Service Oligopolies and Economy-wide Performance in Taiwan: A CGE Analysis

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Abstract

This paper mainly examines the economy-wide implications for the regulation and privatization of service sectors, taking explicit account of imperfect competition. A computable general equilibrium model of the Taiwanese economy is constructed that represents monopoly and oligopoly behaviors and the regulatory environments facing major firms. Simulations on the potential implications of oligopoly behavior and price-cap regulations are conducted to examine the implications of oligopoly rent for real wage rates, output and the extent of sectoral interactions. While simulations on the economic reforms in the tradable sectors are conducted to identify whether the gains from the trade liberalizations in the tradable sectors can be increased or decreased by the presence of the price-cap regulations in the profitable privatized services industries.

Hypothetical cartelization is shown, not surprisingly, to cause a substantial reduction in real GDP and in real wage rates. The potential implications of oligopoly behavior are first examined by estimating the economic costs of the hypothetical full exploitation of oligopoly power. Relative to a 2001 benchmark, the potential gains are then assessed from tighter price-cap regulations. By contrast, price-cap regulations lower prices, expanding demand and benefiting the unregulated sectors via the lower cost of regulated intermediate inputs. Lower home costs also cause the real exchange rate to depreciate. This then fosters expanded exports which further bolsters demand for home goods. The results show that collective oligopoly behavior is not linear in proportional changes, suggesting the merit of economy-wide analysis. Finally, trade liberalizations do not always reduce the mark-ups of the services industries, resulting in the pro-competitive effects whether the economy is initially subject to the price-cap regulations or not.

1.   Introduction

Taiwan became a member of the World Trade Organization on 1 January, 2002. Since then, it has continually pursued trade liberalizations and structural reforms, especially in the services sector where shares in GDP and employment have risen and labor productivity is substantially higher than in the rest of the economy. Taiwan's services sector as a whole commands most of the economy, approximately 73% of GDP and 58% of employment, and its real growth rate calculated at 2001 prices reached 2% in 2008 compared with the whole economy's rate of 3.2%.[1] Services sector continues to expand rapidly and ten state-owned enterprises (SOEs) are scheduled to be privatized and deregulated in the years to come. These include SOEs from the electricity, petroleum, transport, finance, other services and manufacturing sectors. By the end of 2007, the share of SOEs in GDP was 3.14% and the share of the sectors from which SOEs came accounted for 10.3% of the GDP.[2] The non-government part of the services sector in Taiwan tends to be oligopolistic and is routinely subject to regulation. Analysis of regulatory reform in other countries shows significant implications for the economy as a whole, including effects on capital and labor market, and other unregulated sectors through the cost of services supplied as intermediate inputs.

To examine this in the case of Taiwan requires a model that incorporates clearly the monopolistic and oligopolistic behavior which would be exhibited by service firms unfettered by regulation. Such a model will be helpful to explain the implications of privatization and regulatory reforms for major important variables like the level of output, investment, employment, wage rates and overall economic growth. Given the fact that changes in regulatory policies have significant implications for all the regulated sectors and that those sectors are now large contributors to the economy as a whole, there is a need for an economy-wide analysis of regulatory reform which explicitly represents monopoly and oligopoly behavior.

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[1] These numbers only cover the first three quarters of 2008.

[2] By the end of 2004, the share of SOEs in GDP was 4.7% or NT$482.6 billion (6.4% at the end of 2001); employees in SOEs accounted for about 1.7% of all employees in Chinese Taipei in 2004. In 2004, SOEs generated 8.4% of imports and 1.7% of exports (7.4% of imports and 1.1% of exports in 2002).

In recent decades, studies of regulatory policies have tended to focus on the partial equilibrium analysis of individual industries. When such policies span half the economy, however, partial equilibrium analysis is incomplete due to its discounting of economy-wide effects. This paper examines the economy-wide implications of privatization and regulatory regimes over imperfectly competitive services for the level of output, investment, employment, wage rates and overall economic growth. A mathematical model of the Taiwanese economy representing monopoly and oligopoly behaviors and the regulatory environments facing major firms is constructed. In addition, a broader database is created to support the model covering Taiwan's whole economy. All firms are oligopolistic, interacting through prices. Simulations on sectoral interactions with oligopoly and tighter price cap regulation in the short run are conducted in order to examine the implications of oligopoly rent for real wage rates, output and the extent of sectoral interactions. On the other hand, simulations on the economic reforms in the tradable sectors are conducted to identify whether the gains from the trade liberalizations in the tradable sectors can be increased or decreased by the presence of the price-cap regulations in the profitable privatized services industries.

As parts of its commitments to economic liberalization and internationalization, Taiwan started to privatize state-owned enterprises by amending relevant laws and regulations in the early 1990's.[3] To date, 34 formerly SOEs (about 70% of SOEs planned to be privatized) have been privatized, 17 are closed, and three state-owned banks have been turned into three financial holding corporations. Two SOEs are decided not to be privatized at this stage. Ten remaining SOEs are scheduled to be privatized in the future except the Taiwan Water Corporation.

Price regulations are imposed in some industries, like petroleum and energy, electricity, water and telecommunications. These markets are either monopolies or oligopolies. The government regulates these industries to stabilize the current prices. For example, the government reviews oil and gas prices charged by a major state-owned supplier every Friday, thereby influencing the market price. The price of

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[3] The privatization of government-owned enterprises will be executed by way of sales of shares, sales of assets through bidding, formation of a private-owned enterprise by joint venture with private individuals by way of contribution in kind, merger of companies with the surviving enterprise being a private-owned enterprise, and capital increase by cash.

electricity is regulated fully based on the weekly recommendations by the oil and power consulting commission under the Bureau of Energy. Regarding the telecommunication sector, services provided by type I enterprises (facilities-based operators) are subject to price cap regulation by National Communications Commission (NCC) and tariff determined by type II enterprises (non- facilities-based operators) must be notified to NCC.

The remainder of this paper is organized as follows. In section 2, we present an oligopoly model of the Taiwanese economy, including model structure, closures, database and calibration. Section 3 analyzes the potential implications of oligopoly behavior. This is followed by the short-run effects of price cap regulation in section 4 and the economic reforms in the tradable sectors in section 5. Finally, section 6 summarizes the results and concludes.

2. An Oligopoly Model of the Taiwanese Economy

The analytical framework stems from a prototype model originally constructed to analyze the pro-competitiveness effects of trade liberalization in manufacturing by Tyers (2004, 2005).[4] It was subsequently applied to the Australian economy by Tyers and Rees (2008). The version applied to regulatory policy has a number of adaptations. These adaptations are behavioral equations to examine the effects of regulatory policy, including Ramsey price-cap, and a government sector that spends in line with tax revenue collected from both direct and indirect taxes.[5]

In addition, for this particular study, a new database is constructed that emphasises Taiwan's service industries. Finally, following Tyers and Rees (2008), for stability in the tradable goods sectors a restructuring of the model's treatment on foreign goods is required. In this model, foreign goods are assumed to be homogeneous in each sector but differentiated from corresponding generic home products. Home products are then differentiated by variety as indicated in Figure 1.

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[4] It is a development of the models of Harris (1984) and Gunasekera and Tyers (1990).
[5] Direct taxes include income taxes imposed separately on unskilled labor, skilled labor and capital, while indirect taxes include those on consumption, imports and exports. Income taxes are approximately calculated as the ratio of revenue to the tax base in each case.

2.1 Model structure

Table 1 defines the scope of the model. It aggregates the Taiwanese economy into two regions, five primary factors and twelve sectors, of which six are services sectors.[6] The six sectors as a whole represent the dominance of services in domestic demand and the importance of regulation. Oligopolistic firms in all twelve sectors are interacting through prices with the degree of price-setting collusion between firms represented by conjectural variations parameters (μ_i). These are calibrated values, so they represent the extent to which collusion is possible under the present regulatory regime.

Fixed costs with both capital and human components enable the representation of unrealised economies of scale. Home products in each sector are considered non-homogeneous by variety.[7] Production is a Cobb-Douglas function with capital, skilled and unskilled labor, land, nature resources, and intermediate inputs. Intermediate input demands have a constant elasticity of substitution, sub-aggregating home varieties with imported products. Despite their oligopoly power in product markets, all firms are assumed to be price takers on the demand sides of the markets for primary factors or intermediate inputs. Concerning the representation of foreign firms, a simplified assumption is made here. Imports are homogeneous and different from home products as a group. Therefore, the variety diversity of imported goods always keeps constant.

Following Harris' model (1984) and the Australian tradition of single country modelling (Dixon et al., 1982; Dixon and Rimmer, 2002), the economy herein is "almost small", implying that it is a price taker in the market of imported goods, but a price maker in its export market abroad.[8] The country therefore faces finite-elastic and

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[6] They are electricity, telecommunication, finance, transport, construction and other services.

[7] Product differentiation of the Spence-Dixit-Stiglitz type is adopted herein. It is assumed that each individual derives utility from consuming a number of varieties of a given product.

[8] In 2007, Taiwan was ranked as the world's 24th largest economy by International Monetary Fund (IMF World Economic Outlook Database, October 2008). World Trade Organization statistics show that, in the same year, it was the 16th largest merchandise exporter and 17th largest merchandise importer, with a trade surplus of US$ 27.43 billion. Based on merchandise trade, Taiwan's exports and imports accounted for 1.8% and 1.5% of world total exports and imports respectively. In terms of commercial services trade, its share in world total exports was 0.9% and 1.1% in world total imports (WTO Trade Profiles 2008). Therefore, these small shares imply that Taiwan is considered as a small economy.

downward-sloping excess demand curves in the rest of the world.[9] The import product bundle is the effective numeraire because import prices are constant in the solution and are unshocked as exogenous variables in all simulations. The consumer price index (CPI) is a composite Cobb-Douglas-CES index of home product and after-tariff import prices. Consumption taxes are included to complete the formation of consumer price index. This formulation of the CPI enables an analysis of the welfare impacts. Given that collective utility function is also a Cobb-Douglas combination of the volumes of consumption by product aggregate, proportional changes in overall economic welfare are in line with those in real GNP.[10]

Firms in any sector produce differentiated products and interact through prices. With Cobb-Douglas production functions in variable factors and inputs, average variable costs are fixed if factor and intermediate product prices keep constant. Average total cost then declines with output if factor and intermediate product prices do not change. Recurrent fixed costs are calibrated based on the data such as industry profitability, gross value of output and value added. Firms charge a mark-up over average variable cost to at least cover their average fixed cost in a zero-pure-profit monopolistic competition equilibrium. However, they carefully choose this mark-up to avoid their capacity to set price above the average variable costs from being undercut by existing competitors. This then determines the level of pure profits and the potential for entry by new firms. It is not surprising that pure profits are eroded and the mark-up just covers average total costs under free entry and exit.

Each firm in industry *i* produces a unique variety of its product and faces a finite-elastic and downward-sloping demand curve with elasticity ε_i (< 0). The optimal mark-up is decided by the Lerner formula as follows.

$$m_i = \frac{p_i}{v_i} = \frac{1}{1 + \dfrac{1}{\varepsilon_i}} \qquad \forall i \tag{1}$$

[9] This follows the first significant economy-wide model by Dixon et al. (1982) and the first published economy-wide oligopoly model by Harris (1984).

[10] The explanation is detailed in appendix and is available upon request from the author.

where p_i is the firm's product price, v_i is its average variable cost and ε_i is the elasticity of demand facing firms. Firms strategically decide their optimal price by considering other firms' price-setting behavior. A conjectural variations parameter in industry i is defined as the influence of any individual firm k, on the price of firm j.

$$\mu_i = \frac{\partial p_{ij}}{\partial p_{ik}} \tag{2}$$

These conjectural variations parameters represent the power of price surveillance of the government authorities. The Nash equilibrium is then a non-collusive Bertrand oligopoly equilibrium where each firm chooses its price by taking the competitors' prices as constant. In so doing, changes in prices of any individual firm have no effects on others, and thus the conjectural variations parameter is zero. When firms behave as a perfect cartel in which individual firm's price changes in line with others, it has the value unit.

To examine the effects of price-cap regulation a regulated Ramsey mark-up, m_i^R is formulated as equation (3).

$$m_i^R = \frac{afc_i + v_i}{v_i} \tag{3}$$

where afc_i is the firm's average fixed cost. Firms choose compromise mark-ups by changing the parameter φ_i in the equation below.

$$m_i^C = (\varphi_i - 1)m_i^R + (2 - \varphi_i)m_i \qquad \forall i \tag{4}$$

where m_i^C is the chosen regulated mark-up ratio in industry i, m_i^R is the regulated Ramsey mark-up ratio in industry i, m_i is the mark-up ratio in industry i, and φ_i refers to the regulatory regime index which equals to one when there is no price cap and to two when there are price caps – that is, when $\varphi_i = 1$, $m_i^C = m_i$, and $\varphi_i = 2$, $m_i^C = m_i^R$.

Critical to the implications of imperfect competition in the model is that the product of each industry has been consumed in four different markets. It can be consumed by domestic private households or by government, can support other industries as an intermediate input or can be exported abroad. The elasticity of demand faced by firms in industry i is therefore composed of the demand elasticities of four different sources and the shares of the home product in each market. More precisely, the four sources of demand for home produced products are final demand (F), intermediate demand (I), export demand (X) and government demand (G). For sector i, the elasticity of demand is the weighted sum of those of all four sources and can be expressed as follows.

$$\varepsilon_i = s_i^F \varepsilon_i^F + s_i^I \varepsilon_i^I + s_i^X \varepsilon_i^X + s_i^G \varepsilon_i^G \qquad \forall i \qquad\qquad (5)$$

where s_i^j denotes the volume share of the home product in market i for each source of demand j. All these share parameters in the model are endogenous variables. Harris and Cox (1983) address that export demand is more elastic because of the larger number of substitutes available abroad while intermediate demand is relatively inelastic due to firms' reluctance to change arrangements for intermediate input supply. Given the fact that different sources of demand are differently elastic, any shock that reapportions demand between them necessarily changes the firms' competitive behaviors.

Conjectural variation parameters have effects on both the firms' strategic behaviours and the economic cost of service oligopolies because the parameters represent not only firms' capacity to collude but also the power of regulatory price surveillance of the government authorities. Moreover, they are mostly affected by the composition of demand because the parameters change the elasticities of demand facing each firm. Obviously, firms' capacity to reduce the prices is also dependent on their variable productivity, firm numbers and hence the fixed cost burden.[11]

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[11] Productivity in variable factors is also shown to be related positively to privatisation and regulatory improvements but this particular issue is not addressed in this paper.

2.2   Closure

A number of "length of run" closures are possible: long run, medium run and short run. In the long run, physical capital is homogeneous and fully mobile intersectorally and internationally at an exogenous rate of return, while the domestic endowments of other factors are immobile. The real wage of unskilled labor is flexible and production employment is fixed. In the medium run, physical capital is immobile internationally and fixed in each industry so that rates of return on capital vary from sector to sector. The real wage of unskilled labor is flexible and production employment is fixed. A short-run closure differs from the medium-run closure in that the real wage of unskilled labor is rigid and production employment is flexible. The quantity of domestically-owned capital is fixed in the short run, medium run and long run (Harris, 1984). Changes in the total capital stock necessarily have effects on the shares of foreign ownership and in turn the level of income repatriated abroad. The economic profits or losses earned by firms can be treated as endogenous variables if the numbers of domestic firms are fixed. Alternatively, they can be constant when the number of domestic firms is flexible or free entry and exit are allowed.

2.3   Database and Calibration

The model database was constructed from the GTAP Version 6 global database for year 2001 (Dimaranan and McDougall 2006)[12]. It includes detailed bilateral trade, transport and protection data, together with individual country national accounts, government accounts, balance of payments data and input-output tables which represent the intersectoral flows within regions.

Table 2 shows that the privatized services sectors[13] constitute about a fifth of the economy's GDP, but their shares of total exports are relatively small compared with light manufacturing, "steel and other metals", and other manufacturing. In addition, Table 3 indicates that privatized services sectors are more intensive in skilled labor and physical capital than are the tradable sectors.[14] Consequently, their comparative

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[12] GTAP 6 Data Package Documentation is available at the following link:
http://www.gtap.agecon.purdue.edu/databases/v6/v6_doco.asp.
[13] They are electricity, telecommunications, finance, transport and construction.
[14] Transport is an exception, which is an unskilled-labor intensive industry.

performance necessarily shows significant implications for the skilled wage premium and total capital use.

However, the flows represented in the database do not complete all the details of the sectoral structure in the model. More information is needed. For example, data on the effective numbers of firm, pure profits, recurrent fixed costs and minimum efficient scale (MES) for each sector. Some relevant data is available at irregular intervals for some sectors like agriculture and mining, yet there is no complete set of data publicly available which is consistent and comparable across sectors. The available data do not fully meet needs generated by an economy-wide study such as this. It is, therefore, necessary to extrapolate patterns to some sectors and to make crude assumptions about others.

Nonetheless, with the support of two surveys done by different authorities in Taiwan, behavioural variables associated with imperfect competition are calibrated in the following manner. First, pure profits are required as a share of total industry turnover. This is done to finalise the flow database as well as to calibrate industry competitive structure. To this end, data on the industry, commerce and service census published by Directorate-General of Budget, Accounting and Statistics is adopted. The census is widely conducted across Taiwan every ten years and the latest one was carried out in 2001 which is the reference year of the model database.

Second, estimates of the effective number of strategically interacting firms in each industry and their corresponding conjectural variations parameters are then required. Obviously, it does not make sense simply to record the number of establishments in each industry. These numbers are usually too large to represent the numbers of firms which are big enough to have power to influence the price in product market. The number of establishments would be a good substitute for the effective number of firms only if industries were subdivided equally. Yet considerable diversity of firm size and product is observed in each sector.

Again, we use the corporation data from the survey of top 1,000 enterprises published by Common Wealth Magazine for the measures of industry concentration. Here, two commonly-used measures are calculated. They are the Concentration Ratio (CR) and

the Herfindahl-Hirschman Index (HHI). From this a critical judgement is made as to the strategically interacting firm numbers and then their corresponding conjectural variations parameters are decided as indicated in Table 4. Additional details on the calibration of oligopoly parameters are presented in Appendix which is available upon request from the author.

Third and finally, elasticities of substitution between home product varieties and between generic home and the corresponding foreign products are needed. These are drawn initially from the estimation literature and some necessary adjustments are done to make them more reasonable in the context of Taiwanese economy.[15] From them are calculated demand elasticities facing each firm, as also shown in Table 4. Initial shares of the demand faced by industry are then extracted from the GTAP database to calculate the weighted average demand elasticity for each sector. Optimal mark-up ratios are then deduced for each sector through equation (1). The initial equilibrium industry shares, average elasticities of demand and mark-up ratios for each industry are provided in Table 5. The reason why the initial average demand elasticities appear larger in magnitude is that they do not represent the slopes of industry demand curves for generic goods. More precisely, they are the elasticities facing suppliers of individual varieties and are larger because of inter-varietal substitution.

This completes the demand side calibration. On the supply side, the mark-up ratios are used to deduce the initial level of average variable cost in each sector. Next, attention is turned to pure profits. The shares of average variable cost and pure profit in total turnover are then deducted to determine the fixed cost shares of total turnover.[16] Total recurrent fixed cost in each sector then follows. The resulting fixed and variable cost shares are then examined next to industry-specific data. Significant departures merit a reconsideration of elasticity and a second iteration in the calibration.

It is now possible to calculate the scale of production. If industries could expand indefinitely without changing unit factor rewards, average fixed cost would approach average variable cost asymptotically from above. Following Harris' approach (1984),

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[15] Summaries of this literature are offered by Dimaranan and McDougall (2006).

[16] Fixed costs include both physical and human capital costs and Harris and Cox's (1983) estimation that physical capital has a fixed cost share of 5/6 is adopted in our model.

we choose an arbitrary minimum efficient scale product volume at the point where average cost is within 5% of average variable cost. That is to say, average fixed cost is equivalent to 5 per cent of average variable cost at MES output. The results of this calibration are summarised in Table 6. It shows that fixed costs are most prominent in electricity (43%), followed by transport (25%), and petroleum and energy (24%) in which there are comparatively large fixed physical infrastructure and network maintenance costs. The results also indicate that the sector closest to its minimum efficient scale is light manufacturing (63%), followed by other manufacturing (57%), other services (45%), and agriculture (42%).

3.   Potential Implications of Oligopoly Behavior

This section explores the interdependence of the privatized service sectors and examines the potential impacts of oligopoly firms' non-competitive behavior on the economy as a whole. This can be gauged from the effects of hypothetical cartelization. It is done by raising all conjectural variations parameters from baseline values to unity. The next experiment examines the effects when only privatized service sectors are allowed to cartelize. These sectors include electricity, telecommunications, finance, transportation and construction. "Other services" is excluded from the scenario because it is a government-intensive sector.

A long-run closure is constructed for these experiments in which physical capital is homogeneous and fully mobile both internationally and intersectorally at an exogenous rate of return, while the endowments of other domestic factors are fixed. Following Harris (1984), the quantity of domestically-owned capital is fixed so that capital expansions are foreign owned. Production employment is exogenous while the real wage of production labor is flexible.

3.1   Effects of Cartelization in All Sectors

Table 10 shows the long-run effects of hypothetical cartelization on the whole economy and individual sectors. The economy as a whole becomes considerably smaller in the case that oligopoly firms collude and form cartels in all sectors. Real GDP and GNP decrease about 27% and 11% respectively as a result of hypothetical

cartelization in the whole economy.[17] The reduction in outputs together with the reduced demand for factors leads to substantial declines in real factor rewards. It is not surprising that the decrease in non-capital real unit factor rewards is more than 40%.[18] Because the capital stock falls, however, total payments to capital also fall, by about a quarter. Outputs in all sectors decrease and this gives rise to higher home product prices, with the exception of the agricultural and finance sectors. The real exchange rate then appreciates about 11%, indicating that home products are less competitive and hence exports fall. The agricultural and finance sectors are the exceptions in that cartelization reduces home production with less impact on product prices due to more elastic substitution with foreign competition. The enormity of economy-wide effects of hypothetical cartelization in all sectors confirms the importance of oligopoly behavior and of the forces of natural competition and regulation that restrain it.

3.2   Effects of Cartelization in the Privatized Services Sectors

Cartelization only in the privatized services sectors causes real GDP and GNP to be smaller by 13% and 8% respectively. Real skilled and unskilled wages would be lower by 17% and 19%, and the average gross rate of return on capital would be higher by more than a tenth. The magnitudes of the effects are much smaller than those of the previous experiment in which oligopoly firms collude and form cartels in all sectors.

In combination with the reduction of real income, this has crowding-out effects on households' consumption of other goods and services. Therefore, all the outputs of the tradable and other services sectors decrease, with the largest contraction in the "steel and other metals" industry followed by mining. On the whole, the 6.4% real appreciation induces consumers and firms to substitute imports for domestically produced goods. Yet the reduction of households' real incomes tends to contract demand for imports of tradable goods. Hence, the effect of hypothetical cartelization in the privatized services industries on sectoral imports is ambiguous.   Exports

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[17] Real GDP and GNP differences occur because the capital stock falls and net factor income outflows decline.

[18] The real unit factor reward of land decreases about 36%.

contract unambiguously, however, due to the contractions in outputs of the tradable sectors.[19]

3.3   Effects of Cartelization in the Individual Sector

The central part of Table 10 shows the effects of hypothetical cartelization by each individual sector on the economy as a whole. Generally, sectors which have large initial shares of GDP have large impacts on the economy under cartelization. For example, light manufacturing, other manufacturing, finance, and other services are sectors whose cartelization decreases real GDP substantially. Some other sectors, like "steel and other metals" and electricity, also have a great effect on the economy in spite of their relatively small initial shares of GDP because of their significant roles as intermediate inputs across the economy.

Cartelization certainly increases the monopoly/oligopoly rental rate for capital owners. Yet the reduction of outputs results in less demand for physical capital and inputs. Total payments to capital, excluding pure profits, therefore fall in all cases except the one in which cartelization occurs only in the construction sector. This is because construction is the most intensive in unskilled labor among all sectors and the share of construction in domestic intermediate demand by other industries is small. Cheaper unskilled labor therefore helps to bolster construction.

When pure profits are included the average gross rate of return on capital increases in most experiments, with the exception of the "steel and other metals" and "petroleum and energy" sectors. It increases by half in the hypothetical cartelization in all sectors and by a third when the hypothetical cartelization only occurs in the "other services" sector.

The bottom two rows of Table 10 allow an assessment of the model's linearity in proportional changes following the cartelization shocks. We find that the effects of hypothetical cartelization in the whole economy do not necessarily equal to the sum of the effects of cartelization in each sector. It is more evident when the cartelization

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[19] The contraction of the capital stock substantially reduces net factor income payments abroad, reducing the current account deficit. Capital account flows are held constant, however, so that exports contract relative to imports.

is allowed in all sectors while it is not strong when only the privatized services sectors are included in the cartelizing sectors. The results suggest the merit of economy-wide analysis.

3.4   Effects of Cartelization on Sectoral Gross Rate of Return

Table 11 shows the effects of cartelization by the column sectors on gross rates of return in the row sectors. The first row reproduces the second last column of Table 10. The first column indicates the effects of hypothetical cartelization in the whole economy on gross rates of return in each sector. Clearly, gross rates of return increase in most of the twelve sectors following cartelization, but the "steel and other metals" and "petroleum and energy" sectors are the exceptions. Their decreases in gross rates of return are 60% and 28% respectively, due to their roles as intermediate inputs to other industries whose outputs decrease substantially as a result of hypothetical cartelization in the whole economy. Construction yields the largest increase in gross rates of return, followed by the agricultural sector. This is because of their relatively modest roles as intermediate inputs and the relatively small contractions in their outputs. Both more than double their base rates of return.

The second column in Table 11 shows the effects on all sectors if cartelization were to occur only in the privatized services sectors. The gross rates of return in all tradable sectors decrease except that in agriculture. Again, construction causes the largest increase in its rates of return more than tripling the base value, for the reasons indicated above.[20] The effect of the services sectors cartels on light manufacturing is insignificant because the share of the privatized services sectors as a whole in the domestic intermediate demand of light manufacturing is only 14%. In addition, light manufacturing is labor-intensive sector and hence less demand from physical capital due to the reduction of outputs as a result of the cartelization in the privatized services sectors have less impact on the gross rate of return in light manufacturing.

The non-diagonal elements of other columns in Table 11 represent the extent of sectoral interaction under cartelization by the column sectors. This is largest when the

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[20] The reductions of sectoral outputs are lower under the cartelization only in the privatized services sectors than that under the cartelization in all sectors.

cartelization occurs only in the large "other services" sector, but it is also significant for some sectors like light manufacturing, "steel and other metals", "other manufacturing" and electricity.

4. Short-Run Effects of Price Cap Regulation

As part of its commitments to economic liberalization and internationalization, Taiwan has continued to pursue structural reforms especially in some oligopolistic industries like petroleum and energy, electricity, telecommunications and water supply. The government also regulates these industries to stabilize the market prices. The base equilibrium with pure profits generated in all sectors is shown in Table 6. Even though collusion is a long way short of cartelization, high oligopoly rents exist in the mining, telecommunications and finance sectors. Given the existing oligopoly rents, how much economic gain is available from tighter price caps in the profitable sectors in particular?

This section examines the short-run effects of price cap regulation whereby product prices are set to equal average costs (P = AC). We start the analysis by imposing tighter price caps on the profitable sectors via equation (4) simultaneously. The parameter φ_i in the equation is shocked by 100% so that firms are forced to choose the Ramsey regulated mark-ups. The profitable sectors include agriculture, mining, other manufacturing, petroleum and energy, telecommunications, finance, and other services. The experiment is followed by price caps on the profitable privatized services sectors only, which are telecommunications and finance. Finally, price caps are imposed on the profitable sectors individually.

A short-run closure is adopted in which physical capital is immobile internationally and fixed in each industry so that rates of return on capital vary from sector to sector. The real wage of unskilled labor is rigid and production employment is flexible. The quantity of domestically-owned capital is fixed in the short run.

4.1 Price Caps on the Profitable Sectors

If average cost pricing is imposed on the profitable sectors, the economy as a whole becomes substantially larger with an increase of 3.4% in real GNP and real GDP respectively. Clearly, real unit factor rewards increase significantly. However, the average gross rate of return on capital falls by 0.3%, a relatively small number due to the loss of oligopoly rents.

Price-cap regulation in the profitable sectors causes home product prices to fall not only in the regulated industries but also in most of the unregulated ones. Lower prices result in more final demands from households and government. Intermediate demand also increases because it is cheaper than before to use the products of other industries as intermediate inputs. The unregulated industries, therefore, benefit through the lower cost of regulated intermediate inputs. Moreover, exports from tradable sectors expand obviously owing to the lower home product prices as well as the depreciated real exchange rate. Output is driven by demand, which is driven by prices in turn. More final demand increases outputs in all sectors boosting the domestic economy.

Recall that sectoral capital use is fixed and production employment is flexible in the short run. Labor moves towards the regulated industries from other sectors to meet the high demands for factors of production due to the increased outputs. It is evident that this increases the employment of unskilled labor and non-capital real unit factor rewards. While the real production wage is fixed in the short run, real unit factor rewards to skilled labor and employment of unskilled labor increase 6.5% and 4.7% respectively. Lower home costs cause the real exchange rate to depreciate by 0.3%. This then fosters expanded exports which further bolsters demand for home goods.

4.2 Price Caps on the Profitable Privatized Services Sectors

It is worthy of our attention to look at the effects of price-cap regulation only in the profitable privatized service sectors, which are telecommunications and finance. We find that real GDP increases 1.1% because of their high initial profitability, even though the two profitable services sectors are not major contributors to GDP. Gross sectoral rate of return falls in the regulated industries but rises in the unregulated

industries as indicated in Table 13. Both non-capital real unit factor rewards and the employment of production labor increase. Outputs in all industries expand because there are more demands for domestic products, induced by the decreased prices. Exports increase in most of the industries owing to the increased outputs and the depreciated real exchange rate. However, export demands in some industries like petroleum and energy, electricity, and other services fall because the increased home product prices outweigh the corresponding increased outputs.

4.3   Price Caps on the Profitable Sectors Individually

Finally, when price-cap regulations are imposed on the profitable sectors individually, observation of the figures in the central parts of Table 12 and 13 enables us to see that the petroleum and energy sector has the most impact on overall economic performance. This is followed by the finance and other services industries.

Take the petroleum and energy sector for example. Price-cap regulation in the petroleum and energy sector reduces the home product prices, especially in the tradeable sectors. Domestic price of petroleum and energy, electricity, and other manufacturing decrease by 9%, 0.4% and 0.3% respectively. This obviously benefits other industries via the lower cost of intermediate inputs as they are intensively used in other sectors. Consequently, outputs in all sectors expand as a result of the increased demand driven by the reduced domestic product prices. Moreover, the real skilled wage and real resource rents increase. Clearly, the service sectors now face higher skilled wage costs and raise their domestic prices accordingly. However, the transport sector is the exception and its domestic price falls by 1%, for the reasons indicated above. [21] The elasticity of total demand facing home firms in the service sectors falls and causes their mark-ups to rise, driving up the service prices further. The real exchange rate, therefore, appreciates by 0.1%.

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[21] Shares of other manufacturing, petroleum and energy, and electricity in domestic intermediate demand of transport are 9.7%, 34.7% and 2.4% respectively. Obviously, transport benefits from the reduced domestic prices of these three sectors.

5. Economic Reforms in the Tradable Sectors

This section examines the trade liberalizations in the traditional tradable sectors including agriculture, light manufacturing and other manufacturing under the imperfectly competitive services industries with and without the price-cap regulations in the services industries both in the short and long run. The main purpose is to identify whether the gains from the trade liberalizations in the tradable sectors can be increased or decreased by the presence of the price-cap regulations in the profitable privatised services industries. It demonstrates the interaction between trade liberalizations and price-cap regulations in the services industries. This issue is of particular importance in Taiwan where imperfect competition and unexploited scale economies are quite prevalent as it has been subjected to a wave of trade reforms especially since its accession to WTO in 2002.

5.1 Hypothesis

In recent decades there has been large literature on the effects of trade liberalizations on the monopoly power of the domestic firms and on the rationalization of industry.[22] Pro-competitive effects occur if trade liberalization leads to a reduction in the firms' optimal mark-ups of price over marginal cost in the imperfectly competitive industries; that is, trade liberalization causes the pro-competitive effects if firms' optimal mark-ups fall. However, few attempts have been made to explain the interaction between trade liberalizations and price-cap regulations in the services industries.

As such, we carefully examine the pro-competitive effects of trade reforms on the services industries by initiating the hypothesis whether the gains from trade liberalizations in the tradable sectors can be increased or decreased by the presence of the price-cap regulations in the profitable privatized services industries. As the foreign competition increases as a result of trade liberalizations, the market power of the domestic firms is weakened. Then the total elasticity of demand facing services firms increases in which cases mark-ups fall, resulting in the pro-competitive effects. On the

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[22] See Chou et al. (1997), Devarajan and Rodrik (1989, 1991), Golley (1997), Harris (1984), Hertel (1991, 1994), Ianchonichina et al. (2000), Tyers (2004, 2005).

other hand, anti-competitive effects are observed if the mark-ups rise following the trade reforms.

In order to examine the effects of the trade liberalizations with and without the initial price-cap regulations in the services industries, three different trade liberalizations in the initial reference equilibrium are simulated both in the short and long run where the number of firms is exogenous.

Regarding the trade liberalization regimes, agricultural and manufacturing sectors are of most interest among all the tradable sectors. Agriculture is the most protected and sensitive sector in Taiwan. It is substantially subsidized by the government and various price support programmes have been implemented in recent years.[23] As criticized by most trade partners, agricultural tariffs remain higher than the average tariff rate. The continuing opening up the domestic market and liberalizing the agricultural sector have always been at the lists of the reform agenda. Therefore, the first trade liberalization regime refers to a 100% tariff cuts in the agricultural sector.

Manufacturing sector including light manufacturing and other manufacturing is the most competitive industry and constitutes most of Taiwan's exports. It is the main driving force behind Taiwan's economic growth in the past decades. A further tariff reduction is required as part of its commitments to WTO even though the bounded tariff of the industrial products are low and competitive. This leads to the second trade liberalization regime which is a 100% tariff reduction in the manufacturing sector. Finally, a combination of the trade reforms, a 100% tariff reduction both in the agricultural and manufacturing sector, is of interest because normally the trade liberalization is implemented in more than one sector.

Table 14 shows the domestic tariff rates of the tradable sectors in the initial equilibrium and the trade liberalization regimes are indicated in Table 15.

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[23] For example, price stabilization measures for certain agricultural products which are purchased mainly by state-owned enterprises at "guaranteed prices"; short-term price stabilization measures will be triggered once the price falls below a certain threshold; farmers will be subsidized if they reduce the production of rice and switch to other crops due to the excess supply; policy-oriented loan and income support programmes are also used to help farmers to obtain low-interest credits, and to finance the farmers and fishermen aged 65 years or older.

The experiments to examine the consequences of the trade liberalization and its sensitivity to the price-cap regulations are conducted in two steps. First, the original model is used to calculate a new regulated equilibrium where the profitable privatized services sectors are required to choose the Ramsey regulated mark-ups which just cover the fixed costs, assumed that the number of firms is exogenous. Second, from this new reference equilibrium, three different trade liberalizations are then implemented. This is done both in the short and long run.

5.2 Trade Liberalization without Price-cap Regulations

The short-run gains from the trade liberalizations in the absence of the price-cap regulations are positive in terms of real GNP. The percentage change in real GNP is about 0.01% for the trade liberalization in the agricultural sector, 0.4% in the manufacturing sector, and about 0.42% in both sectors. The gains are even more evident in the long run as shown in Table 28.

Trade liberalization, obviously, eliminates the distortionary tariffs of the protected industries and hence reduces the home prices of the imported goods. The imported goods is cheaper than before and substitutes for the domestically produced products. The cheaper goods is obtained from abroad at no expense of the domestic factors of production. In other words, the increased demands are satisfied by the cheaper imported goods and do not have a crowding-out effect on the primary factors of production available to other industries, avoiding the resource movement effects.

On the contrary, the cheaper imported goods have a positive effect on the production of the domestic non-liberalized industries. This can be seen in the case for the trade liberalization in the agricultural sector both in the short and long run. As indicated in Table 21, the outputs in agriculture decrease by 1.9% because of a substitution away from the relatively expensive home products. The outputs in the domestic non-liberalized sectors also increase except the construction and other services sectors. The increase is marginal as agriculture is less important as an intermediate input to other sectors, but it does support the argument that the cheaper imported goods stimulates the production of the domestic non-liberalized industries. This is the benefit of the trade liberalization which reallocates the primary factors of production

away from the previously protected sectors to the non-liberalized ones like the services industries in particular.

However, outputs in most of the sectors increase whether they are liberalized or not when trade liberalizations are implemented in the manufacturing sectors and for the combined liberalization. [24] This violates the standard trade liberalization story in which the outputs of the protected sectors decrease while those of the non-liberalized sectors increase. It occurs for different economic reasons. Take the trade liberalization in the manufacturing sector for example. The imported manufacturing products substitute for the domestically produced goods because they are cheaper as a result of the tariff reductions. This reduces the domestic production of the manufacturing sectors. The contraction in the outputs of the manufacturing sectors makes the primary factors of production available to the non-liberalized industries. As indicated in Table 8 and Table 9, manufacturing is relatively significant as an intermediate input to other sectors as well as manufacturing itself. In order to produce more non-liberalized goods, at the same time, more manufacturing goods are needed. Therefore, the outputs of the manufacturing and non-liberalized sectors finally both expand.[25]

Lower home costs cause the real exchange rate to depreciate. Table 16 shows that without the initial price-cap regulations, the real depreciation in the short run is larger. Real depreciation and the available primary factors of production released from the protected sectors then foster expanded exports which further bolster demand for home goods. Export demands of the services industries except electricity increase in all cases of the trade liberalizations in the short run. This can also be seen when trade liberalizations occur in the manufacturing sector and the combined liberalization in the long run. The short-run percentage changes in the export demand shares of the services sectors, defined as the proportion of exports to outputs, increase especially in the construction followed by the telecommunication and finance in the absence of the initial price-cap regulations in the profitable privatized services industries. The

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[24] The short-run outputs in other services and the long-run outputs in construction and other services sectors fall in the cases for trade liberalizations in the manufacturing sectors and for the combined liberalization.

[25] The second effect overweights the first one and hence the outputs of the manufacturing sectors finally increase.

increase in the export demand shares inevitably causes a decrease in the final and intermediate demand shares and has a great effect on the total elasticity of demands further, as shown in Table 20.

That trade liberalization in the traditional tradable sectors has pro-competitive effects on the services industries is confirmed by the fall in the mark-ups charged by the services industries. The total elasticity of demand is modelled as a weighted sum of final, government, intermediate and export demands. Among all the components, export demand is more elastic because of the larger number of substitutes available abroad while intermediate demand is relatively inelastic due to firms' reluctance to change arrangements for intermediate input supply. Any redistribution of the demand shares among these components caused by the trade liberalizations definitely changes the total elasticity of demand.

Real depreciation from the trade liberalizations leads to an expansion in the export demands of the services industries which is relatively elastic. The export demand shares also increase significantly, indicating a greater proportion of the domestic production is exported abroad. In terms of the formula of total elasticity of demand, an increase in the export demand share implies a greater weight is given to the relatively elastic export demand. This increases the total elasticity of demand facing services firms, reduces the mark-ups and hence leads to the pro-competitive effects. Table 19 and 20 provide the percentage changes in the mark-ups and in the total elasticity of demand, respectively, without the price-cap regulations in the profitable privatized services industries.

However, anti-competitive effect occurs in some of the services sectors like electricity, finance and transport in the short run, as shown in Table 19. Moreover, all the trade liberalizations do not have the pro-competitive effects on the services industries in the long run. Recall the expansion of the relatively elastic export demands caused by the real depreciation is helpful to reducing the mark-ups. The real depreciation is smaller in the long run and hence the stimulus given to the relatively elastic export demand is less. On the other hand, the percentage changes in the intermediate demand shares change more than in the export demand shares in the long run. These could explain why the total elasticity of demands decreases in all the services industries in the long

run and some in the short run, resulting in the anti-competitive effects. Therefore, trade liberalizations in the traditional tradeable sectors in the absence of the price-cap regulations in the profitable privatized services industries do not necessarily have the pro-competitive effects on the services industries both in the short and long run.

The expansion in outputs caused by the lower costs of the imported intermediate inputs not only meets the export demands but also improves the production efficiency, enabling firms to operate further down their average cost curves. Table 26 and Table 28 show the economy-wide effects of trade liberalizations in the short run and long run, respectively, without the price-cap regulations in the profitable privatized services industries. The increase of the sectoral outputs in the long run is more prominent because physical capital is homogeneous and fully mobile intersectorally and internationally at an exogenous rate of return. The comparison of the percentage changes of the sectoral outputs in the services industries is shown in the grey area of Table 21. It is clear that the increase in the services production is largest under the combined liberalization, followed by the trade liberalization in the manufacturing sectors and that in the agricultural sector. This is because the distortions of the tariffs are removed and more factors of production are released from the protected sectors to others like the services industries. Therefore, the more liberalization the more are outputs.

5.3   Trade Liberalization with Price-cap Regulations

When the economy is initially subject to the price-cap regulations in the profitable privatized services sectors which are finance and telecommunications in the short run, net welfare gains in terms of real GNP are reduced. The decreased net welfare gains in the short run persist in terms of real GDP. However, the price-cap regulations in the profitable privatized services sectors prior to the trade liberalizations improve the net welfare gains only in terms of real GNP in the long run, albeit a small margin. Table 22 shows the comparison of the net welfare gains in terms of real GNP and GDP.

The gains from the trade liberalizations include the reductions of the mark-ups and the increases in the outputs of the services industries. Table 23 shows the comparison of the percentage changes in the sectoral outputs of the services industries. It is obvious

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that the sectoral outputs of the services industries are smaller when the economy is initially subject to the price-cap regulations in the profitable privatized services sectors. This is because that the sectoral outputs have already been expanded and moved closer to the competitive level where price equals marginal cost through the implementation of the price-cap regulations prior to the trade liberalizations. Therefore, the gains from trade liberalizations following the price-cap regulations are less strong, implying that the gains are decreasing when the economy is initially subject to the price-cap regulations.

Contrary to the findings in the short run, the long-run gains from the trade liberalizations in terms of real GNP improve when the economy is initially subjected to the price-cap regulations in the profitable privatized services industries. The comparison of the net welfare gains is provided in Table 22. The short-run outputs of the protected industries, which includes agriculture and manufacturing sectors, increase significantly especially in the light manufacturing sector. The increased production can also be observed in most of the services industries, except construction. Compared to Table 27, it is evident that the increases in the sectoral outputs of the protected industries and in most of the services industries are larger in the long run, implying that there is a greater gains from the trade liberalizations following the price-cap regulations.

With the initial price-cap regulations in the finance and telecommunications industries, the mark-ups fall in the protected sectors and lead to the pro-competitive effects in some of the services sectors like telecommunications and construction in the short run. As indicated in Table 24, the anti-competitive effects can be observed in most of the services industries in the short run. It is more evident in the long run. Therefore, trade liberalizations do not always reduce the mark-ups of the services industries, resulting in the pro-competitive effects when the economy is initially subject to the price-cap regulations in the profitable privatized services industries.

The percentage changes in the real depreciation as a result of the lower home costs are significantly smaller in the long run following the price-cap regulations as shown in Table 16. The long-run exports demands are less strong due to less real depreciation. On the other hand, the price-cap regulations prior to the trade liberalizations force

firms to choose the Ramsey regulated mark-ups which just cover the fixed costs. Lower prices induce more final demands as well as intermediate demands, and benefit the unregulated sectors via the lower cost of regulated intermediate inputs. Imports of the agriculture and manufacturing in final and intermediate consumption also increase because of the reductions of the distortionary tariffs caused by the trade liberalizations. Therefore, with more increase in the relatively inelastic final and intermediate demands and less increase in the elastic export demands, the total elasticity of demands falls and hence the mark-ups rise. This explains why anti-competitive effects occur in some of the services industries in the long run.

6.   Conclusions

This paper examines the economy-wide implications for the regulation and privatization of service sectors, taking explicit account of imperfect competition. A computable general equilibrium model of the Taiwanese economy is constructed that represents monopoly and oligopoly behaviors and the regulatory environments facing major firms.

Experiments exploring the potential impacts of exploiting oligopoly power on the whole economy are first conducted. These also help to indicate the interdependence of the privatized services sectors. With full exploitation of oligopoly power, in the long run, real GDP would be smaller by a quarter. This would be just 13% if the cartelization had only occurred in the privatized service sectors. In the latter case, real skilled and unskilled wages would be lower by almost a fifth and the average gross rate of return on capital higher by more than a tenth. The contractions in the regulated sectoral outputs and the resulting increased home product prices have a substantial effect on the traditional tradable sectors as well. The decreased outputs in the tradable sectors obviously reduce the economy's exports and the increased home product prices cause the real exchange rate to appreciate. These results not only show that the potential for economic damage from oligopoly power is considerable; they also show that economy-wide effects can not be accurately measured using separate sectoral analyzes.

Price-cap regulations are conducted to examine, given the existing oligopoly rents, how much economic gains can be obtained from tighter price caps. If average cost pricing is imposed on the profitable sectors, the economy as a whole becomes larger with an increase of 3.4% in real GDP. Real skilled wages and employment of unskilled labor increase by 6.5% and 4.7% respectively. However, the average gross rate of return on capital falls by 0.3% due to the loss of oligopoly rents. Lower prices induce more final demand as well as intermediate demand, and benefit the unregulated sectors via the lower cost of regulated intermediate inputs. Lower home costs cause the real exchange rate to depreciate by 0.3%. This then fosters expanded exports which further bolsters demand for home goods. In contrast with hypothetical cartelization, the economy benefits considerably from tighter price caps in the profitable sectors. Whether the whole of such gains can be realized in practice, however, is doubtful, due to the asymmetric information on average costs and regulatory capture. Yet the remaining scheduled privatizations are likely to contribute positively. The results show that collective oligopoly behavior is not linear in proportional changes, suggesting the merit of economy-wide analysis.

Trade liberalization has become a common trend all over the world in recent decades, and countries everywhere are rushing to espouse economic reforms. Taiwan is no exception. It is ambiguous that the gains from the trade liberalizations in the tradable sectors can be increased by the presence of the price-cap regulations in the profitable privatized services industries prior to the trade liberalizations. The price-cap regulations in the profitable privatized services sectors prior to the trade liberalizations improve the net welfare gains only in terms of real GNP in the long run.

Real exchange rate depreciates due to the lower home costs as a result of the trade liberalizations. The percentage changes in the real depreciation are significantly smaller in the long run following the price-cap regulations. Real depreciation stimulates the export demands which further bolster demands for home goods. Obviously, the sectoral outputs of the services industries expand when the economy is initially subject to the price-cap regulations in the profitable privatized services sectors. It is evident that the increases in the sectoral outputs of the protected sectors and in most of the services industries are larger in the long run, implying that there is a greater gains from the trade liberalizations following the price-cap regulations.

Trade liberalizations in the absence of the price-cap regulations in the profitable privatized services sectors do not necessarily have the pro-competitive effects on the services industries both in the short and long run. On the other hand, with the initial price-cap regulations in the profitable privatized services sectors, the mark-ups fall in the protected sectors and lead to the pro-competitive effects only in some of the services sectors like telecommunications and construction in the short run. The anti-competitive effects can be observed in most of the services industries in the short run and it is even more evident in the long run following the price-cap regulations. Therefore, trade liberalizations do not always reduce the mark-ups of the services industries, resulting in the pro-competitive effects whether the economy is initially subject to the price-cap regulations or not.

Table 1: The scope of the model

Regions	1. Taiwan
	2. Rest of World (ROW)

Primary factors	1. Agricultural land
	2. Unskilled (production) labor
	3. Skilled (professional) labor
	4. Physical capital
	5. Nature resources

Sectors	1. Agriculture
	2. Light manufacturing
	3. Steel and other metals
	4. Mining
	5. Other manufacturing
	6. Petroleum and energy
	7. Electricity
	8. Telecommunications
	9. Finance
	10. Transport
	11. Construction
	12. Other services

Data Source: Aggregate of the 57 sectors GTAP Version 6 database from Dimaranan and McDougall (2006).

Table 2: Sectoral economic significance in the model database

	Value added share of GDP	Share of total exports	Export share of output
Agriculture	2.2	0.4	4.2
Light manufacturing	11.6	51.2	55.6
Steel and other metals	3.0	6.9	26.8
Mining	1.3	1.2	18.4
Other manufacturing	8.9	31.0	43.8
Petroleum and energy	2.4	0.5	3.4
Electricity	3.6	0.0	0.0
Telecommunications	2.3	0.3	5.2
Finance	8.3	0.8	3.3
Transport	3.3	2.4	17.8
Construction	3.0	0.2	1.2
Other services	50.2	5.2	3.8

Note: Privatized services sectors include electricity, telecommunications, finance, transport, and
constructions which are shaded in gray color.
Data Source: Model database (SAM), derived from Dimaranan and McDougall (2006)

Table 3: Factor intensities by industry

	Land	Unskilled labor	Skilled labor	Physical capital	Nature resources
Agriculture	30	48	1	13	8
Light manufacturing	0	40	15	45	0
Steel and other metals	0	47	12	41	0
Mining	0	48	13	35	4
Other manufacturing	0	45	18	37	0
Petroleum and energy	0	54	14	31	1
Electricity	0	18	12	70	0
Telecommunications	0	28	16	55	0
Finance	0	35	20	45	0
Transport	0	46	23	30	0
Construction	0	61	17	22	0
Other services	0	27	34	39	0

Note: These are factor shares of total value added in each industry, calculated from the database.
Data Source: Model database (SAM), derived from Dimaranan and McDougall (2006)

Table 4: Conjectural variations parameter and initial elasticity values

	Effective firm numbers	Conjectural variations parameter	Demand elasticities			
			Final	Gov't	Inter-mediate	Export
Agriculture	50	0.1	-12.1	-7.5	-5.6	-18.7
Light manufacturing	50	0.1	-12.1	-7.5	-5.6	-18.7
Steel and other metals	4	0.5	-7.6	-4.9	-3.7	-13.1
Mining	3	0.4	-8.0	-5.2	-3.6	-13.4
Other manufacturing	40	0.2	-11.4	-7.1	-5.3	-17.6
Petroleum and energy	2	0.4	-5.7	-4.5	-3.1	-12.3
Electricity	2	0.4	-5.2	-3.6	-2.6	-10.2
Telecommunications	3	0.6	-5.4	-3.3	-2.7	-9.7
Finance	30	0.6	-7.4	-4.3	-3.5	-11.4
Transport	5	0.4	-7.9	-4.7	-3.7	-12.7
Construction	30	0.4	-9.1	-5.4	-4.3	-14.1
Other services	100	0.2	-11.1	-6.7	-5.2	-17.1

Note: Effective firm numbers are the "effective" number of strategically interacting firms in each sector.
Data Source: Effective firm numbers and conjectural variations parameters are crude estimates, based on the industry concentration, from the survey of top 1000 enterprises published by the Common Wealth Magazine in 2001.

Table 5: Initial demand shares, average elasticities and mark-ups

	Final demand share	Gov't demand share	Intermediate demand share	Export demand share	Average demand elasticity	Industry mark-ups
Agriculture	44	0	51	4	-9.0	1.12
Light manufacturing	19	0	26	56	-14.1	1.08
Steel and other metals	2	0	71	27	-6.3	1.19
Mining	2	0	79	18	-5.5	1.22
Other manufacturing	17	0	40	44	-11.7	1.09
Petroleum and energy	17	0	79	3	-3.9	1.35
Electricity	19	0	81	0	-3.1	1.48
Telecommunications	45	0	50	5	-4.3	1.31
Finance	36	0	60	3	-5.2	1.24
Transport	36	0	46	18	-6.8	1.17
Construction	78	0	20	1	-8.2	1.14
Other services	49	19	28	4	-8.8	1.13

Note: 1. All variables are endogenous in the model and the figures here represent the initial values.
2. Industry mark-ups are defined as the ratio of producer prices to average variable cost.
Data Source: Model database (SAM), derived from Dimaranan and McDougall (2006)

Table 6: Calibrated pure profit, cost shares and industry scale

% of industry turnover	Pure profit	Fixed cost	Variable cost	Scale
Agriculture	0.5	11	89	42
Light manufacturing	-0.3	7	93	63
Steel and other metals	-1.1	17	84	25
Mining	5.3	13	82	31
Other manufacturing	0.5	8	91	57
Petroleum and energy	2.1	24	74	16
Electricity	-10.5	43	68	8
Telecommunications	9.8	14	77	28
Finance	5.5	14	81	29
Transport	-10.2	25	85	17
Construction	-0.5	13	88	35
Other services	1.6	10	89	45

Note: 1. The final three columns of the table are calibrated. Given estimated elasticities, initial mark-up ratios are calculated, which in turn determine variable cost in each sector. Then pure profit shares are used to deduce the fixed cost residual.
2. Scale is defined as the ratio (in %) of the gross quantity produced and minimum efficient scale which is the level of output where unit fixed cost is 5% of unit variable cost.
Data Source: Pure profit proportions are from the Industry, Commerce and Services Census in Year 2001, published by Directorate-General of Budget, Accounting and Statistics, Executive Yuan, R.O.C..

Table 7: Intermediate cost shares of total turnover   unit: %

	All inputs	Light manufacturing	Other manufacturing	Manufacturing sectors
Agriculture	55.7	15.9	5.0	20.9
Light manufacturing	74.3	37.9	10.4	48.2
Steel and other metals	76.1	0.8	3.7	4.5
Mining	59.7	1.9	7.7	9.5
Other manufacturing	74.3	4.6	35.8	40.4
Petroleum and energy	66.7	0.0	0.5	0.6
Electricity	43.7	0.2	3.6	3.8
Telecommunications	24.5	1.7	0.9	2.6
Finance	28.7	1.7	0.3	2.1
Transport	51.5	0.6	6.2	6.8
Construction	66.1	2.8	12.5	15.3
Other services	27.9	3.1	3.5	6.6

Note: Manufacturing sector includes light manufacturing and other manufacturing.
Data Source: Model database (SAM), derived from Dimaranan and McDougall (2006)

Table 8: Intermediate cost shares of total intermediate cost   unit: %

	Light manufacturing	Other manufacturing	Manufacturing sectors
Agriculture	28.5	9.0	37.5
Light manufacturing	51.0	14.0	64.9
Steel and other metals	1.0	4.9	5.9
Mining	3.1	12.8	15.9
Other manufacturing	6.2	48.1	54.4
Petroleum and energy	0.0	0.8	0.9
Electricity	0.4	8.3	8.7
Telecommunications	7.1	3.5	10.6
Finance	6.0	1.1	7.1
Transport	1.2	12.1	13.3
Construction	4.3	18.9	23.2
Other services	11.0	12.6	23.6

Note: Manufacturing sector includes light manufacturing and other manufacturing.
Data Source: Model database (SAM), derived from Dimaranan and McDougall (2006)

Table 9: Share of industry i in domestic intermediate demand by industry j
unit: %

	agri	lmfg	stl	ming	omfg	petr	ely	cmn	fnce	trns	cns	otrserv
Agriculture	17.5	9.9	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Light manufacturing	29.9	36.7	1.1	3.5	5.4	0.1	0.6	7.9	6.2	1.6	2.9	10.9
Steel and other metals	0.3	3.5	53.4	5.0	15.6	0.2	0.2	0.0	0.0	0.3	22.1	1.0
Mining	0.0	1.1	2.8	31.9	0.7	0.3	0.0	0.0	0.0	0.0	29.0	0.3
Other manufacturing	7.1	14.9	4.2	9.1	39.7	0.7	6.4	4.1	0.6	9.7	15.5	9.8
Petroleum and energy	1.7	1.3	3.5	5.4	7.3	88.9	24.7	0.1	0.0	34.7	0.4	0.8
Electricity	3.0	4.5	7.6	10.6	6.7	5.4	41.2	9.1	2.1	2.4	0.4	6.5
Telecommunication	0.3	0.7	0.4	0.7	0.5	0.1	0.2	18.1	3.8	2.5	0.7	5.3
Finance	9.6	5.5	4.8	6.6	3.7	0.4	11.3	1.7	43.5	7.2	2.9	14.9
Transport	2.5	3.2	2.7	7.7	2.7	1.3	2.9	0.6	1.7	14.6	5.3	4.7
Construction	0.3	0.2	0.1	0.7	0.2	0.1	4.6	12.1	0.7	2.2	0.1	8.4
Other Services	27.7	18.5	19.4	18.7	17.5	2.4	8.0	46.2	41.5	24.8	20.7	37.4

Note: 1. Industry i is given in the row, and industry j is given in the column.
2. The largest share of each column is shaded in gray color.
Data Source: Model database (SAM), derived from Dimaranan and McDougall (2006).

Table 10: Long-run effects of cartelization on overall economic performance   unit: %

Cartelization of:	Real GNP	Real GDP	Real skilled wage	Real unskilled wage	Real resource rent (land)	Real resource rent (natres)	Average gross rate of return	Real exchange rate
Whole economy	-10.9	-27.3	-45.3	-47.2	-36.2	-42.2	50.0	10.5
Privatized services	-8.0	-13.0	-16.9	-19.2	-9.5	-13.6	11.6	6.4
Agriculture	-0.2	-0.1	-0.1	-0.8	-22.6	-15.7	1.3	-0.1
Light manufacturing	-1.1	-1.8	-2.2	-4.3	-13.8	-5.8	4.9	-2.2
Steel & other metals	-3.1	-4.3	-3.9	-4.3	1.7	1.7	-2.3	-0.9
Mining	-0.9	-1.0	-1.1	-1.7	0.5	-10.0	0.4	0.3
Other manufacturing	-2.4	-3.7	-4.5	-6.0	2.9	4.6	0.2	-1.7
Petroleum & energy	-1.9	-2.4	-2.5	-2.6	-0.3	-3.9	-0.7	0.2
Electricity	-4.5	-8.2	-8.4	-8.9	-5.1	-7.9	0.1	2.2
Telecommunications	-0.5	-1.1	-1.6	-1.8	-0.9	-0.9	1.3	0.9
Finance	-1.7	-3.4	-5.1	-5.9	-3.7	-3.4	4.4	2.1
Transport	-1.3	-1.9	-2.8	-3.1	-0.7	-1.8	1.9	0.5
Construction	-0.7	0.4	-0.8	-1.7	-0.2	-1.0	3.6	0.8
Other services	-1.3	-12.2	-29.8	-24.6	-11.6	-10.2	33.7	13.3
Sum whole economy	-19.6	-39.9	-62.9	-65.5	-53.6	-54.1	48.9	15.6
Sum privatized services	-8.8	-14.3	-18.7	-21.2	-10.5	-15.0	11.4	6.6

Note: 1. The shock here is to raise the conjectural variation parameter from baseline values to unity, for the whole sectors, for the privatized service sectors only, and finally for each sector individually.
2. The sums in the bottom two rows simply add the corresponding sectoral effects to examine the non-linearity response.
3. The changes of average gross rate of return are the proportional changes in the rates of return, rather than the percentage point changes.
4. Real exchange rate is defined as the ratio of home GDP price to foreign GDP price.
5. Privatized service sectors include electricity, telecommunications, finance, transport, and construction which are shaded in gray color.
Data Source: Simulations of the model described in the text under the long-run closure.

Table 11: Long-run effects of cartelization on sectoral gross rates of return   unit: %

	Whole economy	Privatized services	agri	lmfg	stl	ming	omfg	petr	ely	cmn	fnce	trns	cns	otrserv
Average	50.0	11.6	1.3	4.9	-2.3	0.4	0.2	-0.7	0.1	1.3	4.4	1.9	3.6	33.7
Agriculture	**126.8**[a]	6.7	**167.5**	-43.5	9.8	3.3	10.5	3.1	0.5	0.7	1.0	3.0	1.8	0.9
Light manufacturing	**36.4**	-0.02	-1.2	**32.7**	3.3	0.9	2.8	1.0	-1.2	0.1	0.0	0.8	0.4	-4.2
Steel & other metals	**-59.8**	-34.3	3.4	26.0	**-21.4**	-3.4	-2.1	-5.9	-29.9	-0.3	-3.6	0.1	-2.9	-21.1
Mining	**6.7**	-23.2	1.0	3.4	-8.3	**53.4**	0.5	-1.7	-7.7	0.0	0.1	-0.3	-15.8	-3.4
Other manufacturing	**9.9**	-8.7	1.3	8.4	-6.9	0.7	**28.0**	-3.8	-10.4	0.1	0.5	0.8	0.1	-6.2
Petroleum & energy	**-27.7**	-36.1	2.9	19.1	-10.8	-0.5	-23.8	**5.9**	-25.5	1.0	4.3	-18.6	1.7	11.1
Electricity	**3.4**	**58.1**	0.3	0.0	-8.8	-1.4	-9.4	-2.7	**60.4**	-0.3	-0.7	-0.3	0.3	-12.1
Telecommunications	**38.0**	**55.2**	0.0	-0.7	-1.3	-0.1	-1.5	-0.5	-1.3	**60.2**	-0.5	-0.6	0.2	-4.8
Finance	**35.3**	**56.1**	-0.2	-1.5	-2.0	-0.2	-1.8	-0.4	-2.5	0.0	**61.7**	-0.3	0.1	-5.0
Transport	**64.8**	**80.2**	0.7	2.7	-0.4	-0.4	0.5	-4.1	-1.5	0.3	1.8	**88.9**	-0.3	3.6
Construction	**195.4**	**214.3**	0.6	2.6	-2.5	-0.4	-1.3	-0.8	-2.5	0.0	2.0	0.2	**226.0**	2.9
Other services	**76.1**	-0.8	0.0	-0.2	-1.1	0.0	-1.1	-0.3	-1.1	0.0	0.0	0.0	0.2	**86.9**

Note: 1. Numbers in bold represent the industry that is cartelized.

2. Hypothetical cartelizations are imposed on the column sectors.

3. The shock here is to raise the conjectural variation parameter from baseline values to unity, for the whole sectors, for the privatized service sectors only, and finally for each sector individually.

4. The changes of gross rates of return are the proportional changes in the rates of return, rather than the percentage point changes.

5. Privatized service sectors include electricity, telecommunications, finance, transport, and construction.

Data Source: Simulations of the model described in the text under the long-run closure.

Table 12: Short-run effects of price caps on overall economic performance   unit: %

Price Caps in :	Real GNP	Real GDP	Real skilled wage	Real unskilled wage	Real resource rent (land)	Real resource rent (natres)	Average gross rate of return	Real exchange rate
Profitable sectors	3.4	3.4	6.5	0.0	2.9	11.6	-0.3	-0.3
Profitable privatized services	1.0	1.1	2.0	0.0	1.2	1.2	-0.4	-0.4
Agriculture	0.02	0.01	0.02	0.0	1.1	0.7	-0.03	0.004
Mining	0.4	0.4	0.4	0.0	-0.3	5.9	0.1	0.1
Other manufacturing	0.1	0.1	0.2	0.0	-0.2	-0.2	0.1	0.2
Petroleum & energy	1.0	1.0	1.1	0.0	0.3	2.4	1.0	0.1
Telecommunications	0.3	0.3	0.5	0.0	0.3	0.3	-0.2	-0.1
Finance	0.7	0.8	1.4	0.0	0.9	0.9	-0.3	-0.2
Other services	0.5	0.5	2.1	0.0	0.6	0.5	-1.0	-0.3
Sum profitable sectors	3.0	3.0	5.8	0.0	2.6	10.5	-0.3	-0.3
Sum profitable privatized services	1.0	1.1	2.0	0.0	1.1	1.1	-0.4	-0.4

Note: 1. The shock here is to impose regulated price caps (P=AC) for the profitable sectors, for the profitable
    privatized services sectors only, and finally for the profitable sectors individually.
   2. The sums in the bottom two rows simply add the corresponding sectoral effects to examine the non-
    linearity response.
   3. The changes of average gross rate of return are the proportional changes in the rates of return, rather
    than the percentage point changes.
   4. Real exchange rate is defined as the ratio of home GDP price to foreign GDP price.
   5. Profitable sectors include agriculture, mining, other manufacturing, petroleum and energy,
    telecommunications, finance, and other services which are shaded in gray color.
   6. Profitable privatized services sectors are telecommunications and finance only.
Data Source: Simulations of the model described in the text under the short-run closure.

Table 13: Short-run effects of price caps on sectoral gross rates of return   unit: %

	Profitable sectors	Profitable privatized services	agri	ming	omfg	petr	cmn	fnce	otrserv
Average	-0.3	-0.4	0.0	0.1	0.1	1.0	-0.2	-0.3	-1.0
Agriculture	**-6.8**	1.6	**-8.0**	-0.7	-0.4	0.3	0.3	1.3	1.0
Light manufacturing	0.7	0.7	0.1	-0.4	-0.3	-0.1	0.1	0.6	0.6
Steel & other metals	6.8	1.6	-0.1	0.6	0.4	2.4	0.2	1.4	1.0
Mining	**-15.8**	1.2	0.0	**-18.2**	0.0	1.5	0.3	0.9	1.0
Other manufacturing	**0.7**	0.6	0.0	-0.4	**-2.4**	2.3	0.1	0.5	0.6
Petroleum & energy	**4.9**	1.5	0.0	1.2	1.9	**-0.6**	0.4	1.1	0.9
Electricity	7.2	1.1	0.0	1.2	0.8	2.0	0.4	0.8	1.2
Telecommunications	**-8.8**	**-11.0**	0.0	0.3	0.3	0.8	**-11.6**	0.8	1.4
Finance	**-7.1**	**-9.6**	0.0	0.5	0.3	0.8	0.2	**-9.8**	1.3
Transport	7.1	1.1	0.0	0.9	0.2	3.2	0.3	0.8	0.9
Construction	6.4	1.6	0.0	0.7	0.3	1.5	0.6	1.0	1.6
Other services	**-0.7**	0.9	0.0	0.3	0.3	0.8	0.2	0.7	**-2.9**

Note: 1. Numbers in bold represent the industry on which tighter price caps are imposed.
2. Price-caps regulations are imposed on the column sectors.
3. The shock here is to impose regulated price caps (P=AC) for the profitable sectors, for the profitable privatized services sectors only, and finally for the profitable sectors individually.
4. The changes of average gross rates of return are the proportional changes in the rates of return, rather than the percentage point changes.
5. Profitable sectors include agriculture, mining, other manufacturing, petroleum and energy, telecommunications, finance, and other services.
6. Profitable privatized services sectors are telecommunications and finance only.
Data Source: Simulations of the model described in the text under the short-run closure.

Table 14: The domestic tariff rates of tradable sectors in the initial equilibrium

Industry	Tariff (%)
Agriculture	5.58
Light manufacturing	2.80
Steel and other metals	3.38
Mining	5.52
Other manufacturing	4.88
Petroleum and energy	2.45

Data Source: GTAP Version 6 Database, derived from Dimaranan and McDougall (2006)

Table 15: Trade liberalization regimes

Liberalization regime	Reduction in tariff rate(s)
Agriculture	-100%
Manufacturing	-100%
Combined liberalization	-100%

Note: Manufacturing sector includes light manufacturing and other manufacturing. Combined liberalization refers to a 100% tariff reduction in agricultural and manufacturing sectors.

Table 16: Percentage changes in the real exchange rate

	Percentage changes in the real exchange rate			
	Without price-cap regulations		With price-cap regulations	
Liberalization in:	Short-run	Long-run	Short-run	Long-run
Agriculture	-0.069	-0.034	-0.069	-0.034
Manufacturing	-0.859	-0.681	-0.862	-0.673
Combined	-0.925	-0.712	-0.928	-0.704

Note: Manufacturing includes light manufacturing and other manufacturing. Combined liberalization refers to a 100% tariff reduction both in the agricultural and manufacturing sectors.
Data Source: Model simulations as described in the text.

Table 17: Percentage changes in the export demand shares without price-cap regulations

	Percentage changes in the export demand shares					
	Short-run			Long-run		
Industry	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization
Agriculture	**8.06**	-0.08	**7.88**	**7.41**	-4.68	**2.38**
Light manufacturing	0.33	**3.82**	**4.13**	0.43	**4.61**	**5.01**
Steel & other metals	-0.07	-0.05	-0.13	-0.23	-0.95	-1.20
Mining	0.57	6.43	6.99	0.27	2.80	3.04
Other manufacturing	0.04	**8.26**	**8.29**	-0.02	**8.26**	**8.22**
Petroleum & energy	-0.06	-2.63	-2.70	-0.13	-4.49	-4.62
Electricity	-0.27	-2.88	-3.17	-0.23	-0.32	-0.57
Telecommunications	0.21	3.37	3.57	-0.01	3.19	3.16
Finance	0.19	1.68	1.85	-0.06	0.77	0.69
Transport	0.02	1.05	1.06	-0.10	0.68	0.57
Construction	0.34	6.30	6.65	0.11	3.71	3.81
Other services	0.40	6.63	7.06	0.11	4.46	4.57

Note: 1. Manufacturing includes light manufacturing and other manufacturing. Combined liberalization refers to a 100% tariff reduction both in the agricultural and manufacturing sectors.
2. The bold numbers indicate the sectors which are liberalized.
Data Source: Model simulations as described in the text.

Table 18: Percentage changes in the export demands without price-cap regulations

| Industry | Percentage changes in the export demands | | | | | |
| | Short-run | | | Long-run | | |
	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization
Agriculture	**6.06**	2.04	**8.15**	**5.41**	-2.60	**2.65**
Light manufacturing	1.17	**9.84**	**11.09**	1.60	**13.89**	**15.67**
Steel & other metals	0.09	3.51	3.58	-0.25	2.43	2.14
Mining	0.95	11.00	12.01	0.50	5.25	5.73
Other manufacturing	0.30	**14.47**	**14.79**	0.17	**15.55**	**15.71**
Petroleum & energy	0.03	-1.45	-1.43	-0.08	-3.49	-3.57
Electricity	-0.19	-1.52	-1.72	-0.12	2.26	2.13
Telecommunications	0.23	3.63	3.85	-0.04	3.52	3.46
Finance	0.22	2.37	2.58	-0.06	1.59	1.51
Transport	0.08	2.32	2.40	-0.08	2.14	2.04
Construction	0.32	6.44	6.76	0.04	3.13	3.16
Other services	0.35	6.02	6.39	0.01	3.52	3.51

Note: 1. Manufacturing includes light manufacturing and other manufacturing. Combined liberalization refers to a 100% tariff reduction both in the agricultural and manufacturing sectors.
    2. The bold numbers indicate the sectors which are liberalized.
Data Source: Model simulations as described in the text.

Table 19: Percentage changes in the mark-ups without price-cap regulations

| Industry | Percentage changes in the mark-ups | | | | | |
| | Short-run | | | Long-run | | |
	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization
Agriculture	**-0.03**	0.11	**0.08**	**-0.02**	0.19	**0.17**
Light manufacturing	-0.01	**-0.10**	**-0.11**	-0.01	**-0.12**	**-0.13**
Steel & other metals	0.01	0.02	0.02	0.02	0.08	0.10
Mining	-0.04	-0.46	-0.50	-0.02	-0.21	-0.22
Other manufacturing	-0.0002	**-0.24**	**-0.24**	0.003	**-0.23**	**-0.23**
Petroleum & energy	0.01	0.17	0.18	0.01	0.23	0.24
Electricity	0.02	0.21	0.22	0.02	0.26	0.27
Telecommunications	-0.0004	-0.03	-0.03	0.005	0.001	0.01
Finance	0.003	0.07	0.07	0.01	0.11	0.11
Transport	0.004	0.02	0.03	0.01	0.05	0.06
Construction	-0.0002	-0.01	-0.01	0.0001	0.002	0.002
Other services	-0.002	-0.03	-0.04	-0.0001	-0.01	-0.01

Note: 1. Manufacturing includes light manufacturing and other manufacturing. Combined liberalization refers to a 100% tariff reduction both in the agricultural and manufacturing sectors.
    2. The bold numbers indicate the sectors which are liberalized.
Data Source: Model simulations as described in the text.

Table 20: Percentage changes in the total elasticity of demand without price-cap regulations

Industry	Percentage changes in the total elasticity of demand					
	Short-run			Long-run		
	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization
Agriculture	**0.23**	-0.88	**-0.65**	**0.16**	-1.50	**-1.36**
Light manufacturing	0.12	**1.31**	**1.42**	0.15	**1.56**	**1.70**
Steel & other metals	-0.03	-0.08	-0.12	-0.09	-0.44	-0.54
Mining	0.19	2.11	2.29	0.09	0.93	1.02
Other manufacturing	0.002	**2.61**	**2.61**	-0.03	**2.56**	**2.53**
Petroleum & energy	-0.03	-0.48	-0.51	-0.03	-0.64	-0.67
Electricity	-0.03	-0.43	-0.46	-0.03	-0.54	-0.57
Telecommunications	0.001	0.09	0.09	-0.02	-0.002	-0.02
Finance	-0.01	-0.28	-0.29	-0.03	-0.44	-0.47
Transport	-0.02	-0.13	-0.16	-0.05	-0.30	-0.36
Construction	0.002	0.04	0.04	-0.0005	-0.01	-0.01
Other services	0.02	0.27	0.29	0.0004	0.08	0.08

Note: 1. Manufacturing includes light manufacturing and other manufacturing. Combined liberalization refers
to a 100% tariff reduction both in the agricultural and manufacturing sectors.
2. The bold numbers indicate the sectors which are liberalized.
Data Source: Model simulations as described in the text.

Table 21: Percentage changes in the sectoral outputs without price-cap regulations

Industry	Percentage changes in the sectoral outputs					
	Short-run			Long-run		
	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization
Agriculture	**-1.86**	2.12	**0.24**	**-1.86**	2.18	**0.27**
Light manufacturing	0.83	**5.80**	**6.68**	1.16	**8.87**	**10.15**
Steel & other metals	0.16	3.55	3.71	-0.02	3.42	3.38
Mining	0.39	4.29	4.69	0.23	2.38	2.61
Other manufacturing	0.25	**5.74**	**6.01**	0.19	**6.73**	**6.92**
Petroleum & energy	0.08	1.21	1.30	0.05	1.05	1.10
Electricity	0.08	1.40	1.49	0.12	2.59	2.71
Telecommunications	0.01	0.25	0.27	-0.03	0.32	0.29
Finance	0.03	0.69	0.72	0.00	0.82	0.82
Transport	0.06	1.27	1.33	0.02	1.45	1.47
Construction	-0.02	0.13	0.11	-0.06	-0.56	-0.63
Other services	-0.05	-0.57	-0.62	-0.10	-0.90	-1.01

Note: 1. Manufacturing includes light manufacturing and other manufacturing. Combined liberalization refers
to a 100% tariff reduction both in the agricultural and manufacturing sectors.
2. The bold numbers indicate the sectors which are liberalized.
Data Source: Model simulations as described in the text.

Table 22: Comparisons of the net welfare gains in terms of real GNP and GDP

| | Percentage changes in real GNP **(real GDP)** | | | | | |
| | Without price-cap regulations | | | With price-cap regulations | | |
	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization
Short-run	0.015	0.403	0.416	0.013	0.385	0.397
	(0.001)	**(-0.004)**	**(-0.004)**	**(0.001)**	**(-0.008)**	**(-0.007)**
Long-run	-0.005	0.118	0.107	-0.005	0.129	0.117
	(-0.003)	**(0.280)**	**(0.274)**	**(-0.003)**	**(0.271)**	**(0.265)**

Note: 1. Manufacturing includes light manufacturing and other manufacturing. Combined liberalization
refers to a 100% tariff reduction both in the agricultural and manufacturing sectors.
2. The bold numbers in the parentheses indicates the percentage changes in real GDP.
Data Source: Model simulations as described in the text.

Table 23: Short-run pcentage changes in the sectoral outputs of the services industries

| | Percentage changes in the sectoral outputs of the services industries | | | | | |
| | Without price-cap regulations | | | With price-cap regulations | | |
Industry	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization
Electricity	0.084	1.404	1.493	0.083	1.384	1.471
	(0.116)	**(2.589)**	**(2.712)**	**(0.115)**	**(2.560)**	**(2.683)**
Telecommunications	0.015	0.254	0.269	0.014	0.261	0.275
	(-0.029)	**(0.320)**	**(0.286)**	**(-0.026)**	**(0.446)**	**(0.415)**
Finance	0.027	0.687	0.715	0.026	0.682	0.709
	(-0.003)	**(0.820)**	**(0.817)**	**(-0.002)**	**(0.789)**	**(0.787)**
Transport	0.060	1.266	1.327	0.059	1.256	1.316
	(0.022)	**(1.449)**	**(1.470)**	**(0.022)**	**(1.437)**	**(1.457)**
Construction	-0.021	0.128	0.106	-0.022	0.114	0.090
	(-0.063)	**(-0.558)**	**(-0.630)**	**(-0.063)**	**(-0.544)**	**(-0.616)**

Note: 1. Manufacturing includes light manufacturing and other manufacturing. Combined liberalization
refers to a 100% tariff reduction both in the agricultural and manufacturing sectors.
2. The bold numbers in the parentheses indicates the percentage changes of the outputs in the long run.
Data Source: Model simulations as described in the text.

Table 24: Percentage changes in the mark-ups with price-cap regulations

| Industry | Percentage changes in mark-ups | | | | | |
| | Short-run | | | Long-run | | |
	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization
Agriculture	**-0.03**	0.11	**0.08**	**-0.02**	0.19	**0.17**
Light manufacturing	-0.01	**-0.10**	**-0.11**	-0.01	**-0.12**	**-0.13**
Steel & other metals	0.01	0.01	0.02	0.02	0.09	0.10
Mining	-0.04	-0.46	-0.50	-0.02	-0.20	-0.22
Other manufacturing	-0.0003	**-0.24**	**-0.24**	0.003	**-0.23**	**-0.23**
Petroleum & energy	0.01	0.17	0.18	0.01	0.22	0.23
Electricity	0.02	0.20	0.22	0.02	0.25	0.27
Telecommunications	-0.0014	-0.04	-0.04	0.004	-0.040	-0.04
Finance	0.002	0.06	0.06	0.01	0.10	0.11
Transport	0.004	0.02	0.03	0.01	0.05	0.06
Construction	-0.0002	-0.01	-0.01	0.0001	0.002	0.002
Other services	-0.002	-0.03	-0.04	-0.0001	-0.01	-0.01

Note: 1. Manufacturing includes light manufacturing and other manufacturing. Combined liberalization refers to a 100% tariff reduction both in the agricultural and manufacturing sectors.
2. The bold numbers indicate the sectors which are liberalized.
Data Source: Model simulations as described in the text.

Table 25: Percentage changes in the total elasticity of demand with price-cap regulations

| Industry | Percentage changes in the total elasticity of demand | | | | | |
| | Short-run | | | Long-run | | |
	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization
Agriculture	**0.23**	-0.88	**-0.64**	**0.16**	-1.49	**-1.35**
Light manufacturing	0.12	**1.31**	**1.42**	0.15	**1.55**	**1.69**
Steel & other metals	-0.03	-0.07	-0.11	-0.09	-0.45	-0.55
Mining	0.19	2.12	2.30	0.09	0.91	0.99
Other manufacturing	0.003	**2.61**	**2.61**	-0.03	**2.56**	**2.52**
Petroleum & energy	-0.03	-0.48	-0.51	-0.03	-0.63	-0.66
Electricity	-0.03	-0.43	-0.46	-0.03	-0.53	-0.56
Telecommunications	0.005	0.14	0.15	-0.01	0.140	0.12
Finance	-0.01	-0.26	-0.27	-0.03	-0.42	-0.45
Transport	-0.02	-0.13	-0.15	-0.05	-0.30	-0.36
Construction	0.002	0.04	0.04	-0.0005	-0.01	-0.01
Other services	0.02	0.27	0.29	0.0005	0.08	0.08

Note: 1. Manufacturing includes light manufacturing and other manufacturing. Combined liberalization refers to a 100% tariff reduction both in the agricultural and manufacturing sectors.
2. The bold numbers indicate the sectors which are liberalized.
Data Source: Model simulations as described in the text.

Table 26: Short-Run Effects of Trade Liberalization without Price-cap Regulations

Change in: (%)	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization
Real GNP	0.0145	0.4032	0.4165
Real GDP	0.0014	-0.0044	-0.0037
Real Exchange Rate	-0.0688	-0.8586	-0.9250
Real Skilled Wage	0.0527	0.4038	0.4574
Real production Wage	0.0000	0.0000	0.0000
Real Resource Rent_land	-2.4003	2.6548	0.2181
Real Resource Rent_natres	-1.6675	2.9544	1.2636
Average Rate of Return on Capital	0.1159	2.9284	3.0536
Gross Sectoral Output			
Agriculture	**-1.8552**	2.1152	**0.2418**
Light manufacturing	0.8304	**5.8047**	**6.6834**
Other manufacturing	0.2525	**5.7434**	**6.0083**
Electricity	0.0842	1.4041	1.4929
Telecommunications	0.0147	0.2543	0.2690
Finance	0.0271	0.6866	0.7153
Transport	0.0601	1.2655	1.3265
Construction	-0.0208	0.1284	0.1055
Export Demand			
Agriculture	**6.0600**	2.0351	**8.1455**
Light manufacturing	1.1659	**9.8443**	**11.0881**
Other manufacturing	0.2971	**14.4743**	**14.7937**
Electricity	-0.1891	-1.5213	-1.7231
Telecommunications	0.2266	3.6308	3.8527
Finance	0.2150	2.3739	2.5766
Transport	0.0827	2.3238	2.3962
Construction	0.3184	6.4365	6.7605
Export Demand Share			
Agriculture	**8.0649**	-0.0784	**7.8847**
Light manufacturing	0.3327	**3.8179**	**4.1287**
Other manufacturing	0.0445	**8.2566**	**8.2875**
Electricity	-0.2730	-2.8849	-3.1687
Telecommunications	0.2119	3.3679	3.5741
Finance	0.1879	1.6759	1.8481
Transport	0.0226	1.0451	1.0556
Construction	0.3393	6.3001	6.6480
Elasticity of Total Demand			
Agriculture	**0.2342**	-0.8836	**-0.6489**
Light manufacturing	0.1190	**1.3107**	**1.4225**
Other manufacturing	0.0024	**2.6074**	**2.6061**
Electricity	-0.0318	-0.4294	-0.4613
Telecommunications	0.0012	0.0859	0.0863
Finance	-0.0107	-0.2823	-0.2945
Transport	-0.0215	-0.1305	-0.1550
Construction	0.0016	0.0417	0.0434
Mark-up Ratio			
Agriculture	**-0.0291**	0.1110	**0.0813**
Light manufacturing	-0.0091	**-0.0986**	**-0.1069**
Other manufacturing	-0.0002	**-0.2371**	**-0.2369**
Electricity	0.0151	0.2054	0.2207
Telecommunications	-0.0004	-0.0263	-0.0264
Finance	0.0026	0.0679	0.0708
Transport	0.0037	0.0224	0.0267
Construction	-0.0002	-0.0058	-0.0060

Note: 1. Manufacturing includes light manufacturing and other manufacturing. Combined liberalization refers to a 100% tariff reduction both in the agricultural and manufacturing sectors.

2. The bold numbers indicate the sectors which are liberalized.

Data Source: Model simulations as described in the text.

Table 27: Short-Run Effects of Trade Liberalization with Price-cap Regulations

Change in: (%)	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization
Real GNP	0.0132	0.3852	0.3971
Real GDP	0.0010	-0.0077	-0.0073
Real Exchange Rate	-0.0689	-0.8619	-0.9284
Real Skilled Wage	0.0519	0.3995	0.4524
Real production Wage	0.0000	0.0000	0.0000
Real Resource Rent_land	-2.3846	2.6399	0.2200
Real Resource Rent_natres	-1.6562	2.9414	1.2626
Average Rate of Return on Capital	0.1162	2.9332	3.0587
Gross Sectoral Output			
Agriculture	**-1.8435**	2.1011	**0.2402**
Light manufacturing	0.8254	**5.7748**	**6.6479**
Other manufacturing	0.2518	**5.7079**	**5.9720**
Electricity	0.0828	1.3841	1.4715
Telecommunications	0.0141	0.2605	0.2746
Finance	0.0263	0.6815	0.7095
Transport	0.0595	1.2558	1.3162
Construction	-0.0218	0.1143	0.0905
Export Demand			
Agriculture	**6.0219**	2.0785	**8.1522**
Light manufacturing	1.1617	**9.8227**	**11.0615**
Other manufacturing	0.2979	**14.4544**	**14.7746**
Electricity	-0.1869	-1.4953	-1.6951
Telecommunications	0.2104	3.4106	3.6162
Finance	0.2069	2.3461	2.5413
Transport	0.0844	2.3468	2.4209
Construction	0.3191	6.4344	6.7590
Export Demand Share			
Agriculture	**8.0131**	-0.0221	**7.8930**
Light manufacturing	0.3335	**3.8269**	**4.1385**
Other manufacturing	0.0460	**8.2742**	**8.3065**
Electricity	-0.2695	-2.8401	-3.1207
Telecommunications	0.1963	3.1419	3.3324
Finance	0.1806	1.6533	1.8190
Transport	0.0250	1.0775	1.0904
Construction	0.3410	6.3129	6.6625
Elasticity of Total Demand			
Agriculture	**0.2349**	-0.8790	**-0.6434**
Light manufacturing	0.1192	**1.3128**	**1.4248**
Other manufacturing	0.0029	**2.6075**	**2.6067**
Electricity	-0.0317	-0.4274	-0.4591
Telecommunications	0.0048	0.1418	0.1456
Finance	-0.0091	-0.2608	-0.2715
Transport	-0.0211	-0.1260	-0.1502
Construction	0.0015	0.0403	0.0419
Mark-up Ratio			
Agriculture	**-0.0291**	0.1104	**0.0806**
Light manufacturing	-0.0091	**-0.0988**	**-0.1071**
Other manufacturing	-0.0003	**-0.2373**	**-0.2372**
Electricity	0.0151	0.2045	0.2198
Telecommunications	-0.0014	-0.0423	-0.0434
Finance	0.0022	0.0622	0.0648
Transport	0.0036	0.0217	0.0259
Construction	-0.0002	-0.0056	-0.0058

Note: 1. Manufacturing includes light manufacturing and other manufacturing. Combined liberalization refers to a 100% tariff reduction both in the agricultural and manufacturing sectors.
    2. The bold numbers indicate the sectors which are liberalized.
Data Source: Model simulations as described in the text.

Table 28: Long-Run Effects of Trade Liberalization without Price-cap Regulations

Change in: (%)	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization
Real GNP	-0.0047	0.1182	0.1070
Real GDP	-0.0025	0.2804	0.2738
Real Exchange Rate	-0.0337	-0.6815	-0.7122
Real Skilled Wage	0.0337	0.4845	0.5155
Real production Wage	0.0697	1.8757	1.9497
Real Resource Rent_land	-2.3858	2.9925	0.5193
Real Resource Rent_natres	-1.6921	2.8543	1.0973
Average Rate of Return on Capital	0.0416	1.2359	1.2793
Real Gross Sectoral Output			
Agriculture	**-1.8649**	2.1844	**0.2658**
Light manufacturing	1.1649	**8.8685**	**10.1516**
Other manufacturing	0.1912	**6.7297**	**6.9224**
Electricity	0.1161	2.5888	2.7123
Telecommunications	-0.0294	0.3202	0.2857
Finance	-0.0029	0.8204	0.8172
Transport	0.0223	1.4493	1.4698
Construction	-0.0632	-0.5577	-0.6295
Export Demand			
Agriculture	**5.4059**	-2.5977	**2.6502**
Light manufacturing	1.5997	**13.8896**	**15.6733**
Other manufacturing	0.1682	**15.5471**	**15.7127**
Electricity	-0.1187	2.2597	2.1252
Telecommunications	-0.0405	3.5196	3.4583
Finance	-0.0634	1.5936	1.5079
Transport	-0.0790	2.1435	2.0445
Construction	0.0444	3.1313	3.1555
Export Demand Share			
Agriculture	*7.4089*	-4.6799	*2.3781*
Light manufacturing	0.4299	**4.6120**	**5.0128**
Other manufacturing	-0.0230	**8.2614**	**8.2213**
Electricity	-0.2345	-0.3207	-0.5716
Telecommunications	-0.0110	3.1892	3.1635
Finance	-0.0605	0.7668	0.6852
Transport	-0.1013	0.6843	0.5664
Construction	0.1076	3.7097	3.8089
Elasticity of Total Demand			
Agriculture	**0.1615**	-1.4965	**-1.3565**
Light manufacturing	0.1508	**1.5574**	**1.6987**
Other manufacturing	-0.0274	**2.5590**	**2.5260**
Electricity	-0.0336	-0.5378	-0.5720
Telecommunications	-0.0161	-0.0022	-0.0205
Finance	-0.0257	-0.4441	-0.4727
Transport	-0.0499	-0.3015	-0.3565
Construction	-0.0005	-0.0122	-0.0128
Mark-up Ratio			
Agriculture	**-0.0201**	0.1893	**0.1713**
Light manufacturing	-0.0115	**-0.1168**	**-0.1272**
Other manufacturing	0.0026	**-0.2328**	**-0.2298**
Electricity	0.0160	0.2576	0.2741
Telecommunications	0.0049	0.0007	0.0063
Finance	0.0062	0.1070	0.1139
Transport	0.0086	0.0520	0.0615
Construction	0.0001	0.0017	0.0018

Note: 1. Manufacturing includes light manufacturing and other manufacturing. Combined liberalization refers to a 100% tariff reduction both in the agricultural and manufacturing sectors.
2. The bold numbers indicate the sectors which are liberalized.
Data Source: Model simulations as described in the text.

Table 29: Long-Run Effects of Trade Liberalization with Price-cap Regulations

Change in: (%)	Liberalization in Agriculture	Liberalization in Manufacturing	Combined Liberalization
Real GNP	-0.0047	0.1286	0.1174
Real GDP	-0.0025	0.2714	0.2648
Real Exchange Rate	-0.0337	-0.6727	-0.7035
Real Skilled Wage	0.0336	0.4823	0.5132
Real production Wage	0.0699	1.8685	1.9427
Real Resource Rent_land	-2.3804	2.9756	0.5080
Real Resource Rent_natres	-1.6909	2.8329	1.0772
Average Rate of Return on Capital	0.0431	1.2602	1.3052
Real Gross Sectoral Output			
Agriculture	**-1.8613**	2.1722	**0.2572**
Light manufacturing	1.1600	**8.8054**	**10.0825**
Other manufacturing	0.1909	**6.6798**	**6.8724**
Electricity	0.1152	2.5604	2.6829
Telecommunications	-0.0258	0.4458	0.4151
Finance	-0.0020	0.7891	0.7867
Transport	0.0223	1.4367	1.4572
Construction	-0.0629	-0.5444	-0.6158
Export Demand			
Agriculture	**5.3878**	-2.6267	**2.6030**
Light manufacturing	1.5932	**13.7947**	**15.5701**
Other manufacturing	0.1681	**15.4881**	**15.6540**
Electricity	-0.1178	2.2288	2.0953
Telecommunications	-0.0242	3.3703	3.3290
Finance	-0.0573	1.3605	1.2829
Transport	-0.0792	2.1089	2.0100
Construction	0.0442	3.0846	3.1088
Export Demand Share			
Agriculture	*7.3866*	*-4.6969*	*2.3398*
Light manufacturing	0.4282	**4.5855**	**4.9850**
Other manufacturing	-0.0228	**8.2568**	**8.2169**
Electricity	-0.2327	-0.3234	-0.5723
Telecommunications	0.0016	2.9115	2.9018
Finance	-0.0553	0.5669	0.4923
Transport	-0.1015	0.6627	0.5448
Construction	0.1071	3.6488	3.7477
Elasticity of Total Demand			
Agriculture	**0.1613**	-1.4877	**-1.3480**
Light manufacturing	0.1506	**1.5517**	**1.6928**
Other manufacturing	-0.0272	**2.5575**	**2.5246**
Electricity	-0.0332	-0.5280	-0.5619
Telecommunications	-0.0135	0.1405	0.1246
Finance	-0.0255	-0.4202	-0.4488
Transport	-0.0498	-0.3018	-0.3567
Construction	-0.0005	-0.0131	-0.0138
Mark-up Ratio			
Agriculture	**-0.0200**	0.1883	**0.1703**
Light manufacturing	-0.0115	**-0.1165**	**-0.1269**
Other manufacturing	0.0026	**-0.2328**	**-0.2299**
Electricity	0.0158	0.2533	0.2696
Telecommunications	0.0039	-0.0404	-0.0359
Finance	0.0060	0.0997	0.1065
Transport	0.0086	0.0521	0.0616
Construction	0.0001	0.0018	0.0019

Note: 1. Manufacturing includes light manufacturing and other manufacturing. Combined liberalization refers to a 100% tariff reduction both in the agricultural and manufacturing sectors.
    2. The bold numbers indicate the sectors which are liberalized.
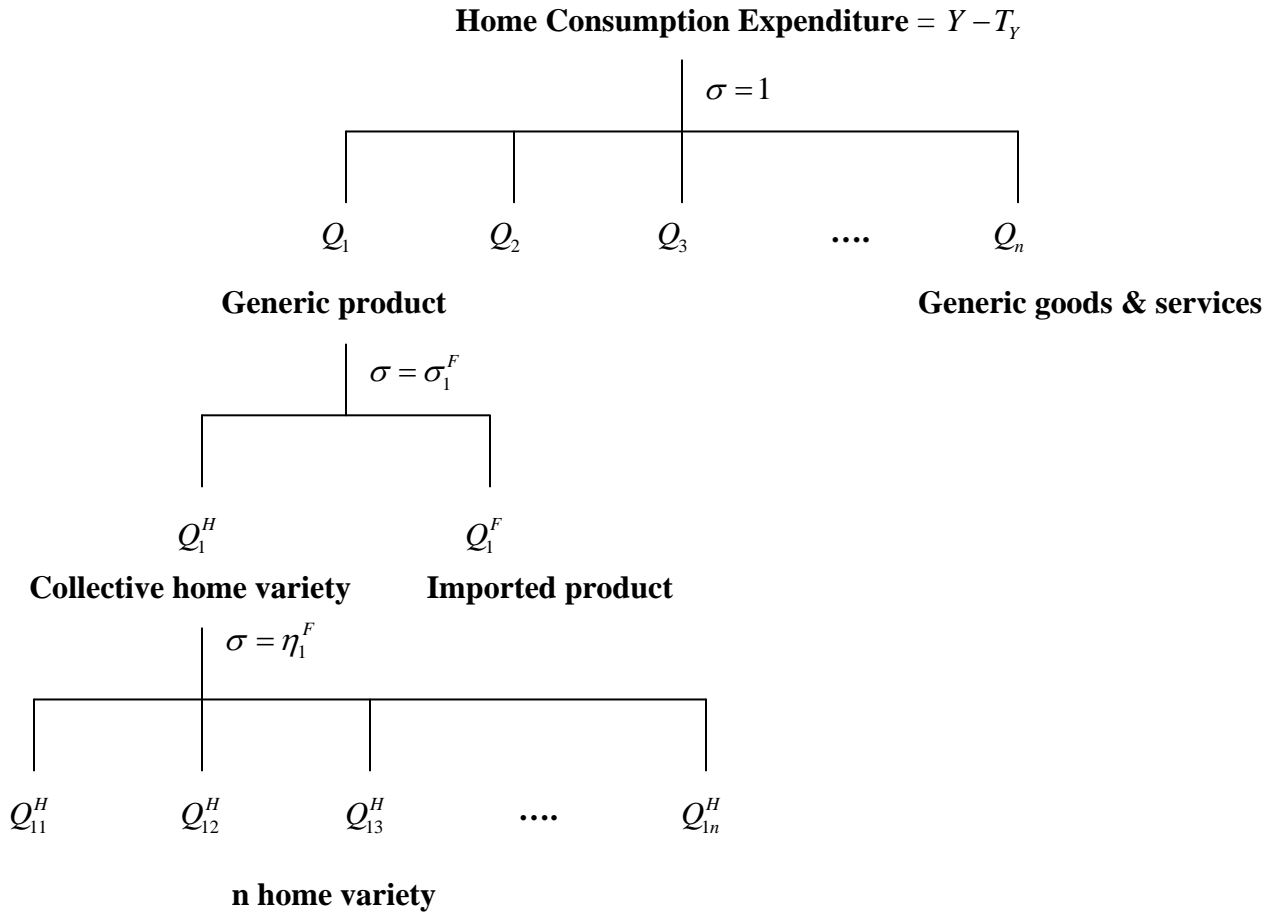Data Source: Model simulations as described in the text.

Table 30: Social Accounting Matrix, Taiwan (Year 2001)

		P/L	LAND	U/L	S/L	K	N/R	HH	Govn't	agri	lmfg	stl	ming	omfg	petr	ely	cmn	fnce	trns	cns	otrserv	ROW	TOTAL
Factors	Profits and Loss									67	-335	-397	465	466	408	-1824	819	1732	-1899	-112	2953		2342
	Land									1781	0	0	0	0	0	0	0	0	0	0	0		1781
	Unskilled Labor									2811	12624	3797	1685	10860	3466	1798	1770	7827	4155	4992	36843		92627
	Skilled Labor									87	4620	984	459	4340	893	1154	1035	4577	2093	1375	45623		67240
	Capital									671	14283	3773	751	8272	1557	8612	2656	8236	4640	1903	50023		105377
	Nature Resources									479	0	0	126	0	51	0	0	0	0	0	0		656
Households		2342	1781	92627	67240	105377	656															-14775	255248
Government								32868	0	21	1198	201	64	897	156	74	1	4	46	80	117	137	35863
Production sectors	Agriculture							5936	0	1206	5577	0	0	32	0	0	0	0	0	10	37	566	13365
	Light manufacturing							23706	0	2057	20736	231	137	2734	5	29	132	495	109	399	5143	70012	125928
	Steel and other metals							817	0	23	1952	11122	194	7951	13	8	0	0	21	3050	453	9394	34997
	Mining							186	0	2	635	592	1238	341	23	1	0	0	0	4011	160	1626	8815
	Other manufacturing							16099	0	491	8432	872	355	20212	51	302	68	46	675	2141	4635	42358	96738
	Petroleum and energy							3398	0	114	723	725	210	3713	6017	1171	2	3	2423	61	388	658	19608
	Electricity							3342	0	203	2541	1578	413	3394	368	1956	152	167	168	52	3090	0	17424
	Telecommunication							3708	0	19	368	89	27	263	6	9	303	302	178	95	2518	436	8320
	Finance							11389	64	661	3108	990	256	1878	25	536	29	3486	502	402	7039	1030	31395
	Transport							6780	0	170	1826	556	300	1362	90	137	11	132	1022	731	2205	3315	18636
	Construction							19076	0	23	112	27	29	107	7	217	202	53	151	16	4002	285	24307
	Other Services							92080	35799	1905	10466	4029	727	8918	165	379	771	3321	1727	2855	17710	7076	187926
Rest of the world	Agriculture							805	0	89	2221	1	0	275	2	1	0	4	1	8	19		
(imports)	Light manufacturing							8147	0	63	26955	33	26	1730	0	0	12	43	5	291	593		
	Steel and other metals							158	0	19	1062	4832	21	2831	4	2	0	0	2	186	55		
	Mining							215	0	0	1036	274	812	301	2	0	0	0	0	416	23		
	Other manufacturing							20764	0	182	4625	423	321	14403	55	328	4	57	485	890	1966		
	Petroleum and energy							102	0	184	69	86	154	759	6232	2351	0	0	884	0	24		
	Electricity							0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Telecommunication							23	0	0	0	0	0	0	0	0	330	0	6	0	67		
	Finance							88	0	1	323	15	0	92	0	14	1	409	11	1	71		
	Transport							1964	0	5	95	16	6	87	0	1	14	16	768	10	240		
	Construction							292	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Other Services							3304	0	31	674	149	39	521	12	169	8	484	465	444	1926		
	TOTAL	2342	1781	92627	67240	105377	656	255248	35863	13365	125928	34997	8815	96738	19608	17424	8320	31395	18636	24307	187926		

Note: Unit: USD / Millions

Data Source: GTAP Data Base, Version 6 from Dimaranan and McDougall (2006)

Figure 1: Final Demand Structure and Elasticity

Home Consumption Expenditure $= Y - T_Y$

$\sigma = 1$

$Q_1 \qquad Q_2 \qquad Q_3 \qquad \text{....} \qquad Q_n$

Generic product .... **Generic goods & services**

$\sigma = \sigma_1^F$

$Q_1^H \qquad\qquad Q_1^F$

Collective home variety ..... **Imported product**

$\sigma = \eta_1^F$

$Q_{11}^H \qquad Q_{12}^H \qquad Q_{13}^H \qquad \text{....} \qquad Q_{1n}^H$

n home variety

Final Demand Elasticity with Price Interaction

$$\varepsilon_i^F = -\eta_i^F + \frac{1}{n_i}\left(\frac{p_{iHj}}{\hat{P}_{iH}}\right)^{1-\eta_i^F}\left\{\left(\sigma_i^F - 1\right)\delta_i^F\left(\frac{\hat{P}_{iH}}{\hat{P}_i^F}\right)^{(1-\sigma_i^F)} + \left(\eta_i^F - \sigma_i^F\right)\left(1 + (n_i - 1)\mu_i\right)\right\}$$

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