition. In accordance to the Agreement, Tunisia committed to permitting telex and data transmission competition from 1999, mobile telephone and paging, frame relay, and teleconferencing from 2000, and local telephone competition in 2003.⁷ However, Tunisia was less inclined to make binding commitments to pro-competitive regulatory reforms. During the GATS Telecommunications negotiations, Tunisia was one of the few signees that refrained from signing on to the Reference Paper, which committed members to a schedule of pro-competitive regulatory reforms.

By incorporating market structure into a CGE framework for Tunisia, we are not only able to quantify the potential gains of telecommunications liberalization, but are also able to quantify the importance of regulation and market structure to the success of telecom liberalization.

⁷For all services, foreign ownership was capped at 49%, and foreign ownership of Tunisie Telecom was only permitted to 10% beginning in 2002.

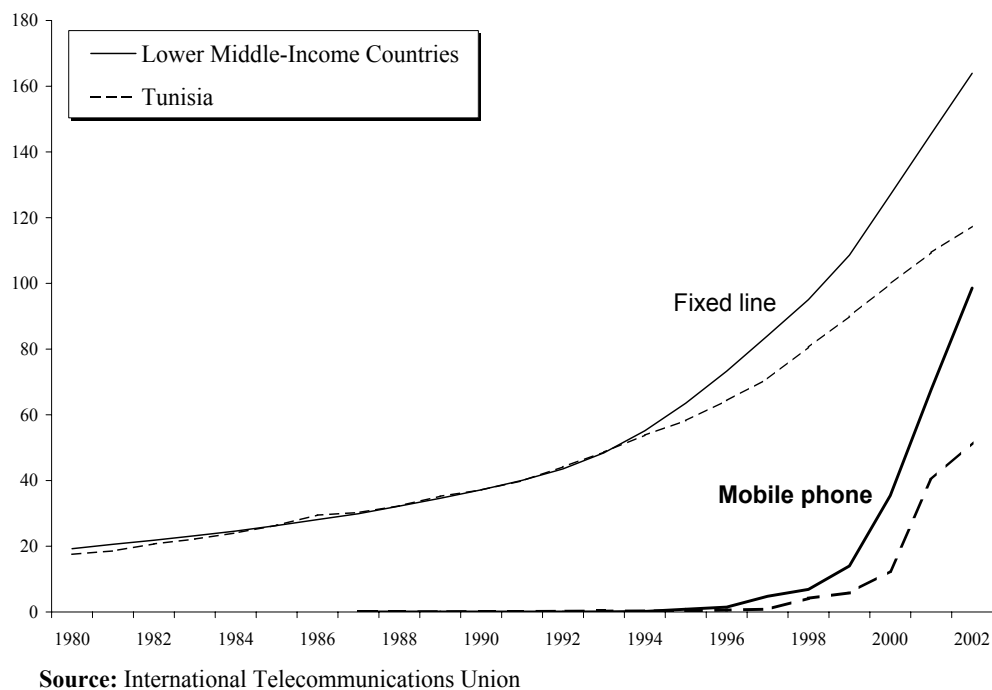


Figure 3: Fixed Line and Mobile Phone Penetration Rates (per 1000 people)

5.1 Benchmark Data

The data required for the CGE model consist of a Social Accounting Matrix (SAM), estimates of the price-cost margin in the telecommunications sector and of other parameters such as import and export trade flows by region and elasticities of substitution and transformation. The core input-output model is the 1995 table provided on a diskette by the Institut National de la Statistique (INS). The 56 sector table was combined with the INS *Les Comptes de la Nation* (1998) report and then assembled into a consistent set of relationships between intermediate demand, final demand and value-added to produce the SAM.

In order to have valid estimates of the Lerner markup in the telecommunications sector, it would be necessary to estimate the impact of telecom barriers on price markups.⁸ Unfortunately, these estimates are not available for Tunisia. By relying on industry studies in Tunisia and extensive discussions with Tunisian industry experts, country economists and government officials and

⁸Christopher Findlay and Tony Warren (2000) suggest computing the pro-competitive impacts using price-cost margins (or “net interest margins”).

on studies by Zarrouk (2000) and Konan and Maskus (2004), we have been able to estimate an approximate monopoly markup of 20% in Tunisia's telecom sector.

We allow for the possibility that the foreign telecom provider is more efficient than the domestic incumbent in providing telecommunications services. If this is the case, we assume that the foreign firm faces a marginal cost that is 10% lower than that of the domestic incumbent.

Welfare results in CGE models are highly sensitive to the assumptions on trade elasticities (Hertel et al., 2004). The data required to estimate the relevant trade elasticities for the Tunisian market are not available. Therefore, we make standard assumptions about their values. In particular, benchmark trade elasticities are drawn from Rutherford, Rutstrom and Tarr (1995) and Konan and Maskus (2000, 2004). The various trade elasticities are 2.0 for substitution between domestic and imported goods, 5.0 for substitution among regional imports and for transformation between domestic output and exports, and 8.0 for transformation among regional export destinations. For the reasons mentioned above, we also assume that the trade elasticities are 0.5 for services and 0 for producer services.

5.2 Estimation Results

In this section, we present the results of the analysis of telecom liberalization in Tunisia. As mentioned above, the telecom liberalization scenarios considered can be categorized according to four effects: a love-of-variety effect, a pro-competitive effect, a profit-shifting effect and an efficiency effect (Table 1). First, when a foreign firm enters, a *love-of-variety effect* occurs. Second, since duopoly is a more competitive market structure than cartel, we indicate that a *pro-competitive effect* occurs under international duopoly (*DUO*) but not under cartel (*CAR*). Third, a *profit shifting effect* occurs if the rents generated by the foreign entrant are shifted abroad (subscript *F*), but not if the rents are transferred to the domestic representative agent (subscript *D*). Finally, if the foreign firm is relatively more efficient than the domestic firm, we indicate that an *efficiency effect* occurs (superscript *A* for asymmetry). If both the domestic and foreign firms are equally efficient, no efficiency effect occurs, and we represent this with superscript *S* (for symmetry).

As it can be expected, the welfare gain of telecommunications liberalization is the highest under DUO_D^A (Table 3.4). Under this best-case scenario, a more efficient foreign firm strategically competes in quantities with the domestic incumbent and transfers its profits to the domestic rep-

Table 1: Telecom Liberalization Scenarios

No Profit Shifting

		<i>Efficiency Effect</i>	
		yes	no
<i>Pro-Competitive Effect</i>	yes	DUO_D^A	DUO_D^S
	no	CAR_D^A	CAR_D^S

No Profit Shifting

		<i>Efficiency Effect</i>	
		yes	no
<i>Pro-Competitive Effect</i>	yes	DUO_D^A	DUO_D^S
	no	CAR_D^A	CAR_D^S

representative agent. As a result, the welfare-improving efficiency and pro-competitive effects are present. In addition, the welfare-reducing profit shifting effect does not occur. In this case, household welfare (measured as Hicksian equivalent variation) is estimated to improve by 1.71 percent while real output increases by 1.03 percent. The economic growth is primarily export-led, with aggregate exports expanding 8.48 percent. The benefits accrue equally to capital and labor, with returns to both increasing by 0.86 percent. Resources are primarily moved into telecommunications and manufacturing. The share of the economy in telecom increases from 1 percent in the benchmark to 2.8 percent, while the share of manufacturing increases from 32.1 to 32.7 percent. The increase in manufacturing is largely driven by a 15.5 percent growth of the clothing industry (see Appendix 4). Economic activity in agriculture, petroleum and mining, and non-producer services, on the other hand, decline.

Under the worst-case scenario, CAR_F^S , an equally efficient foreign firm colludes with the domestic incumbent and shifts its profits abroad. As a result, there are no welfare-improving pro-competitive or efficiency effects, while the welfare-reducing profit shifting effect occurs. In this case, household welfare is estimated to worsen 0.15 percent while real output increases by 0.13 percent. The economic growth remains export-led, with aggregate exports expanding 0.74 percent. Despite the drop in welfare, real returns to mobile factors increase. Capital gains disproportionately, with the rate of return of capital increasing by 0.09 percent and wages increasing 0.07 percent. Resources

Table 2: Macro-Economic Impact of Telecom Liberalization

	BMK	DUO_D^A	DUO_D^S	DUO_F^A	DUO_F^S	CAR_D^A	CAR_D^S	CAR_F^A	CAR_F^S
Macroeconomic Indicators^a									
Household welfare (EV)	-	1.71	0.95	1.09	0.56	0.84	0.25	0.37	-0.15
Output, real	-	1.03	0.58	0.99	0.55	0.52	0.16	0.49	0.13
Consumer price index	-	-1.09	-0.24	-1.45	-0.42	-0.77	-0.19	-0.90	-0.19
Aggregate Trade^a									
Real exchange rate	-	-2.59E-09	1.03E-11	3.52E-06	1.16E-05	-5.38E-07	-1.50E-07	8.43E-07	2.95E-06
Aggregate exports	-	8.48	4.73	8.48	4.73	2.77	0.74	2.77	0.74
Aggregate imports	-	2.88	1.70	2.88	1.70	1.10	0.31	1.10	0.31
Return to Mobile Factors^a									
Capital	-	0.86	0.54	0.86	0.54	0.32	0.09	0.32	0.09
Labor	-	0.86	0.52	0.86	0.52	0.27	0.07	0.27	0.07
Output Share^b									
Agriculture	19.06	18.10	18.50	18.10	18.50	18.77	18.99	18.77	18.99
Manufacturing	32.07	32.65	32.38	32.65	32.38	32.24	32.11	32.24	32.11
Mining & Utilities	6.89	6.70	6.78	6.70	6.78	6.83	6.87	6.83	6.87
Services	41.98	42.55	42.34	42.55	42.34	42.16	42.03	42.16	42.03
Services excl. producer services	37.53	36.31	36.83	36.31	36.83	37.14	37.43	37.14	37.43
Producer services excl. telecom	3.50	3.49	3.50	3.49	3.50	3.50	3.50	3.50	3.50
Telecom	0.95	2.75	2.01	2.75	2.01	1.53	1.11	1.53	1.11

^a % change from BMK

^b % share of real output

continue to be moved into telecommunications and manufacturing. The share of the economy in telecom increases from 1 percent in the benchmark to 1.1 percent, while the share of manufacturing increases insignificantly. The increase in manufacturing is largely driven by a 1.3 percent growth of the clothing industry (see Appendix C). Economic activity in agriculture, petroleum and mining, and non-producer services, on the other hand, decline.

Under the alternative scenarios, changes in the macro-indicators are in the same direction as in the best-case scenario, but their magnitudes differ. If the profit shifting effect occurs (i.e., the foreign firm shifts profits abroad), then the resulting real income loss of the representative agent leads to a smaller welfare gain than when profits are retained. Aggregate trade, sectoral output shares and the returns to mobile factors, on the other hand, remain virtually unchanged. In the absence of efficiency and/or pro-competitive effects, the magnitude of the changes in all the macro-indicators are dampened when compared to the scenarios where they are present. Welfare, output, exports and returns to mobile factors see smaller gains, while sectoral output shares see smaller changes.

It is useful to further decompose the total welfare gains into the pro-competitive effect, the efficiency effect and the profit shifting effect. This can be done for each scenario by measuring the change in the total welfare gain if an effect is removed in Table 2. Consider the first column of Table 3 (DUO_D^A) as an example. As discussed earlier, under this best-case scenario the welfare gain is 1.7 percent and both pro-competitive and efficiency effects are present, while there is no profit-shifting effect. The contribution of the pro-competitive effect to welfare can be calculated by subtracting the welfare gain under CAR_D^A from that under DUO_D^A , which amounts to 0.89 percent.⁹ Similarly, the efficiency effect is calculated to be $\% \Delta W(DUO_D^A - DUO_D^S) = 0.76$ percent. Similar calculations are made for the other scenarios in Table 3. If we subtract the sum of the three effects from the total effect under each scenario, we find positive residual effects of varying magnitudes. This residual effect can be attributed to two separate factors. On the one hand, since there is imperfect substitutability between domestic and foreign telecom services, there is an additional love-of-variety effect that affects welfare positively in each scenario. Since the residual effect is a constant 0.25 percent in all scenarios where maximum one effect is present, we estimate the love-of-variety effect to contribute 0.25 percent to welfare under each scenario. On the other hand, there

⁹ $\% \Delta W(DUO_D^A - CAR_D^A)$

are interaction effects present. An interaction between the efficiency effect and the profit-shifting effect leads to an additional increase in welfare (*DUOFA* and *CARFA*). The interaction between the pro-competitive effect and the efficiency effect has a negative impact on welfare, implying that either type of reform alone will produce some gains that overlap those of the other effect (*DUODA*).

Sensitivity analysis of the size of the foreign firm's efficiency advantage provides further evidence of an interaction between the efficiency effect and the profit shifting effect. As illustrated in Figure 4, the welfare loss of profit shifting under duopoly increases as the efficiency advantage of the foreign firm increases. The reason is that a larger efficiency advantage leads to an increase in the foreign firm's market share and profits. Profit shifting thus leads to a larger welfare loss since it induces a larger real income loss to the domestic represent agent.

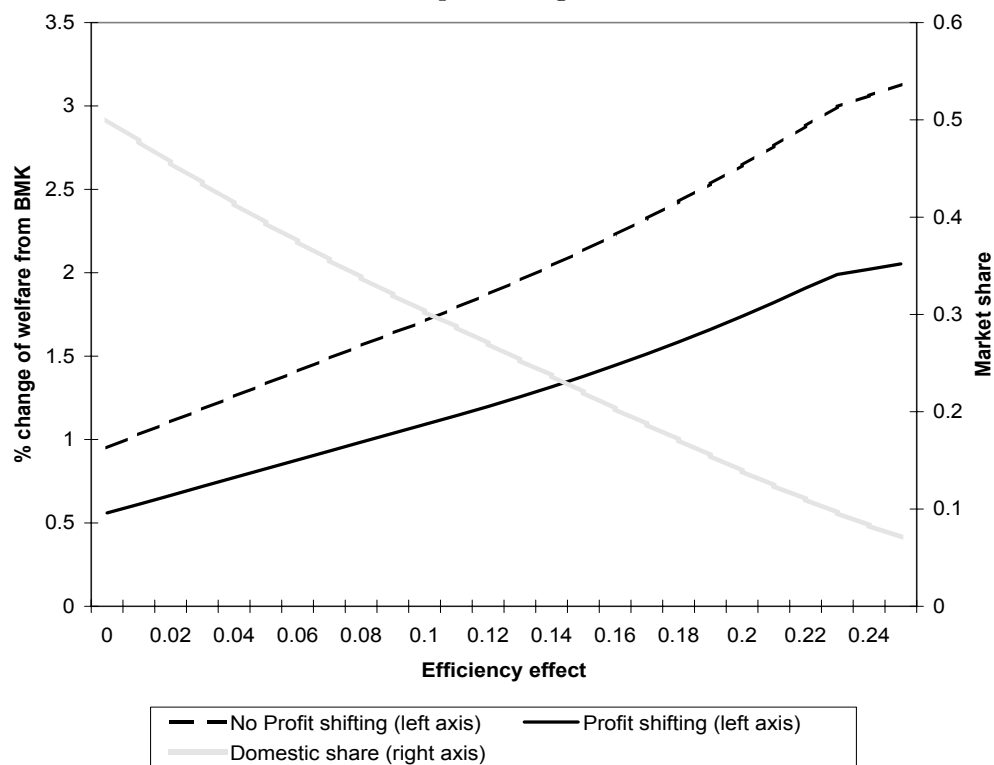


Figure 4: Interaction between Profit-Shifting Effect and Efficiency Effect under Duopoly

Table 3: Decomposition of welfare effects

	DUO_D^A	DUO_D^S	DUO_F^A	DUO_F^S	CAR_D^A	CAR_D^S	CAR_F^A	CAR_F^S
Total effect	1.71	0.95	1.09	0.56	0.84	0.25	0.37	-0.15
Pro-competitive effect	0.89	0.70	0.72	0.71	-	-	-	-
Efficiency effect	0.76	-	0.53	-	0.59	-	0.52	-
Profit-shifting effect	-	-	-0.62	-0.39	-	-	-0.47	-0.40
Residual effect	0.06	0.25	0.46	0.25	0.25	0.25	0.32	0.25
<i>Love-of-variety effect</i>	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
<i>Interaction effect</i>	-0.19	-	0.21	-	-	-	0.06	-

6 Conclusion

This paper has focused on the importance of regulation and market structure on the success of service trade liberalization. For this purpose, we have introduced an imperfectly competitive service sector that can take on various market structures into a CGE model. We assumed that the services sector is dominated by a domestic monopoly in the benchmark. In the counterfactual scenarios, the domestic incumbent and a foreign entrant form a duopoly if pro-competitive regulatory reforms are in place. If no pro-competitive reforms are implemented, the two firms collude.

We have demonstrated that in this type of setting, service trade liberalization in the imperfectly competitive services sector can induce four welfare effects. It can induce a positive love-of-variety effect if services provided by domestic and foreign firms are considered to be imperfect substitutes. It can lead to a positive pro-competitive effect if the two firms decide to compete in quantities instead of colluding. It can induce a positive efficiency effect if the foreign firm is more efficient than the domestic firm. Finally, it can lead to a negative profit-shifting effect if the foreign firm shifts its profits abroad.

We applied our framework to quantify the welfare impact of telecommunications liberalization in Tunisia. Our results suggest that pro-competitive regulatory reform needs to precede or accompany telecom liberalization. According to our conservative estimates, the potential welfare implications of telecom liberalization are clearly positive if competition can be guaranteed between the two firms. Welfare (measured as equivalent variation) and GDP are both estimated to increase more than 0.5 percent, and the welfare gains can increase to 1.7 percent if foreign firms are more efficient and do not shift their profits abroad. In contrast, telecom liberalization can be welfare deteriorating if the two firms collude and the foreign firm shifts its profits abroad. Our results thus call for Tunisia to step up its pro-competitive regulatory reforms while liberalizing its telecom sector.

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Appendix A: Full Description of the CGE Model

Final output in sector i , Y_i , is produced according to a nested Leontief-CES production function of intermediate inputs, x_{ji} for sectors $j = 1, \dots, n$ and the composite value added function V_i .

$$(A-1) \quad Y_i = \min \left[\frac{x_{1i}}{a_{1i}}, \dots, \frac{x_{ni}}{a_{ni}}, \frac{V_i}{a_{VA}} \right]$$

Composite value added, V_i , is a CES nest of value added $L_i^{\alpha_i} K_i^{\beta_i}$ and producer services PS_i .

$$(A-2) \quad V_i = \left[(L_i^{\alpha_i} K_i^{\beta_i})^\gamma + PS_i^\gamma \right]^{\frac{1}{\gamma}}$$

Composite producer services, PS_i , are produced according to a Leontief production function. They consist of telecommunication services, commercial services, construction services, transportation services, financial services, insurance, business services, property rent and leasing, repair services and education and health services.

$$(A-3) \quad PS_i = \min \left[\frac{x_{1i}}{b_{1i}}, \dots, \frac{x_{m-1,i}}{b_{m-1,i}}, \frac{Z_i}{b_{zi}} \right]$$

Telecommunications services, Z , is comprised of telecom services provided by the domestic incumbent Z_D and telecom services provided by the multinational market entrant Z_M .

$$(A-4) \quad Z = (Z_D^\epsilon + Z_M^\epsilon)^{\frac{1}{\epsilon}}$$

In export sectors, the production for the domestic market D_i is distinguished from that for export EX_i according to a two-tier nested constant elasticity of transformation (CET) frontier.

$$(A-5) \quad Y_i = \left[\delta_{D_i} D_i^{\frac{\zeta_i-1}{\zeta_i}} + \delta_{EX_i} EX_i^{\frac{\zeta_i-1}{\zeta_i}} \right]^{\frac{\zeta_i}{\zeta_i-1}}$$

The second-tier CET-nest aggregates total exports, X_i , from exports by destination, EX_{ri} , indexed by r (EU, MENA, and ROW).

$$(A-6) \quad EX_i = \left[\sum_r \eta_{ir} EX_{ir}^{\frac{\kappa_i-1}{\kappa_i}} \right]^{\frac{\kappa_i}{\kappa_i-1}}$$

Intermediate good, z_{ji} , and final demand, c_j , in sector j is differentiated by country of origin.

Domestic output D_{ji} and D_{jc} , and region r imports, IM_{rji} and IM_{rjc} are aggregated in the following nested Armington CES functions.

$$(A-7) \quad x_{ji} = \left[\lambda_{Dj} D_{ji}^{\frac{\mu_j-1}{\mu_j}} + \lambda_{IMj} IM_{ji}^{\frac{\mu_j-1}{\mu_j}} \right]^{\frac{\mu_j}{\mu_j-1}}$$

$$(A-8) \quad C_j = \left[\nu_{Dj} D_{jc}^{\frac{\xi_j-1}{\xi_j}} + \nu_{IMj} IM_{jc}^{\frac{\xi_j-1}{\xi_j}} \right]^{\frac{\xi_j}{\xi_j-1}}$$

where composite intermediate and final imports, respectively, IM_{ji} and IM_{jc} , are given by the following:

$$(A-9) \quad IM_{ji} = \left[\sum_r \varpi_{jr} IM_{jir}^{\frac{\psi_i-1}{\psi_i}} \right]^{\frac{\psi_i}{\psi_i-1}}$$

$$(A-10) \quad IM_{jc} = \left[\sum_r \varpi_{jr} IM_{jCr}^{\frac{\psi_i-1}{\psi_i}} \right]^{\frac{\psi_i}{\psi_i-1}}$$

In all sectors except for the telecommunications sector, firms face constant returns to scale and behave competitively, implying that prices, p_j , equal marginal cost, c_j , for output within sector j . The domestic policy environment is reflected by government revenue producing tariffs on sector j imports from region r , t_{jr} and a tax on primary input value added, τ_j

$$(A-11) \quad c_j Y_j = \sum_j p_j D_{ji} + \sum_j \sum_r (1 + t_{jr}) p_{jr}^{im} IM_{jir} + (w_K K_i + w_L L_i)$$

In the imperfectly competitive telecom sector, the domestic and foreign firm face the following Lerner markup condition:

$$(A-12) \quad \frac{p_{zj} - c_j}{p_{zj}} = \frac{1}{\sigma} \left[\frac{\theta_u}{1 + (\sigma - 1)s_i} + \sum_i \frac{\theta_{yi}\rho}{(1 - s_j)\rho + \sigma(s_{vai})s_j} \right]^{-1}$$

In the model, private household expenditures are determined by a representative agent with a multi-nested CES utility function. This allows the agent to make separable multi-staged budget decisions. In the top-tier budgeting decision the income elasticity is assumed to be unity with a Cobb-Douglas nested utility function:

$$(A-13) \quad U = \Pi_i C_i^{b_i}, \quad \text{with } \sum_i b_i = 1$$

The second budgeting stage involves the consumer deciding how much to spend on domestic versus imported commodities, which is determined in equations (A-7)-(A-10).

Private households receive income generated by returns to endowments of labor, \bar{E}_L , and other value added, \bar{E}_K . Households receive monopoly rent transfers from the domestic telecom incumbent $\pi_D Z_D$ and under some scenarios from the multinational telecom provider $\pi_M Z_M$. Households support a government budget deficit, D , and engage in savings through exogenously fixed investment instruments, I_i .

$$(A-14) \quad \sum_i \tilde{p}_i^C C_i = w_K \bar{E}_K + w_L \bar{E}_L - \sum_i p_i I_i^I - \sum_i \tilde{p}_i^{IF} I_i^F - r^F K^F - D + \pi_D Z_D + \pi_M Z_M$$

The model simplifies the treatment of government and intertemporal decisions. The government is assumed to spend based on a fixed real income, with preferences reflecting those of households. A lump-sum tax adjusts endogenously in response to policy shocks to maintain a revenue-neutral government budget.

$$(A-15) \quad \sum_i \tilde{p}_i^G G_i = D + \sum_i \tau_{Vi} \tilde{p}_i^C V_i + \sum_i \sum_r t_{ir} p_{ir}^{im} (IM_{iCr} + IM_{iIr}^F)$$

Similarly, real private investment in each sector, I_i , is exogenously fixed at the benchmark level.

As noted above, import and export prices are exogenous following the small-economy assumption. The real current account balance, B , is exogenously given at international prices and is assumed to be exogenous. That is, the volume of trade adjusts endogenously to ensure a constant real current account. The balance of payments conditions also holds.

$$(A-16) \quad B = \sum_i \sum_r p_{ri}^{ex} EX_{ri} - \sum_i \sum_j \sum_r p_{ri}^{im} IM_{ri}^j - \sum_i \sum_r p_{ri}^{im} IM_{ri}^C$$

$$(A-17) \quad 0 = \sum_r \sum_i \frac{1}{e} (p_{ri}^{im} IM_{ri} - p_{ri}^{ex} EX_{ri} - w_L^F L^F - r^F K^F - \pi_M Z_M)$$

It is important to note that key identities hold as the optimizing behavior of agents assures that income will equal expenditures. Market clearance is achieved in each goods market, each factor market and the total supply value in the economy is balanced.

$$(A-18) \quad S_i = \sum_j a_{ji} Y_j + G_i + I_i^F + I_i^I + C_i$$

$$(A-19) \quad \sum_i K_i = \bar{E}_K; \quad \sum_i L_i = \bar{E}_L$$

$$(A-20) \quad \begin{aligned} \tilde{p}_i S_i &= \tilde{p}_i^Z \sum_j a_{ij} (1 + v_i) Y_j + \tilde{p}_i^C D_{iC} + \tilde{p}_i^{IF} D_{iI}^F + \tilde{p}_i^G D_{iG} + \tilde{p}_i^{IF} I_i^I + \\ &\quad \sum_r (1 + \tau_{Vi} + u_i + t_{ir}) p_{ir}^{im} (IM_{iCr} + IM_{iGr} + IM_{iIr}^F) \end{aligned}$$

In this Arrow-Debreu type model, Walras' law is satisfied and, given a numeraire, a unique set of real prices is determined in each scenario. (A full list of all identities can be found in Denise E. Konan (2003).)

Table 4: List of Variables

B	Current-account balance
c_i	Index of marginal cost of production
C_i	Private consumption
D	Government budget deficit
D_{ij}	Domestic sales in sector i used by j
e	Real exchange rate (price index for foreign exchange)
EX_{ir}	Exports in sector i to region r
G_i	Public consumption
I_i^F, I_i^I	Fixed capital formation and inventory
IM_{ijr}	Imports in sector i from region r used in j
K^F	Net payments on foreign capital holdings
K_i	Non-labor (capital) inputs
L_i	Domestic labor inputs
p_i	Domestic producer price index
p_i^j	Price index of domestic goods used by j
p_{ir}	Producer price index for goods exported to region r
p_{ijr}	Domestic price index for imports in sector i from region r used in j
\tilde{p}_i	Composite price index for total domestic supply
\tilde{p}_{ij}	Composite price index (weighted average of home and imported prices)
PS_i	Producer services
S_i	Supply on domestic market
U	Utility of representative consumer
V_i	Value added
w_K, w_L	Factor price indexes
x_{ij}	Composite intermediate input of j into i
Y_i	Output of good i
Z_D	Telecom services provided by domestic incumbent
Z_M	Telecom services provided by foreign entrant
θ_i	Share of total telecom services used by i
ρ	Elasticity of substitution between value added and producer services
τ_{Vi}	Endogenous tax rate on value added
ϕ_i	Elasticity of demand for telecom user i

Table 5: List of Parameters

α_i	Labor share of value added in sector i
β_i	Non-labor share of value added
γ	$\frac{\rho-1}{\rho}$
ϵ	$\frac{\sigma-1}{\sigma}$
ζ_i	Transformation elasticity between domestic and exported output
κ_i	Transformation elasticity on exports between regions
λ_i	Service resource-using barriers on output ($\lambda_i = 0$ for non-service sectors)
μ_j	Substitution elasticity between domestic and imported intermediates
ξ_j	Substitution elasticity between domestic and imported consumption
π_i	Telecom rents for service provider i
σ	Elasticity of substitution between domestic and foreign telecom services
ψ_i	Armington elasticity on imports between regions
\bar{E}_K, \bar{E}_L	Endowments of capital and labor
p_{ir}^{im}	Price of imports from region r
p_{ir}^{ex}	Price of exports to region r
r^F	Price of foreign capital payments
t_{ir}	Tariff rate on imports from region r ($t_{ri} = 0$ for service sectors)
u_i	Resource-using services border barriers ($u_i = 0$ for non-service sectors)

Appendix B: Hoffmann General Equilibrium Lerner Markup Condition

Hoffmann (2003) uses three equations to derive the general equilibrium Lerner markup condition when a firm faces different buyers. First, the following arbitrage condition needs to hold for firm z :

$$(B-1) \quad \frac{\partial p_z}{\partial z_i} dz_i = \frac{\partial p_z}{\partial z_j} dz_j$$

In equation (1), z_i represents the amount of services allocated to sector i . By converting the partials to inverse price elasticities and rearranging:

$$(B-2) \quad dz_i = \frac{\phi_i}{\phi_j} \frac{z_i}{z_j} dz_j$$

where $\phi_i = -\frac{\partial z_i}{\partial p_z} \frac{p_z}{z_i}$. If we sum (B-2) over all uses i :

$$(B-3) \quad \sum_i dz_i = \sum_i \frac{\phi_i}{\phi_j} \frac{z_i}{z_j} dz_j$$

A second necessary equation states that changes in a firm's total supply z equals the sum of the changes in the supply to all the buyers:

$$(B-4) \quad dz = \sum_i dz_i$$

By combining (B-3) and (B-4):

$$(B-5) \quad dz_j = \left[\frac{\phi_j z_j}{\sum_i \phi_i z_i} \right] dz$$

A final equation is the total derivative of the profit equation for firm z :

$$(B-6) \quad (p_z - c) \sum_i dz_i + \sum_i z_i \frac{\partial p_z}{\partial z_i} dz_i = 0$$

If we incorporate (B-4) and (B-5) into (B-7):

$$(B-7) \quad (p_z - c) dz - p_z \frac{\sum_i z_i}{\sum_i \phi_i z_i} dz = 0$$

This leads us to Hoffmann's Lerner markup condition:

$$(B-8) \quad p_z \left[1 - \frac{1}{\sum_i \phi_i \theta_i} \right] = c$$

where $\theta_i = \frac{z_i}{\sum_i z_i}$. It can be useful to distinguish the usage of telecom services as a final good from the other usages since the derivation of the demand elasticity will be different:

$$(B-9) \quad p_z \left[1 - \frac{1}{\phi_u \theta_u + \sum_i \phi_i \theta_i} \right] = c$$

where ϕ_u equals the consumers' demand elasticity for firm z 's telecom services; θ_u equals the share of firm z 's telecom services that is sold to consumers; ϕ_i equals the demand elasticity for firm z 's telecom services by sector i and θ_i equals the share of firm z 's total telecom services that is sold to sector i .

Appendix C: Sectoral Impact Table

Table 6: Sector Codes and Descriptions

Aggregate Sectors	Code	Sectors
Agriculture	AGR	Agriculture
	FOO	Food
Manufacturing	CEM	Cement
	MET	Non-ferrous metals
	MTW	Metal work
	MAC	Machines and equipment
	TRA	Automobiles and trucks
	AUR	Autoparts and repair
	EL1	Electric materials
	EL2	Electronics material
	APP	Household appliances
	CHM	Chemicals
	CLO	Apparel
	LEA	Leather
	WOO	Woodwork
	PAP	Paper, books, records
	PLA	Plastics
Mining and utilities	MIN	Minerals
	PET	Petroleum and gas
	ELE	Electricity
	WAT	Water
Services		
Producer services	TEL	Telecommunications
	FIN	Finance
	INS	Insurance
	BUS	Business
Non-producer services	CNS	Construction
	COM	Distribution/Commerce
	TRN	Transportation
	HOT	Hotel
	RES	Restaurant
	REN	Real Estate
	REP	Repair
	EDH	Health and Education
	PUB	Public

Table 7: Impact of Telecom Liberalization on Sectoral Output

	DUO_D^A	DUO_D^S	DUO_F^A	DUO_F^S	CAR_D^A	CAR_D^S	CAR_F^A	CAR_F^S
AGR	-1.6	-0.9	-1.6	-0.9	-0.2	0.0	-0.2	0.0
FOO	-1.6	-0.9	-1.6	-0.9	-0.2	0.0	-0.2	0.0
CEM	-0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0
MET	0.5	0.3	0.5	0.3	0.2	0.1	0.2	0.1
MTW	0.2	0.1	0.2	0.1	0.2	0.1	0.2	0.1
MAC	2.9	1.8	2.9	1.8	1.0	0.3	1.0	0.3
TRA	0.0	0.0	0.0	0.0	0.2	0.1	0.2	0.1
AUR	0.8	0.5	0.8	0.5	0.3	0.1	0.3	0.1
EL1	4.1	2.4	4.1	2.4	1.3	0.3	1.3	0.3
EL2	3.5	2.2	3.5	2.2	1.2	0.3	1.2	0.3
APP	-0.6	-0.3	-0.6	-0.3	0.1	0.1	0.1	0.1
CHM	0.1	0.0	0.1	0.0	0.2	0.1	0.2	0.1
CLO	15.5	8.6	15.5	8.6	4.9	1.3	4.9	1.3
LEA	-0.8	-0.5	-0.8	-0.5	0.0	0.0	0.0	0.0
WOO	-0.8	-0.4	-0.8	-0.4	0.0	0.0	0.0	0.0
PAP	1.6	0.9	1.6	0.9	0.7	0.2	0.7	0.2
PLA	1.7	1.0	1.7	1.0	0.7	0.2	0.7	0.2
OTH	5.1	2.9	5.1	2.9	1.8	0.5	1.8	0.5
MIN	0.0	0.0	0.0	0.0	0.2	0.1	0.2	0.1
PET	1.1	0.6	1.1	0.6	0.4	0.1	0.4	0.1
ELE	0.3	0.2	0.3	0.2	0.2	0.1	0.2	0.1
WAT	0.5	0.4	0.5	0.4	0.3	0.1	0.3	0.1
COM	2.1	1.2	2.1	1.2	0.9	0.2	0.9	0.2
CNS	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0
TRN	1.4	0.9	1.4	0.9	0.7	0.2	0.7	0.2
TEL	199.9	116.0	199.9	116.0	62.7	16.7	62.7	16.7
HOT	-0.5	-0.3	-0.5	-0.3	0.0	0.0	0.0	0.0
RES	-2.4	-1.4	-2.4	-1.4	-0.4	-0.1	-0.4	-0.1
FIN	0.6	0.4	0.6	0.4	0.5	0.2	0.5	0.2
INS	2.1	1.3	2.1	1.3	0.9	0.3	0.9	0.3
BUS	11.3	6.8	11.3	6.8	4.0	1.1	4.0	1.1
REN	-3.0	-1.4	-3.0	-1.4	1.1	0.5	1.1	0.5
REP	1.9	1.2	1.9	1.2	0.8	0.2	0.8	0.2
EDH	-1.2	-0.6	-1.2	-0.6	0.0	0.0	0.0	0.0
PUB	-0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0

% change from BMK