Economic Effects of Liberalization: The Case of China's Accession to the World Trade Organization [1]

Claustre Bajona
University of Miami

Tianshu Chu
East-West Center

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Abstract

Many developing economies have joined or applied to join the WTO as part of their process of transformation to market-oriented economies. Most of these developing countries have a dual market structure where subsidized state-owned enterprises co-exist with private, competitive, enterprises. Besides liberalization of capital markets and reduction of tariffs, accession to the WTO usually brings provisions to significantly reduce the domestic industrial subsidies that are responsible for this dual structure. In this paper we develop a dynamic applied general equilibrium model to quantitatively asses the welfare benefits of both, capital market liberalization and domestic industrial policy reform, and we apply it to the case of China. We find that the major benefits are derived from domestic policy reform, with capital market liberalization having a relatively small positive welfare effect. We conclude that accession to the WTO is used as a commitment device to the implementation of, sometimes unpopular, domestic policy reforms.

1 Introduction

A large number of developing countries, with heavily subsidized state economies have recently joined or applied to join the World Trade Organization (WTO). The most significant example is China, which after 15 years of negotiations joined the WTO in December 2001. Most of these countries are in the process of reforming their economies to become more market-oriented. Developing countries usually have a dual market structure, with some enterprises being subsidized by the government and other firms in the same sector operating in a completely competitive market. The latter are a very diverse group ranging from foreign firms to private domestic entrepreneurs to members of the informal sector. An important characteristic of this dual market structure is that the subsidized and competitive firms operate different technologies, with the subsidized firms being in general less efficient, and they are able to co-exist with the more efficient private firms only because of government regulation. Upon application for accession to the WTO countries make a commitment to guaranteeing the access of the other WTO members to their own markets. The required policy reforms often involve unpopular reforms like the elimination of domestic subsidies to industry and the reduction of the state sector. The conditions for accession are usually asymmetric, with the new entrants giving more concessions in terms of reduction of trade barriers than the concessions they receive from WTO's members. Given this asymmetry and the popularity of the organization (the WTO has currently 143 member countries, with 30 countries having filed applications to join the organization), it seems that the benefits of accessing the WTO go beyond the gains derived from tariff reduction.

The case of China is a clear example since effective domestic tariffs are low and it had had "most favored nation" status with the US for several years before joining the WTO. The purpose of this paper is to investigate the source of these additional benefits that countries derive from accession to the WTO. In this paper we argue that most of the benefits of accession to the WTO comes from the internal restructuring of the country's economy that comes along with the liberalization of the domestic markets. In this sense, application for accession to the WTO can be interpreted as a commitment device to implementing domestic industrial policy reforms that would otherwise be difficult to achieve.

We develop a dynamic applied general equilibrium model to assess the

economic effects of liberalization in an economy with a dual market structure. In the model both regulated and free market enterprises co-exist. State owned enterprises (SOEs), usually inefficient, remain in the market thanks to heavy subsidies from the government. In this framework we explore welfare benefits of capital market liberalization and domestic policy reforms both in the steady state and in the transitional dynamics. Under capital market liberalization consumers can borrow and lend internationally at a fixed world interest rate. Regarding domestic policy reforms we analyze two types of policies: subsidies to capital and subsidies to labor. Subsidies to capital allow the SOEs to hire capital at a rental rate below its market value. Subsidies to labor allow the government to maintain employment levels in big, inefficient firms by picking up the losses that these firms may have. We find that the highest welfare gains are obtained from domestic policy reform, with capital market liberalization having a relatively small positive welfare effect. Of both domestic policies, reduction of labor subsidies deliver the highest gains.

Under the light of our findings we conclude that in economies with relatively low effective tariff rates, like the case of China, major welfare gains are to be obtained from domestic policy reforms, and only minor gains are obtained from capital market liberalization. It is to the extend that trade liberalization induces the country to reform its domestic policies that the countries will benefit from further liberalization that follows the accession to institutions like the WTO.

It is interesting to note that in the steady state analysis capital market liberalization reduces steady state welfare, since countries need to run trade surpluses in the long run in order to compensate for high deficits incurred in the early periods of liberalization. Once transitional dynamics are introduced, this is no longer the case, with capital market liberalization having a small but positive effect on welfare. Therefore, our results suggest that in order to fully understand the benefits from liberalization comparative statics are not enough and dynamic models are needed. Moreover, the country starts feeling the gains from trade liberalization after a transitional period where reforms reduce welfare. This initial episode of lower welfare is the reason why countries need a commitment device, like membership to the WTO, to guarantee that economic reforms will go through despite the resistance of some groups in society. In our model this resistance may be a result of the initial low-welfare periods. In most countries, resistance to domestic policy reform often is due to high unemployment costs that some groups of society

have to face when labor subsidies are reduced. We have not built in the features needed to capture the costs of unemployment in this model. The cost of unemployment is a complex but important issue, and we leave it to future studies.

In the paper we apply our theory to the case of China, the last country that joined the WTO and a clear example of a country with a strong, inefficient state sector. China's SOEs traditionally dominated the industrial and the service sectors. SOEs are given both preferential treatment by the government in terms of credit and subsidies, and are subject to stringent restrictions on employment. With the accession to the WTO subsidies that are inconsistent with the agreement must be removed. These subsidies include subsides from the central government as well as from the local governments to loss-making SOEs. Subsidies to loss-making firms are substantial: in 1998 these subsidies were of the order of four billion US dollars.

Studies investigating the benefits from economic liberalization in China vary greatly in quantitative results. Martin (2001) uses the GTAP, a static computable general equilibrium model, to estimate the benefits of China's accession to the WTO. He estimates an increase in China's GDP of 2.2% due to accession to the WTO. Wang (1999) developed a a computable general equilibrium model, and predicted a 4% increase in GDP and negative change in terms of trade for China. Zhang, Zhang and Wan (1998) estimated the cost of protection in China, adopting a computable partial equilibrium developed by Uimonen. Zhang et.al (1998) predict that the benefit of removing all tariff and non-tariff barriers in China cound bring an increase in GNP of as much as 14%. The study does not take into account dynamic gains from trade or interactions among sectors. McKibbin and Tang (1998) study the role of international financial flows in the Chinese economic reforms. The idea that most of the gains of economic liberalization may come from internal reforms is not new. Frazier (1999) notes that the real importance of China's accession to the WTO is not the possible benefits that some US firms may get in the short run from a major access to Chinese markets but the long run benefits that will derive from the restructuring of the Chinese economy. Claro (2001) points out that the effects of eliminating the dual economic system will be much higher than the effects of pure trade liberalization. In his paper he is concerned about the benefits derived from transfers of technology between foreign and domestic enterprises, and does not consider the fact that the dual system may exist within a country where a competitive sector is allowed to

co-exist with the state firms. Furthermore, his model is static and, therefore, does not take into account the dynamic effects of trade liberalization.

This paper is organized as follows. In section 2 we describe the Chinese economy and the conditions for China's accession to the WTO. Section 3 presents the model economy. Section 4 contains the calibration of the model to the Chinese economy. Section 5 presents the results of steady state comparative statics. In section 6 we describe the transitional dynamics. Section 7 concludes.

2 China and the WTO

This section is divided in two parts. The first part briefly describes the characteristics of the Chinese economy and its performance since the beginning of the liberalization process. It also describes the importance of SOEs in the production process. In the second part we summarize the conditions under which China gains accession to the WTO.

2.1 The Chinese Economic Liberalization

The Chinese economy was essentially a central planning economy prior to 1978. The liberalization process started with Deng Xiaoping's advocating an "open to the inside and open to the outside" policy. Open to the outside led to a series of policies liberalizing international trade and foreign direct investment. The "open to the inside" policy led to the introduction of the market system, the introduction of competition, economic incentives to the state sectors, and allowing non-state ownership to exist and develop. The simultaneous opening to the inside and the outside creates interactions between two dynamic transformations, making it more complex to account for the policy impacts.

The Chinese economy has gone a long way since it initiated its economic liberalization. In PPP terms, China was the second largest economy in the world in 1997, with a GDP of $4.4 trillion (57% of the size of the US economy. By nominal exchange rate, China has just become the sixth largest economy with GDP $1.2 trillion in 2001. It accounts for about 11% of world GDP, and 50% of Asian GDP. Given its large population size, the GDP per capita was $3,570. [USITC – World Bank.].

The average growth rate from 1983 to 1992 was of 10.2%. This rate decreased a bit to 9.7% in the period 1993-2000. The annual growth rate decreased in the 1990s, from 13.5% in 1993 to 7.1% in 1999.[IMF World economic outlook, 2001].

China's trade with the rest of the world has expanded substantially since the beginning of the economic liberalization. China's merchandise trade with the world went from a deficit to a surplus of $43 billion in the period of 1990 to 1998.[USITC]. In terms of China's current account, it went from a current account deficit of 11.9 billion dollars in 1993 to a surplus of 20.5 billion dollars in 2000. [IMF World Economic Outlook]. Not only the volume, but also the composition of trade has change since the beginning of the liberalization process. In 1980, China's exports and imports of manufactures accounted for about half of total exports and imports. In 1997, manufacturing exports accounted for 87% of total exports, whereas manufacturing imports accounted for 80% of total imports. [USITC]

In terms of exports, China was the 7th largest exporter of merchandise trade and the 8th largest importer in the year 2000. In service trade, it was the 12th exporter and the 10th importer. [WTO annual report, 2001]

In terms of financial markets, China is the recipient of 40% of the FDI that goes to developing countries, and is the second world recipient of FDI, after the US. Portfolio investment in the country is very small, at a level of 5% of GDP in 1995. The reason for this is that the financial markets in China are very underdeveloped and that the government has a lot of restrictions on capital account transactions.

With respect to industry, following the Soviet Union's economic structure, the Chinese industries were mostly state owned at the beginning of the economic reform. The state sector dominated virtuously all non-farm sectors. In 1980, SOEs accounted for 76% of industrial output. After the reform, this share decreased to 25.5% in 1997. [Chen and Divan, 2000]. The reason is that with the reduction of subsidies and protection, half of SOEs are facing losses. Most of the growth in the Chinese economy in the past decade is accounted for by the growth of private and collective enterprises. TFP growth in the state sector has increased a little, due to capital deepening, but not at the same rate as the TFP in the non-state sector. Further reduction of subsidies under the WTO agreement will reduce even more the importance of SOEs in Chinese production.

The existence of SOEs and the dual economy affects the Chinese economy

mainly in an inefficient distribution of resources. Domestic policies that protect workers in SOEs against lay offs, cheap loans from the state owned commercial banks, as well as other forms of government subsidies keep the SOEs afloat. Gradual liberalization since the 80s has helped to reduce the problem, at the expenses of social unrest due to the fact that the private sector cannot absorb all the workers that lose their jobs in the SOEs that collapse.

The total employment in China contains 696 million people, half of which are working in agriculture. Among the half that reside in urban areas, 110 million people work for state-owned units, which was more than 30% of urban employment. The manufacture sector has been dominated by state sector, even though the role of state is declining. In 1999, 35 million people work in manufacturing, and 17 million of them work are in state-owned units, which was 47% of total. The level of wages paid by the SOEs, once the fringe benefits are taken into account, are comparable, or can be higher according to Chen and Diwen (2000), to the wages paid by non-state enterprises. This evidence is used in the model where we assume that both, the state and the non-state enterprises pay the competitive wage to their workers.

Despite the inefficiency of SOEs, over 65% of capital formation took place in the public sector in the period 1994-97. SOEs consumed 70-80% of Chinese savings over the recent years. This was possible because the direct subsidies by the central and local governments, plus subsidies from state banks to the SOEs, by lending to them at a very small interest rate. Chen and Divan estimate that 20-40% of these loans are non-performing.

In summary, the Chinese economy is undergoing deep transformation since the beginning of the liberalization. Inefficient SOEs, highly subsidized in their investments and their labor income are losing ground in the industrial arena gradually, as the subsidies are removed. This more efficient intertemporal allocation of resources is what we see as the greatest gain from accession to WTO. These gains will be captured in the long run, after the economic transformation has taken place. In the short run, distress caused by collapsing SOEs, in terms of lost jobs and output, are what makes accession to WTO necessary as a commitment device.

2.2 China's WTO accession agreement

On November 11, 2001 China ratified the WTO agreement and became the 143rd member of the WTO on December 11, 2001. As a result of the negotiations, China commits to give a uniform and non-discriminatory treatment to the enterprises of all the WTO members. All enterprises in China and in other WTO members shall gain the right to trade.

Radically, a list of non-traded barriers are to be abolished, including import licensing, quota and "specific import tendering requirements for machinery and electronic products". Quotas are either to be removed or to increase at 15% of annual rate. Another radical measure is to enforce the TRIMs Agreement immediately and without the recourse of the provision available to developing countries to phase out within up to five years. This essentially eliminate the local contents requirement and the export requirement for foreign direct investment.

In terms of subsidies, China has agreed to remove all subsidies to SOEs and others as specified in the Agreement on Subsidies and Countervailing Measures (SCM) upon accession.

The elimination of dual prices is also an important issue, which will imply the reduction of subsidies to SOEs and, thus, change the industrial structure of the country substantially. The agreement calls for the implementation of these policies in a gradual manner, usually in a period of 3 to 5 years. China also compromises to enact legislation to comply with the WTO agreement.

Under the agreement, the average bound tariff level will decrease to 15% for agricultural goods and to 8.9% for industrial goods. Most tariffs will be reduced or eliminated by 2004, and no later than 2010. In some sectors, the reduction will be important. For instance, in the automobile industry, tariffs will decrease from 80-100% to 25% by 2005. For most of the goods exported to China, though, the tariffs are already low.

In agriculture, China commits to eliminate exports subsidies and to limit its subsidies to the sector to 8.5% of the value of farm output. The most important concessions come in the area of services. China compromises to open its telecommunication, financial, distribution, and insurance markets to foreigners. After a phase-out of three years, foreigners will be able to have stake in companies that service all costumers, without geographical restrictions.

In exchange, China will have the guarantee of access to the markets of

all WTO members. China will also be party to the Agreement on Textiles and Clothing, which will completely eliminate the quotas on textiles of the Multi-Fiber Agreement from China at the end of 2004. This is probably the most important market that China will have access to. As Lardy pointed out, China gain a small accession to the markets with a great price. China has agreed to a disadvantageous term on anti-dumping for up to 15 years of accession, and a utterly disadvantageous and asymmetrical safeguard for up to 12 years. WTO members will keep a safeguard Mechanism that they can apply freely without proof or evidence, if they claim that imports from China threaten to cause a market disruption to domestic producers of other WTO members. And China cannot take any action within two or three years. These measures undermines the goal of WTO and serves as a curb for the growth of Chinese exports.

3 The Model

Our model is in the spirit of Fernandez de Cordoba and Kehoe (1999), with the extension of the explicit modeling of the dual economy. In the domestic country, highly subsidized domestic firms co-exist with firms that behave competitively. We can interpret the competitive firms as foreign firms entering the domestic market or, as in the case of China, a combination of foreign firms and domestic entrepreneurs who are not covered by the government subsidies and, therefore, are not subject to government regulations on employment. We model the domestic economy as a small open economy. This assumption means that we take the world interest rates as exogenous. Since we are considering developing countries, with underdeveloped financial markets, we believe that this assumption is not very restrictive. We model the rest of the world (ROW) as a demand function for the products of the domestic economy. The rest of the world also lends at a fixed interest rate and exports goods to China at the given price.

There are four goods in the model: two goods produced at home, a tradable good (good 1) and a non-tradable good (good 2), a composite of the tradable good, which is consumed and used as intermediate good, and an investment good that is transformed in capital in one period. The goods produced at home can be produced by the state-owned enterprises (SOEs) and by the private sector. We denote by "private sector" in this paper the non-

state sector. In this way, it includes all collective enterprises, entrepreneurial businesses and foreign enterprises. We designate the state sector with the subscript G for government, and the non-state sector with P for private. The factors of production in this economy are capital, labor, the non-traded good, and the composite traded good. There are adjustment costs on capital that limit its mobility from one sector to another.

3.1 Consumers

There is a measure l of identical, infinitely-lived consumers in the country. People are endowed with one unit of time, which they supply inelastically. Consumers derive utility from the consumption of both, the traded and the non-traded goods. The representative individual solves the following problem:

$$\begin{aligned} \max \quad & \sum_{t=0}^{\infty} \beta^t \frac{\varepsilon c_{1t}^{\rho} + (1-\varepsilon) c_{2t}^{\rho} - 1}{\rho} \\ s.t. \quad & p_{1t} c_{1t} + p_{2t} c_{2t} + a_{t+1} = w_t + (1 + r_t) a_t + TC_t \\ & \\ & a_t \geq -A \\ & a_t = q_{1t-1} k_{1t} + q_{2t-1} k_{2t} + b_t \\ & k_{10}, k_{20}, b_0 \text{ given} \end{aligned}$$

where c_{it} is the consumption of good i at period t, p_{it} is the price of good i at period t, a_t represents the assets held by the individual at period t; w_t and r_t are the wage rate and the return to savings at period t, TC_t represents the net transfers from the government to consumers; k_{it} is the capital of type i held in period t and $q_{i,t-1}$ is the return at period t of capital of type i invested at $t-1$ to be used in period t. Notice that in the utility function that we are considering the elasticity of substitution between goods is the same as the intertemporal elasticity of substitution, $1/(1-\rho)$. We make this assumption for simplification purposes, and we do not expect the quantitative results to change much with a more general utility function.

The definition of a_t needs further explanation. Consumers in this economy can hold three types of assets: capital in each of the sectors, and foreign bonds, b_t. Therefore, q_{it} represents the price of the investment good in sector i relative to the world price of the tradable good (taken as a numeraire). By treating investment goods in different sectors as different goods, we are able

to introduce imperfect capital flow between the two sectors, and capture the fact that capital is not completely mobile across sectors.

3.2 Producers

All sectors use capital and labor, as well as tradable and non-tradable inputs in their production process. The production function for a private firm in sector j is defined as:

$$y_{DPj} = \min \left\{ \frac{z_{Pj1}}{za_{Pj1}}, \frac{z_{Pj2}}{za_{Pj2}}, A_{Pj} k_{Pj}^{\alpha_j} l_{Pj}^{1-\alpha_j} \right\}$$

where y_{DPj} is the domestic production of good j by the private sector, z_{Pji} is the use of good i by industry j in the private sector, za_{Pji} is the amount of good i that the private sector needs to produce one unit of good j. The production function is, thus, Leontief relative to both the traded and non-traded goods, and Cobb-Douglas with respect to the capital and labor inputs. This choice of production function, standard in the literature of CGE models, makes calibration straight forward from the input-output tables.

The firm's objective is to choose the amount of inputs in order to maximize profits. In doing so, firms take as given the prices of the intermediate inputs, the price of their product, wages and rental rates of capital. Firms also take as given the government policy, which in the case of private firms represents ad valorem taxes on their final product. We will denote t_{Pjt} as the tax rate charged to private firms in industry j in period t.

Government enterprises have a production function with the same structure:

$$y_{DGj} = \min \left\{ \frac{z_{Gj1}}{za_{Gj1}}, \frac{z_{Gj2}}{za_{Gj2}}, A_{Gj} k_{Gj}^{\alpha_j} l_{Gj}^{1-\alpha_j} \right\}$$

Notice that we allow for the technologies of the private and government enterprises to differ in the unit costs of each of the intermediate inputs as well as the technological level in producing value added. We take the labor share to be the same in both industries. Therefore, government policy will capture any differences in the capital-labor mixture that may exist between the different types of producers.

SOEs also maximize profits taking all prices as given. We justify this assumption with anecdotal evidence. Once the government policy on subsidies and labor controls is set, the managers of the state enterprises make their choices on how much to produce. They seem to behave competitively.

We capture government regulation of the SOEs in three ways. First, taxation on the final product may differ from the tax rates on private enterprises. We denote by t_{Gjt} the tax rate on SOEs in sector j. Second, SOEs receive subsidies on capital. If we denote by R_{Gjt} the free-market rental rate of capital that a state enterprise in sector j would face, the firm actually faces the rate $(1 - s_{Gjt})R_{Gjt}$. This subsidy captures the fact that the government uses state-owned banks to provide cheap loans to the SOEs. Finally, SOEs face restrictions on lay offs in exchange from the government subsidies. We capture this fact by introducing a minimum labor requirement each period, $\bar{l}_j$.

The SOE problem is, thus, to maximize profits given the labor requirement imposed by the government and the subsidy on capital. If the labor restriction is not binding, the SOE makes zero profits. If the labor restriction is binding, the SOE may make negative profits. If this is the case, the government picks up the receipt. We interpret the negative profits as a subsidy to labor by the government.

We assume that the goods produced by the state and the non-state enterprises are perfect substitutes. Therefore, the total amount of good j produced in the country, y_{Dj} is just the sum of the quantities produced by the state and the non-state firms.

Notice that as long as the labor requirement is positive, the state enterprises will always produce a positive amount. Furthermore, private enterprises can co-exist with state enterprises in a given sector only if the labor restriction for the state enterprises is binding.

In order to account for intra-industry trade, we introduce the Armington aggregator assumption in the tradable good. We assume that the domestically produced and the foreign produced traded goods are not perfect substitutes. In particular, the traded good purchased by consumers and firms in the country is a composite of the domestically produced traded good and the traded good imported from the rest of the world. We denote this composite by y_j. The Armington aggregator takes the following form in this model:

$$y_j = M\left(\mu x_{Dj}^{\zeta} + (1-\mu)m_j^{\zeta}\right)^{1/\zeta}$$

where x_{Dj} is the demand for the domestically produced good j and m_j is the import demand for good j.

The investment good is a composite of the traded good and the non-traded good, which are combined in the following production function:

$$i_{t+1} = G z_{I1}^{\gamma} z_{I2}^{1-\gamma}$$

Here, i_{t+1} is the investment good purchased in period t to be used as capital in period $t+1$. The variable z_{Ij} represents the amount of good j used as an intermediate input in the investment sector. As in Fernandez de Cordoba and Kehoe (1999) we interpret the inputs to investment as equipment (traded good) and structures (non-traded good). The investment good can be used in either sector to increase the capital stock in the sector. To take into account the fact that moving capital from one sector to another is costly, we introduce adjustment costs to capital. We model the adjustment costs in the following way:

$$k_{sjt+1} = \phi\left(\frac{i_{sjt+1}}{k_{sjt}}\right) k_{sjt} + (1-\delta) k_{sjt}$$

Where the adjustment function $\phi()$ is assumed to be increasing in the investment-capital ratihave the following properties: $\phi'(i/k) > 0$, $\phi''(i/k) < 0$, $\phi(\delta) = \delta$, $\phi'(\delta) = 1$. The first two properties state that $\phi()$ is increasing and strictly concave in the investment-capital ratio. The last two properties are needed for the existence of a steady state with depreciation rate δ. Lucas and Prescott (....) show existence and uniqueness of equilibrium in a model with adjustment costs with this specific form. The specific adjustment cost taken here is adopted from Kehoe (...) and it is a one-parameter function, η, that satisfies the conditions listed above. The particular function is:

$$\phi(x) = \left(\delta^{1-\eta} x^{\eta} - (1-\eta)\delta\right)/\eta, \quad 0 < \eta \leq 1$$

3.3 Government

The government in this economy balances its budget every period. Government revenue comes from taxes on producers of final goods, T, and from tariff revenue, TR. Government outlays come from purchases of each of the goods in the economy, g_j, determined exogenously and subsidies to capital

and labor hired by the SOEs, S_K and S_L. Any excess funds (costs) are transferred to (bared by) the consumer in the form of net government transfers, TC. The budget constraint that the government faces is the following:

$$p_1 g_1 + p_2 g_2 + S_K + S_L = TR + T + TC$$

Subsidies to capital are the total subsidies to each of the industries, and are a proportion of the market determined real return on capital:

$$S_K = \sum_j s_j R_{Gj} k_{Gj}$$

As we have mentioned before, the losses that arise from the SOEs are a result of the labor restrictions imposed by the government. We interpret this losses as subsidies to labor.

$$S_L = -\sum_j \Pi_{Gj}$$

Tax revenues come from output taxation in each industry and sector:

$$T = \sum_j t_j p_{Dj} (y_{DPj} + y_{DGj})$$

Government also gets tariff revenue from imports of the foreign good. We denote by τ_{Dj} the ad valorem tariff on the imported good in industry j.

3.4 Rest of the world

We model the foreign country as an import demand function for the domestically produced traded good. The domestic exporters face an ad valorem tariff of τ_F when selling to the rest of the world. The foreign demand, denoted by x_{F1} is modeled as:

$$x_{F1} = D \cdot ((1 + \tau_F) p_{D1})^{-1/(1-\zeta)}$$

3.5 Feasibility conditions

Feasibility in this economy implies that all markets will clear as well as that the balance of payments balances every period. The balance of payments account states that any trade deficit will be counteracted by a capital account surplus of the same amount. Formally,

$$m_{1t} + b_{t+1} = p_{D1t}x_{F1t} + (1 + r_t)b_t$$

Within the domestic country, feasibility implies that all markets clear. In the tradeable good market, the domestic and foreign demand for domestically produced traded good have to add up to the total amount of good produced:

$$x_{D1} + x_{F1} = y_{D1}$$

The market for the non-tradable good and the market for the composite tradable good also have to clear. Formally,

$$g_j + c_j + \sum_i (z_{Pij} + z_{Gij}) + z_{Ij} = y_j$$

That is, the consumption by the government, consumers, firms and the investment composite of a good j has to equal its total production in the country.

Market clearing in the investment composite implies that the total investment done in the country at a specific period equals the amount of investment composite produced in the country:

$$\sum_j (i_{Gj} + i_{Pj}) = i$$

Factor markets also clear. This implies that the demand for labor in the country equals the total amount of workers available in the country and that total capital used in the country equals its stock of capital:

$$\sum_j (l_{Gj} + l_{Pj}) = l$$

$$\sum_j (k_{Gj} + k_{Pj}) = k$$

3.6 Equilibrium

The equilibrium in this economy, given initial levels of capital in each sector, initial total foreign debt, and given government policies, is defined as follows:

Definition 1 *Given government policies, k_{Pj0}, k_{Gj0}, b_0, and the world interest rate in periods when the economy has open capital markets, the equilibrium of this economy is determined by a set of sequences: consumer decisions:$\{c_{jt}, a_{jt}, b_t\}_{j,t}$, private firms' decisions $\{z_{Pj1t}, z_{Pj2t}, k_{Pjt}, l_{Pjt}, y_{DPjt}\}_{j,t}$, SOEs decisions: $\{z_{Gj1t}, z_{Gj2t}, k_{Gjt}, l_{Gjt}, y_{DGjt}\}$ investment decisions $\{z_{I1t}, z_{I2t}, i_t, i_{Pjt}, i_{Gjt}\}_{j,t}$, prices $\{p_{jt}, p_{Djt}, w_t, r_t, R_{Pjt}, R_{Gjt}\}_{j,t}$, and import decisions, $\{x_{D1t}, x_{Ft}\}_{j,t}$ such that,they satisfy the consumer and producers' problems, all markets clear, and the law of motion for capital in each industry and sector is satisfied.*

It can be proven that an equilibrium for this economy exists and it is unique.

4 Calibration

4.1 The input-output matrix

To study the effects of each of the policies in the economy, we calibrate the model economy to the Chinese economy and perform policy exercises. In calibrating the model we want to match data on the Chinese NIPA accounts and in its input-output matrix.

We calibrate the productivity parameters to the Chinese input-output matrix for 1997. The matrix as reported in the *China Statistical Yearbook*, contains 15 sectors which we aggregate into a tradable and a non-tradable sector. Once the aggregated matrix is constructed, we normalize each value to be a percentage of GDP. The way we aggregate the sectors is the following: traded goods: agriculture, mining and quarrying, foodstuffs, textiles and garments, other manufacturing, coke gas and petroleum refining, chemicals, non-metal mineral products, metal products, machinery and equipment. The non-traded goods are: electricity and hot water, construction, transport and communications, commerce and restaurants, public utilities, banking and insurance, and other services. ADJUSTMENTS MADE: In adjusting the matrix, we put the "other" as a use of a good in imports, and we get rid of

the "traded" part of the goods that we consider non-tradable. Note: the table shows a volume of trade of 10% and 15% of total production in restaurants and commerce and in public utilities. More research in this area is needed to figure out what is going on.

Following standard procedures in the calibration of computable general equilibrium models (See Kehoe and Kehoe (....)) we normalize all prices in 1997 to one, except the real interest rate and all quantities to be equal to their monetary value in 1997, except the capital stock.

The input-output matrix does not distinguish between the non-state sector and the SOEs. Since in our model we have this distinction, we need to split the expenditures of each sector between expenditures done by the non-state enterprises in that sector and expenditures done by SOEs in the sector. The procedure to create the entries for the private sector and the SOEs from the data given is the following:

- From the China Statistical Yearbook we obtain that the SOE's share of output in the tradable good is 21% and in the non-tradable good is 60% [Need to do this calculation more carefully and report the table]. These data allow us to separate production in each sector by ownership.

- From the same source, we obtain that the SOE's share of employment in the traded sector is 9.5% and in the non-traded sector is 50%. With this information we separate labor in each sector by ownership.

- We assume that the unit costs of intermediate goods is the same for both, the SOEs and the non-state enterprises. Under this assumption, the share of intermediate goods used in by the SOEs is the same as the SOE's share of output.

- We assume a uniform tax rate in each sector. Therefore, the SOEs account for the same share of taxes as of output.

- The only item that is left to split is the capital income. The procedure here is slightly more complicated due to the fact that we have subsidies to capital in the state sectors. We first calibrate the capital share. In the model, we assume a uniform capital share for all ownerships in a sector. We calibrate the labor share of output using labor and value added of the private sector (notice that since we assume the same unit

costs, the SOE's share of value added is the same as the SOE's share of output). The capital share, α_j is just one minus the labor share. Given output and the capital share, we can compute capital income in the private sector from the firms' first order condition in steady state:

$$\frac{\alpha_j y_{DPj}}{k_{Pj}} = (r + \delta)$$

Given the capital income in the non-state enterprises, we compute the capital income in the SOEs by subtracting the former from the total capital income in the sector.

This procedure allows us to separate expenditures in each sector between SOE expenditures and non-state owned expenditures.

4.2 Production function in each sector

We assume the same technology for all forms of ownership in the use of intermediate goods. Under this assumption, the unit costs a_{Pji} and a_{Gji} are equal, for all j, i.

The labor share of income, α_j is calculated from labor income and total output in the private enterprises, for each sector.

To compute the technology level, we need an estimate of the capital stock. We construct a capital stock series using data from China Statistical Yearbook. First we calculate the depreciation rates using investment data and capital stock data that is available for state sectors. Since no good data source were found on depreciation rates on other types of ownership, we use the depreciation rates we obtained for the state sector to approximate the country level depreciation rates. Average growth rate of investment is calculated and used to construct investment in early years that data are not available. Then Harberger-type perpetual inventory method is used to construct capital stock using the investment and depreciation rates derived in previous steps.

Given the aggregate capital stock K, and an estimate for depreciation, which we take it to be 8.1%, the average depreciation rate we constructed before between 1987-1996. We back up the interest rate r_0, which turns out to be 16.8%. We obtain capital in each sector by ownership by dividing its

capital income by the return to capital, $r_0 + \delta$. The technology parameter is then computed as:

$$A_{sj} = \frac{y_{DPj}}{k_{sj}^{\alpha_j} l_{sj}^{(1-\alpha_j)}}$$

4.3 Armington aggregator

We take the elasticity parameter, ζ_j to be equal to .5 as in Fernandez de Cordoba and Kehoe.. We get imports and exports from the input-output matrix. We compute the domestic demand for good j as $x_{Dj} = y_{Dj} - ex_j$ where ex_j is export demand. Recall that since we assume the non-state and the SOE production to be perfect substitutes, we only need the aggregated numbers in each sector to calibrate these parameters. We obtain the weight parameter μ from the first order conditions after normalizing all prices to one:

$$m_j = \left(\frac{1-\mu_j}{\mu_j} \frac{1}{(1+\tau_{Dj})} \right)^{\frac{1}{1-\zeta_j}} x_{Dj}$$

Notice that we need an estimate for the tariff rate. We explain below how we obtain it. Finally, the technology parameter M_j is obtained from the equation that writes the price of the composite traded good as an index price of the domestic and foreign traded goods, after all prices are normalized to one.

4.4 Foreign demand

Given exports from the input-output matrix and the tariff rate (we explain below how it is calibrated), we can calibrate the parameter D_j right from the expression of the foreign demand.

4.5 Investment function

We obtain the expenditures in each sector for investment from the input-output matrix. We calibrate the parameter γ_j as the expenditures in good j over total investment. The technology parameter G_j is obtained:

$$G_j = \frac{I}{\prod_j z_{Ij}^{\gamma_j}}$$

where I stands for total investment.

4.6 Capital adjustment costs

The depreciation rate δ is taken to be 8.1%. This rate is by taking the average depreciation rate from 1987-1996 using State Investment data from China Statistics Yearbook. We constructed the depreciation rate using capital stock of SOEs in original value (no depreciation) and net value (taking out the depreciation). The adjustment parameter η is taken to be .95 as in Fernandez de Cordoba and Kehoe.

4.7 Preference parameters

We obtain consumption data from the input-output matrix. The values of ε_j are obtained from the first order conditions of the consumer and the fact that $\sum_j \varepsilon_j = 1$. We take β to be .95 so that each period represents one year, and ρ to be -1. This gives an intertemporal elasticity of substitution of .5.

4.8 Interest rate and borrowing

Interest rate is calibrated given an estimate of total capital and of depreciation. It turns out to be 16.8%. We assume balanced trade in the first period (before the country opens its capital markets). So $b_0 = 0$.

4.9 Policies

We take policies in this model as being exogenous. The policy exercises that we perform have to do with changes in the policy parameters. We obtain government purchases, g_j, of traded and non-traded goods from the input-output matrix. The labor restriction policy,$\bar{l}_j$: we assume that the SOEs cannot fire people. We take as initial employment values the ones calibrated from the input-output matrix. We take the foreign tariffs on Chinese goods to be the average tariff on a country with a "most favorable nation" trade status. The tariff rate is 5.2% taken from Yao(). Chinese tariffs are difficult to calibrate, since the actual tariff rates applied to foreign goods are much lower than the official tariff rates. China also has important non-tariff barriers which increase the protection on Chinese goods. The "Journal of Policy Reform paper" estimates the actual tariff rate on manufactures at 2.56% and the NTB at 15.9%. So we take a value for τ_{Dj} of 17.65%. The NTB

are required to be phased out by 2005 at a rate of 15% annually. We will use this fact to study the effects of China's accession to WTO. The tax rate t_j is calibrated from the input-output matrix Subsidies on capital for SOEs, s_j. We calibrate these so that the first order condition on the SOE in their maximization with respect to capital is consistent with the steady state assumption. That is, it has to be true that:

$$\frac{\alpha_j y_{Gj}}{k_{Gj}} = (1 - s_j)(r + \delta)$$

4.10 Calibrated parameters

Please see Figure 1 for the values of calibrated parameters.

5 Simulations: Comparative Statics in Steady State

In this section we present the steady state results for the benchmark economy and compare them with the long run equilibrium after reducing each, the labor restriction policy, subsidy to capital, and both at the same time by 10%. This is done in the closed economy version and the open economy version, where the country opens its capital markets after 5 periods. Notice that in the open economy case, the steady state is path dependent: the initial conditions determine the level of borrowing that will be done in steady state.

5.1 Closed Economy

Comparing the benchmark case with the reduction in policies we observe that the higher increase in GDP occurs with the reduction of the labor restriction. The labor restriction is the most important friction in this model. The intuition is simple: the SOEs are inefficient firms. The only reason why they are allowed to co-exist with the most efficient, private firms is because they maintain the employment level. The optimal solution, even with a capital subsidy, is to let them fail. Not doing so reduces the long run real GDP and welfare. We compare steady state welfare by looking at equivalent variation, that is, how much consumption would have to increase in the benchmark economy in order for consumers to have the same level of welfare as in the

economy with reduced labor restriction. The number we obtain is 2.7%. That is, a reduction of the labor restriction by 10% (this is equivalent in our model to reducing the labor force employed by the SOEs by 10%) leads to an increase in real GDP of 1.7% and and increase in welfare of 2.7%. Notice that the SOEs share of output decreases by 11% in each sector. Total factor productivity (TFP) also increases.[1]

The highest impact on steady state welfare comes from reducing both policies, even though the increase in steady state real GDP is lower when we also reduce the subsidy together with the labor restriction. This is due to the fact that the reduction of the subsidy actually reduces the steady state real GDP. Welfare, though, increases with the reduction of the subsidy by 1.8%. The reason for this is that a lower subsidy reduces capital in steady state and therefore output is lower. TFP increases by more than the reduction in labor. The reason for this is a reallocation of resources from traded to non-traded sector. The SOE loses ground in the traded sector, so the private sector moves capital into it. The non-traded sector, mainly stated owned, actually increases its share of output produced by SOEs as the private sector concentrates in producing traded goods. Notice that the SOEs are highly subsidized in the traded sector, so a reduction of subsidies by 10% is more significant than in the non-traded sector. Notice also that the difference in productivity between SOEs and the private sector is also much higher in the traded sector. The increase in welfare is lower than with the reduction of labor.

In order to understand the effects of the different policies in the steady state for the closed economy, we plot the steady state values of real GDP, the SOEs shares of output and the period utility as the subsidy and labor restrictions are reduced. In the x-axis we show the percentage reduction from the calibrated subsidy. Figures 2-4 show the effects of the reduction in the labor restriction. In figure 3 we plot the reduction of SOEs share of income. It is linear relative to the decrease in the subsidy. We can say that the restriction to labor has an almost linear effect on the steady state SOE shares of output and on real GDP (figure 2), which increases by almost 20%. The effect on welfare is also increasing. (Figure 4).

[1]We measure TFP as $Y/(K^{\alpha}L^{1-\alpha})$ where Y is real GDP, K is total capital in the economy and L is total labor. We compute α as the average of α_i, with $\alpha_i = (RK_i)/Y_i$ where RK_i is real capital income in sector i. Notice that different measures of α will change absolute values, but not the directions of improvement in TFP.

Identical exercise for the reduction of the subsidy to capital delivers different results. The results for this case are plotted in figures 5-8. Figures 5 and 6 plot the SOE shares for each industry as the subsidy to capital is reduced. Notice that the SOE share for industry 2 is increasing for a while but then decreases when the subsidy is sufficiently reduced. The intuition here is the following : since the traded good is more subsidized than the non-traded good, private firms concentrate in the production of the traded good, where they have the comparative advantage, and which has been liberalized further than the non-traded sector in absolute values. That produces the pattern. Once subsidies are sufficiently reduced, SOEs stabilize and the dominating effect is that lower subsidies reduce SOE shares in all industries.

Real GDP decreases with the subsidies, since the economy has less capital in steady state and the TFP does not increase that much with reallocation of resources from the public to the private sectors (figure 7).

An interesting result is plotted in figure 8. Figure 8 shows the period utility in steady state as a function of the reduction of the subsidy [Need to do the equivalent variation]. It has a hump shape. My intuition of this result is the following: the result is related to the level of capital in steady state that delivers the optimal consumption, or the Golden Rule. There is an optimal subsidy that delivers the maximum amount of consumption in steady state. Since we have restrictions to labor, this optimal subsidy is not zero.

5.2 Open Economy

In this section we run the same experiments as for the closed economy, but assuming that the economy opens its capital markets after 5 periods. Opening capital markets means that the economy can borrow from abroad at the world interest rate, r_*, which is also the interest rate prevailing in the economy, due to the small open economy assumption. The results are similar to the ones in the previous section. Real GDP increases more when reducing both policies, compared to the case with a closed economy. Increases in TFP are also much higher here, by a magnitude of 3, but the same ordering prevails. The reduction of SOEs shares of output is of the same magnitude as in the case of a closed economy, as are the equivalent variations.

One thing to notice in this case is that reducing subsidies to capital has a stronger positive effect in the open economy relative to the closed economy.

Specific variables of the open economy case are the borrowing level and the balance of payments. In all situations, the country is borrowing from abroad in steady state, with the highest borrowing happening in the benchmark case and the lower when both subsidies are reduced. Here it turns out that the reduction in subsidies to capital is mainly responsible for the decrease in borrowing.

Borrowing is financed by a trade surplus. Notice that the steady state value of borrowing here is path dependent. There exists a continuum of steady states, one per each level of borrowing.

5.3 Open versus Closed Economy

Finally, we compare the steady state results of the policy experiments for the case of the closed economy relative to the open economy. At first sight, it is surprising that both in GDP terms and in welfare terms the open economy has lower values in steady state. The explanation is simple, though, and relies on the transition results that we present in the next section. In the open economy, individuals borrow heavily when the economy opens and are able to attain higher levels of consumption. These early borrowing has to be paid off later in steady state, where countries are running trade surpluses just enough to pay off the interest on the accumulated debt. When the whole equilibrium is considered, countries derive higher utility in the case of an open economy.

Another interesting feature is that when the subsidy to capital is reduced, the TFP increase is higher in the open economy, whereas it is lower in the benchmark and labor-only cases. This result comes from the fact that with the ability to borrow, more capital is accumulated in the economy. Higher levels of capital imply higher misallocation of resources since a high fraction of this capital goes to the SOEs. Again, robustness checks should be done here.

5.4 Summary

Given that the steady state in the open economy is path dependent, steady state comparisons do not tell the whole story. In particular, lower steady state welfare in the open economy is the result of higher welfare in early periods in the economy. Steady state comparisons, though indicative of the

effects of different policies, cannot be used as a measure of the order in which policies should be implemented. In particular, only comparing steady state values, opening the economy is the worst option, delivering lower welfare, GDP and TFP than the benchmark, closed economy. The policy implication, looking only at the long run results, would advise to reform domestic policies first, with emphasis in the labor restrictions. Opening the economy induces countries to get indebted and resources are used up in the long run to pay for this debt incurred in early periods, which decreases the amount available for investment and consumption, since countries need to run trade surpluses in the long run to pay off this debt.

Therefore, to answer the question of which policies should be liberalized first, it is key to study the transitional dynamics of the model.

6 Transitional Dynamics

In this section we study the effects of implementing the different domestic and trade policies by taking into account the transition pattern. We assume that the Chinese economy starts at the calibrated equilibrium and that people correctly forecast that there will be a change in policy in three periods. We assume that, following the provisions of the WTO agreement, that the domestic policy reform is gradually implemented in a period of 5 years (periods 3-8). We study the effect of a 10% reduction of subsidies and labor restrictions in the five year period. We also study the effect of capital market liberalization. We conduct three types of comparisons. First, we study in a closed economy the effects of implementing the different domestic policy reforms separately and both at the same time, relative to the case of no reform. We call this experiment domestic policy reform. Second we study the timing of capital market liberalization in an economy that does reform domestic policies. We call this experiment, time of liberalization. Finally, we study the effects of combining domestic reform with reform of the capital markets. We call this experiment domestic versus capital market reform.

The welfare results of these experiments are summarized as follows: the highest intertemporal welfare is achieved when both domestic policy reform and capital market liberalization are implemented. The sooner the capital market is opened, the better. Most of the welfare gain is achieved, though, by domestic policy reform. Capital market liberalization without domestic

policy reform delivers one of the worst welfare levels, second only to the case without reform nor liberalization.

6.1 Time of liberalization

Figure 9-11 presents the transitional dynamics of real GDP and TFP in two situations that differ only on the timing of capital market liberalization. In both cases, gradual domestic policy reform is implemented in the periods 3-8. In the first case, capital markets are opened in period 3 whereas in the second case they are opened in period 10, once the domestic reform has ended. In terms of welfare, the earlier the capital markets are liberalized, the better. The differences are, though, small. In terms of equivalent variation, the welfare gains of opening early are of .13%. Regarding GDP, the steady state values achieved are the same, but the transitional growth rates are different. After an early transition period, higher values of GDP are obtained by liberalizing the capital market early. On the other hand, expectations of early liberalization reduce GDP growth in the initial periods: capital is not accumulated as fast, as firms wait until the rental rate of capital decreases with the opening of the capital market. This feature of the model can explain the reluctance of some sectors in society to open capital markets, since it translates in to smaller GDP growth in the earlier periods. Comparing TFP values delivers similar results as the comparison of real GDP.

6.2 Domestic versus capital market reform

The highest welfare levels are obtained when both capital market reforms and domestic reforms are implemented. The domestic reform is producing most of the welfare gains, with capital market liberalization delivering only an increase in welfare of .15% in terms of equivalent variation, if the economy reforms domestic policies, or of .04% if it does not. The most interesting results are obtained when we compare real GDP and TFP figures. Figure 12-14 presents the results of such comparisons. We observe that the steady state values for real GDP are very similar, with the highest value obtained when the economy reforms domestic policies but does not liberalize capital markets and the lowest value obtained when no reforms are implemented. The transitional dynamics deliver a much richer picture. Domestic policy reform, as well as capital market liberalization reduces growth in the initial periods.

This fact explains, thus, why a commitment device to domestic reform, like accessing the WTO may be needed in order to get the reforms implemented. Liberalization and domestic reform produce the highest reduction of growth in the initial periods, but has a shorter transition, surpassing the output levels of the no-reform case in two periods, whereas it takes five periods to outpace the no-reform economy if the domestic reforms are implemented without capital market liberalization. The analysis of the TFP transitions is as expected: TFP is higher when domestic reforms are implemented, and it improves with liberalization. The intuition is as explained earlier.

6.3 Domestic policy reform

In terms of welfare we obtain the same results as in the steady state comparisons: The highest welfare is obtained when both reforms are implemented, with an equivalent variation compared to the case with no reforms at all of 5.5%.[2] Reducing the capital subsidy to the SOEs by an homogeneous 10% would produce an equivalent variation of 3.5%, whereas the welfare improvement, in terms of equivalent variation, for the case of labor reform only is of 2.3%. The intuition is simple: a reduction in the subsidies to capital for SOEs brings a higher welfare gain for two reasons: first, the subsidized economy accumulates more capital than what would be optimal since it is cheaper for the SOEs to rent it. Second, this excess of capital is also misallocated to the less efficient enterprises, the SOEs.

Figure 15-17 presents the transitional dynamics of real GDP and TFP for each of the simulated economies. In terms of output per capita, the highest steady state level of capital is obtained when only labor reform is implemented. The reason is two fold: the reduction in the labor friction frees workers from the SOEs into the more efficient private sector. Second, since the subsidies to capital are still in place, the country accumulates more capital than optimal and, thus, produces more output than in the less subsidized version of the economy. The same argument justifies the fact that the case with only subsidy reform produces the smallest steady state output in the long run. Regarding TFP the results are reversed. The case where both domestic policy reforms are implemented delivers higher TFP values over

[2]That is, to reach the welfare level that is obtained with both domestic reforms, the consumption in the case with no reforms should be increased by 5.5% every period and for all goods

the transition, as well as higher TFP growth. Furthermore, expectations of subsidy reform reduce investment in capital in the SOE sector, so TFP is also higher in the periods before the reform. It is interesting to compare the simulations for the cases of labor and subsidy reforms alone. Even though subsidy reform delivers higher TFP in the initial periods, TFP grows slower than when only labor reform is implemented, with the latter surpassing the former once the reform period is completed.

6.4 Summary

The transitional dynamics show that the Chinese economy can obtain major gains in terms of welfare and TFP from reforming domestic policies. Domestic policy reform, though, slows growth in the early periods of the transition. This reduction of growth together with other problems like increasing unemployment that are not modeled in this paper may make domestic reforms unpopular. If domestic reforms are combined with capital market liberalization, the overall welfare gains are higher, specially if the capital markets are opened right before the domestic reform begins, and the period of slow growth is shortened, even though the reduction in growth may be higher in the periods prior to the reform as people postpone their capital investments until after the liberalization. Therefore, accession to the WTO is a valuable commitment device to welfare enhancing domestic policy liberalization that may not be implemented otherwise due to the hardship that they bring to earlier periods.

7 Conclusion

In this paper we study why developing countries actively seek to join the World Trade Organization. These countries usually endow with a large amount of inefficient state sectors that live on government subsidies but also provide employment. Under these situation, which reform can bring forth more welfare gain to the country? Does the sequencing of reform and liberalization matter? Does the combination of bother reform out perform the case with only one reform? To answer these questions, we develop an applied dynamic general equilibrium model and calibrate it to the case of China's WTO accession.

Chinese government has started unilateral trade liberalization and domestic reform long before the accession of WTO. During 1992 and 2001, the structure of economy and the trade had changed dramatically. The share of SOEs dropped greatly, and the share of trade increased dramatically. However, by the late 1990s, it was agreed that the reform reached greater resistance. The entire SOE sector were making net losses for consecutive years. It was under such a situation that China actively negotiated and finally succeeded in the admission to the WTO. An interesting question arises: WTO does not bring forth much new markets for China, indeed the WTO agreement is rather like another unilateral liberalization. Then, Why would China spend so much effort to join WTO? Our results are very revealing: we find that liberalization actually can serve as a commitment for continual reform. In our computation of transition dynamics, we find that either liberalization or domestic reform will cause a slow down in growth at the initial periods, even though eventually the welfare will be higher than the benchmark non-reform case.

Our model features two type of domestic reforms: the reduction in labor restriction on SOEs, and the reduction in capital subsidies to the SOEs. Then we also have the capital market liberalization as a outcome of WTO accession. We find that the domestic reform, in particular, the reduction in labor restriction, results in the largest increase in GDP and welfare. In the steady state case, the introduction of capital market liberalization will result in negative impact to the GDP and welfare. However, when the transition is also considered, the total impact of liberalization on welfare and GDP is small but positive. This is because that even though the long term GDP is slightly smaller, the borrowing from the capital markets enables higher consumption in the early periods and more than compensate the slight difference in GDP in the long run.

Therefore, there are three messages that we think are important from our study: 1. the domestic reform is the vital one that brings most the benefit. 2. the capital liberalization brings a small but positive increase in welfare. 3. The WTO agreement can serve as a commitment for deepening the domestic reforms, even though the impact of liberalization alone is small.

Important future research can be done on three areas: 1. explicitly model the agriculture sector, which is very large in most developing countries. 2. to incorporate the non-tariff barriers, and 3. to incorporate unemployment.

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Figure 1: Calibrated Parameters

CALIBRATED PARAMETERS

PRODUCTION PARAMETERS

Unit costs of intermediates		
private (zaP)	*traded*	*non-traded*
traded	0.54	0.11
non-traded	0.37	0.19
public (zaG)		
traded	0.54	0.11
non-traded	0.37	0.19
Domestic producers		
alpha	0.24	0.44
aP	5.35	3.07
aG	2.33	2.35
Armington aggregator		
M	1.65	0.00
mu	0.73	0.00
zeta	0.50	0.50
Intestment technology		
G	1.94	
gamma	0.38	0.62
Depreciation		
delta	0.08	
Adjustment costs of capital		
eta	0.95	

PREFERENCE PARAMETERS

Utility parameters		
epsilon	0.87	0.13
beta	0.95	
rho	-1.00	
Foreign demand		
D	24.09	

INITIAL VALUE OF VARIABLES

	traded	*non-traded*
interest rate: r0	0.13	
foreign borrowing:	0.00	
investment	37.59	
Total labor: l0	54.87	
Capital:		
kP0	35.49	28.27
kG0	52.50	30.84

POLICY PARAMETERS

Labor restrictions		
lambda	10.58	11.77
Tariffs		
tauD	0.00	0.00
tauF	0.05	0.05
Subsidy to capital		
sg	0.83	0.08
Taxes		
taxP	0.13	0.11
taxG	0.13	0.11
Government consumption		
xg	0.00	11.52

Figure 2: Real GDP: Reduction in Labor Restriction

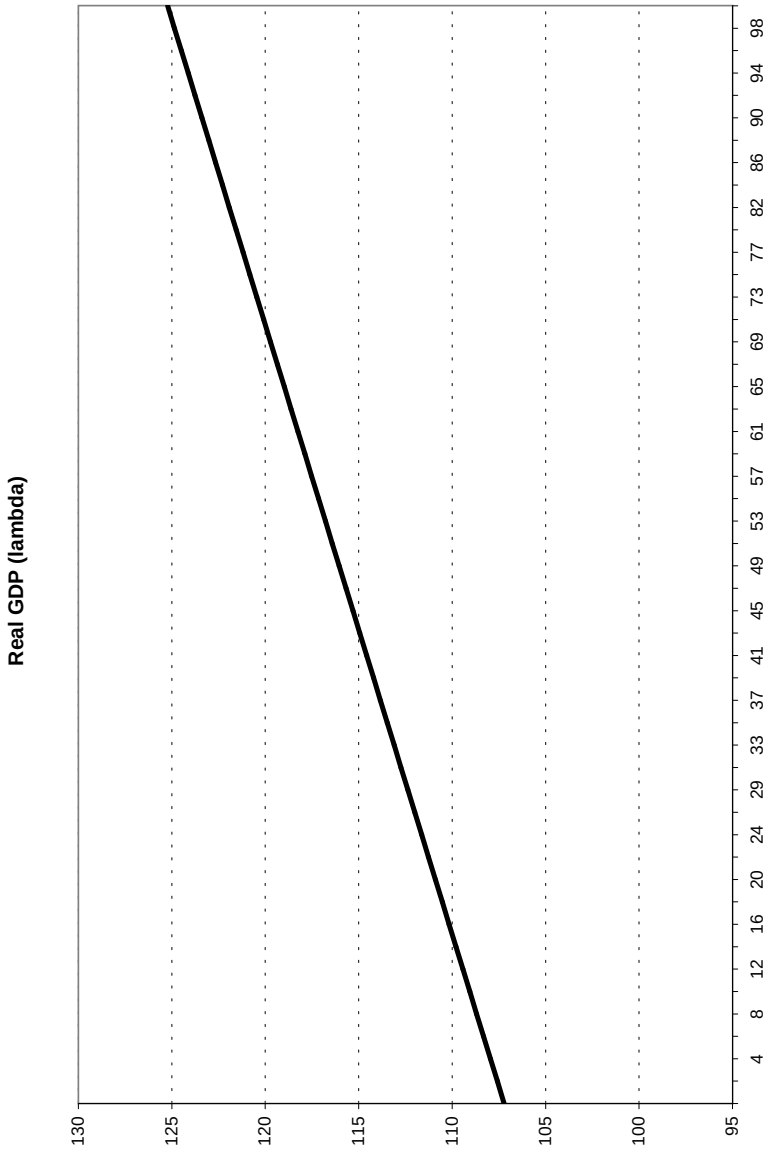

Figure 3: SOE Share of GDP: Reduction in Labor Restriction

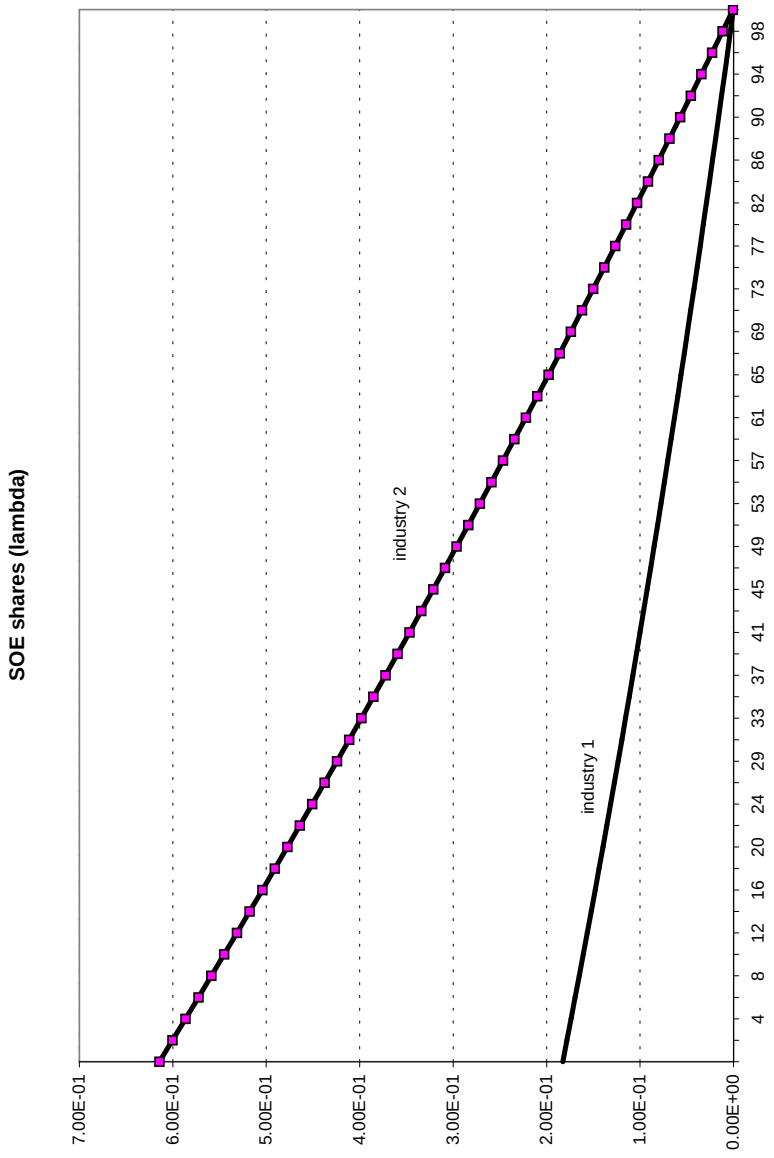

Figure 4: Welfare: Reduction in Labor Restriction

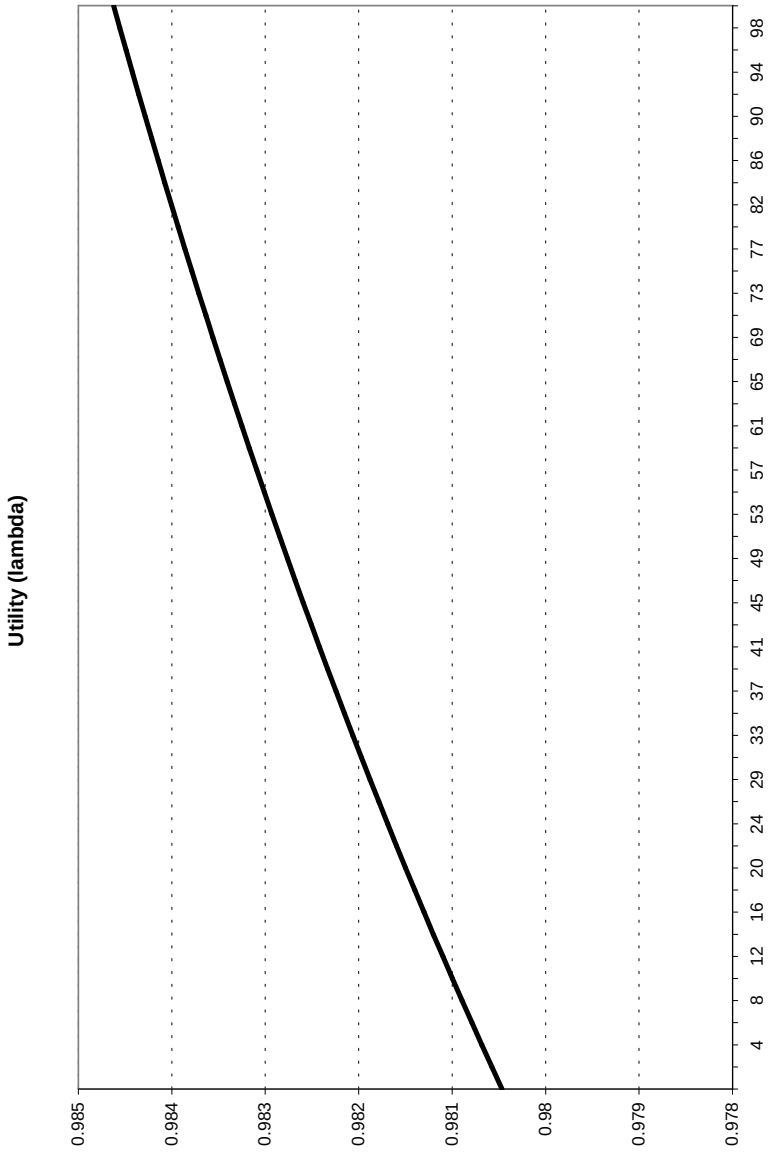

Figure 5: Real GDP: Reduction in Capital Subsidy

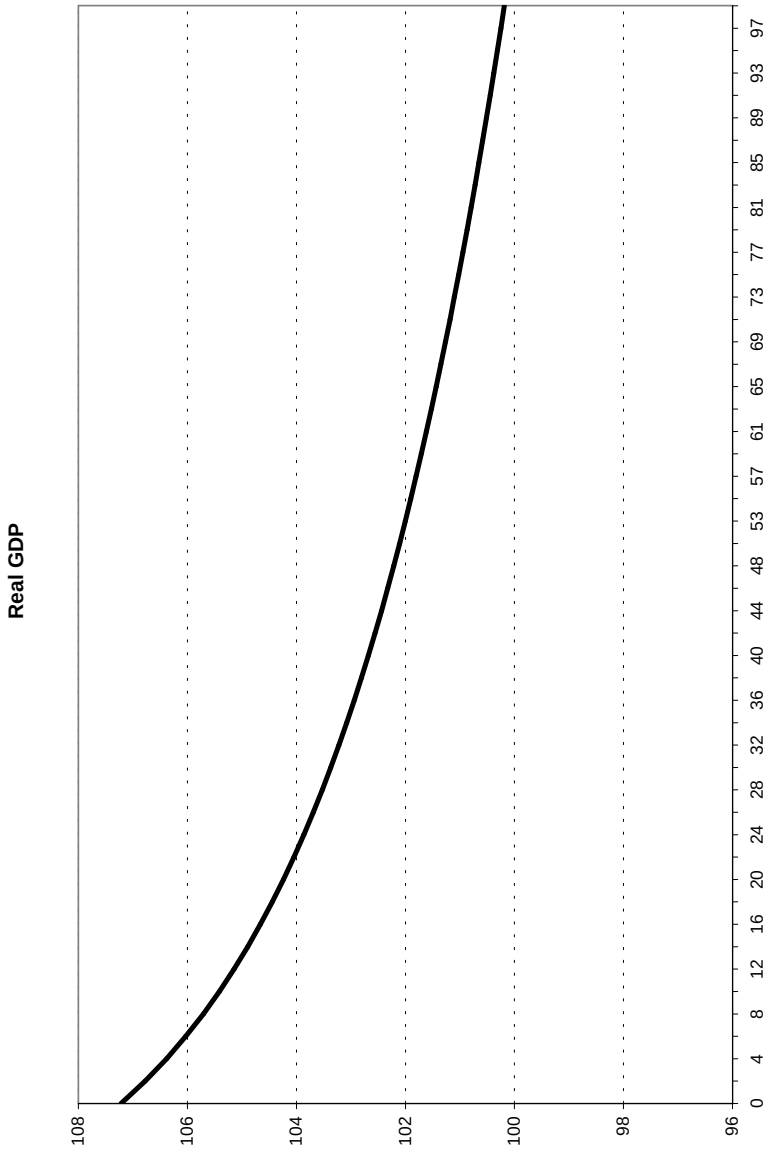

Figure 6: SOE Share in Industry 1: Reduction in Capital Subsidy

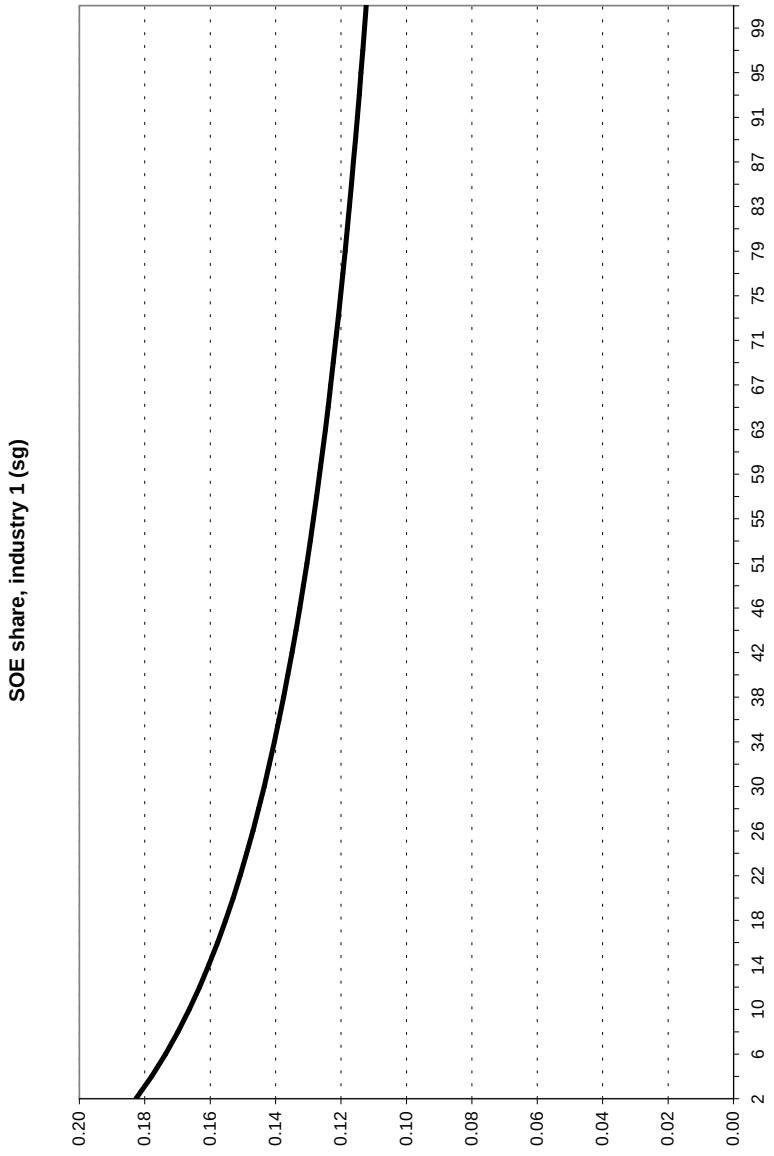

Figure 7: SOE Share in Industry 2: Reduction in Capital Subsidy

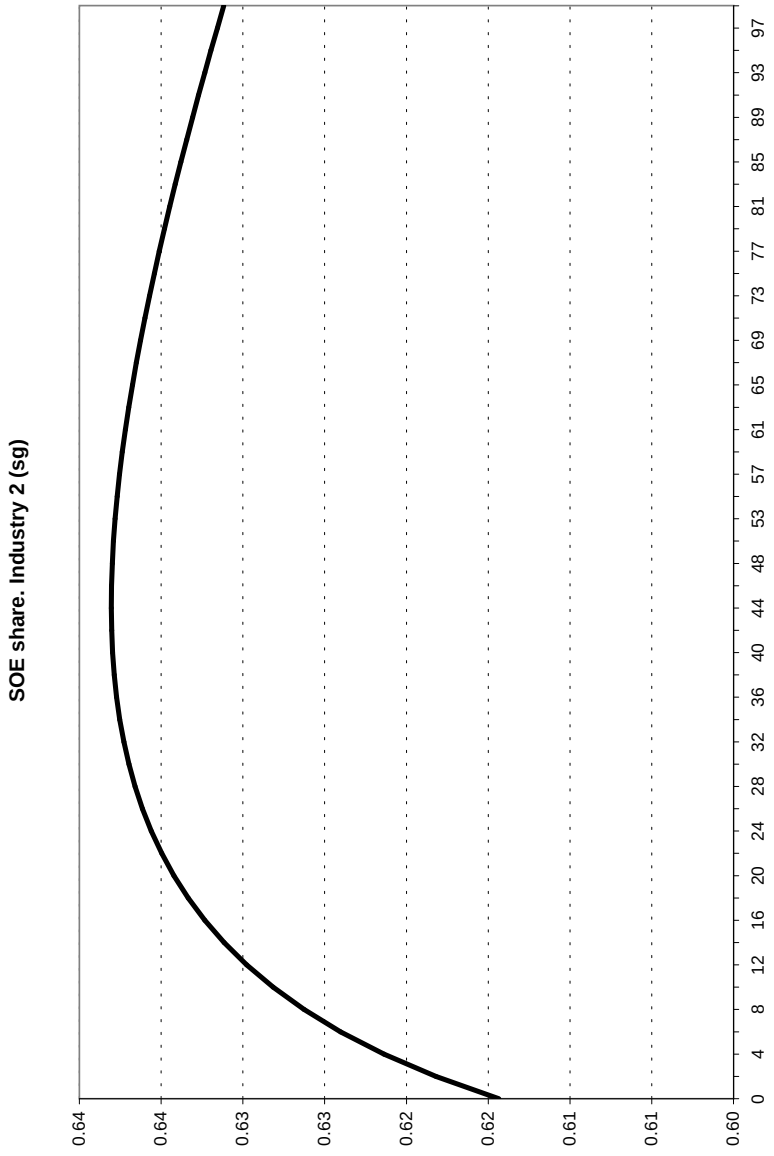

Figure 8: Welfare: Reduction in Capital Subsidy

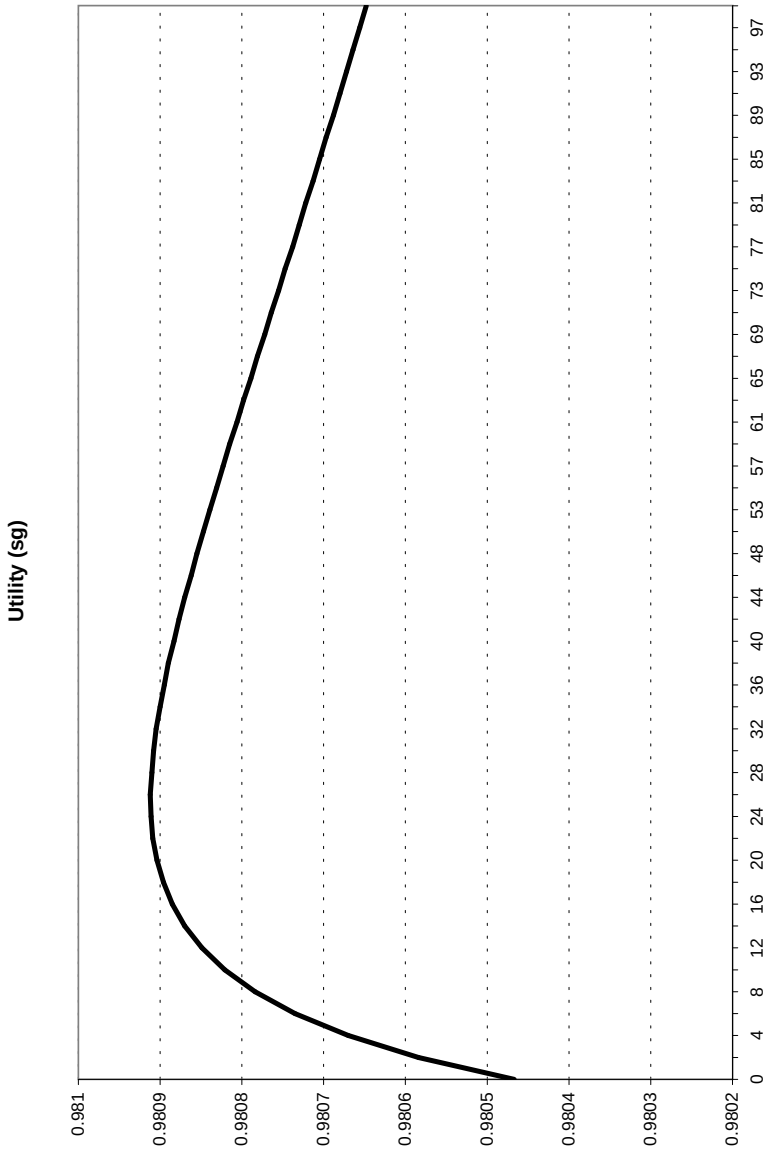

Figure 9: Real GDP: Time of Opening

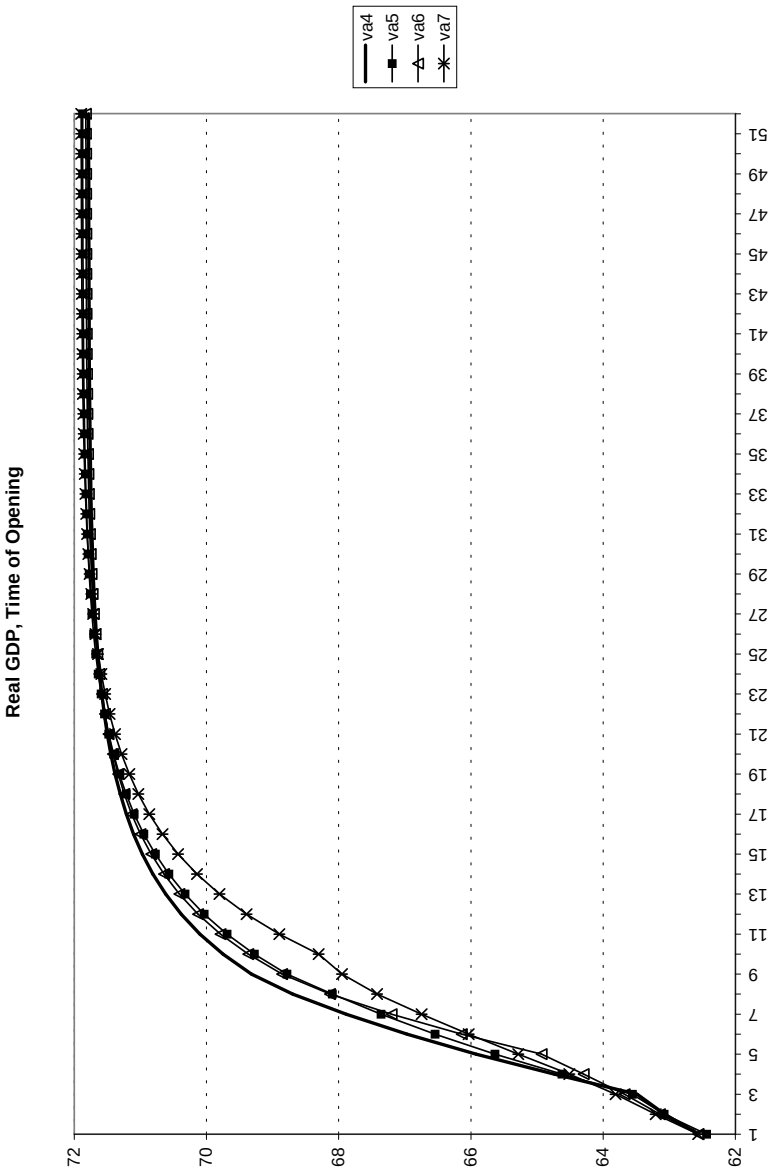

Figure 10: Total Factor Productivity: Time of Opening

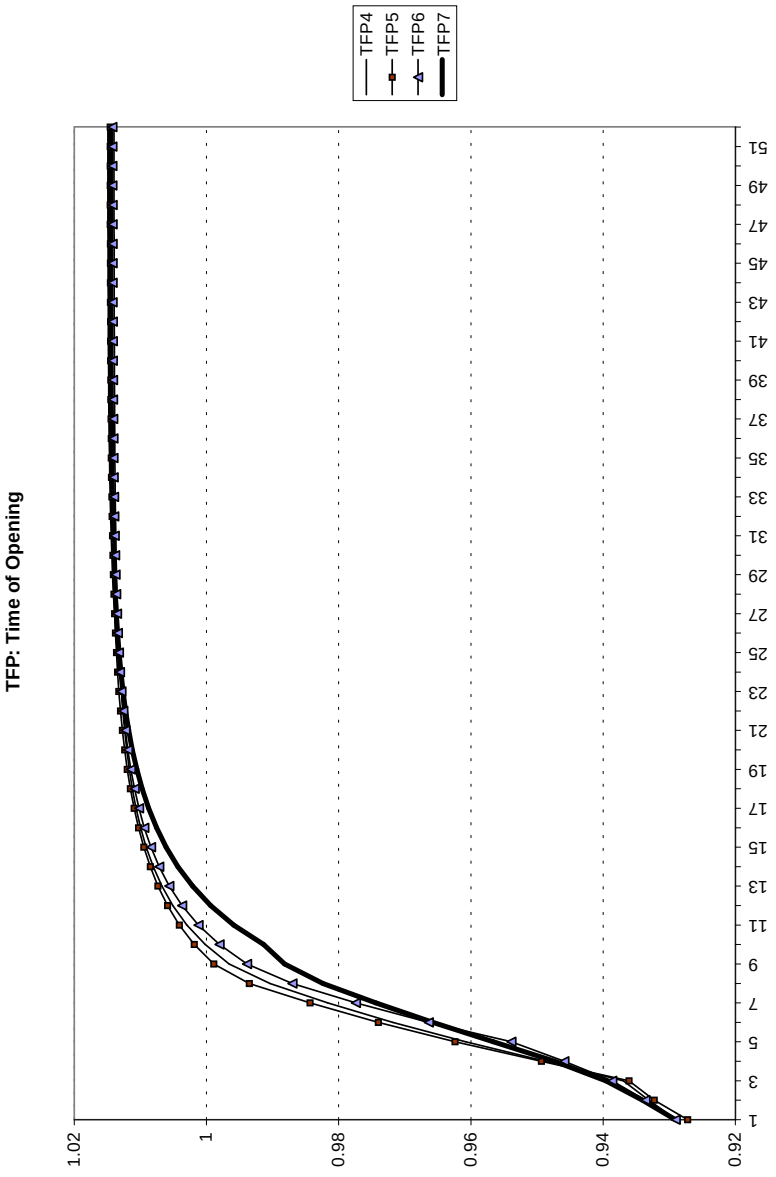

Figure 11: SOE Shares: Time of Opening

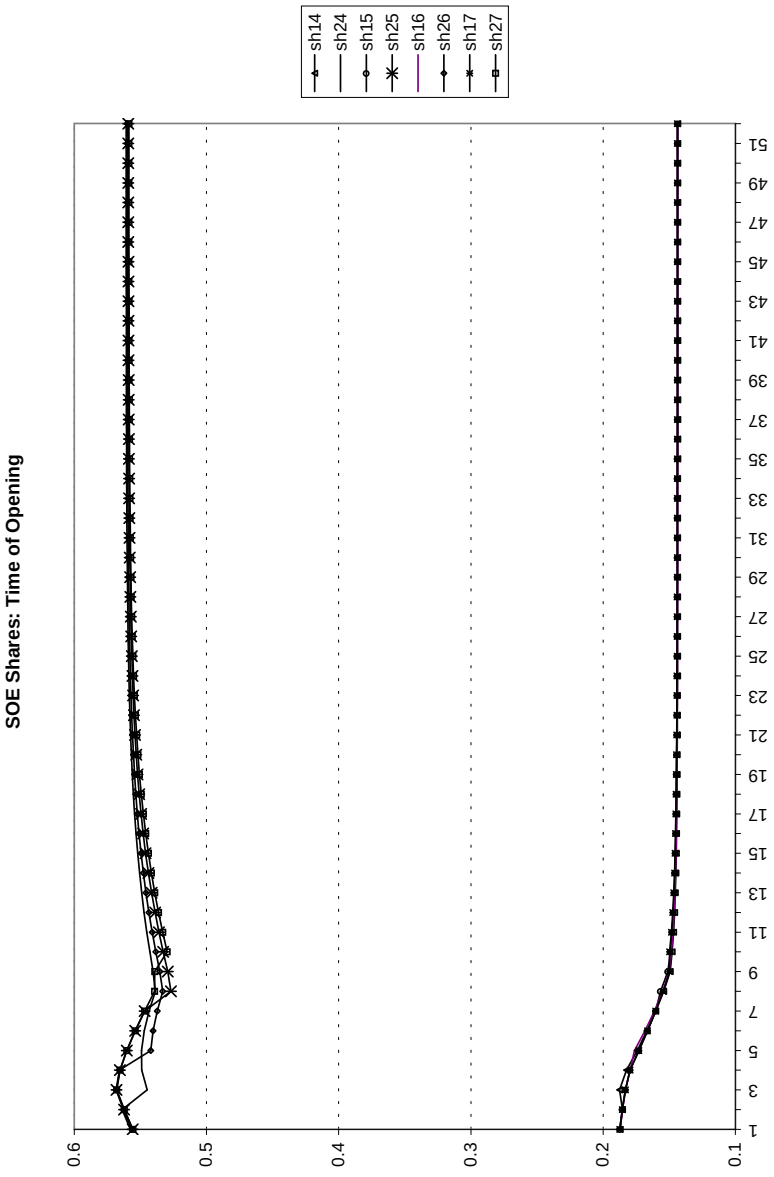

Figure 12: Real GDP: Sequencing of Reforms

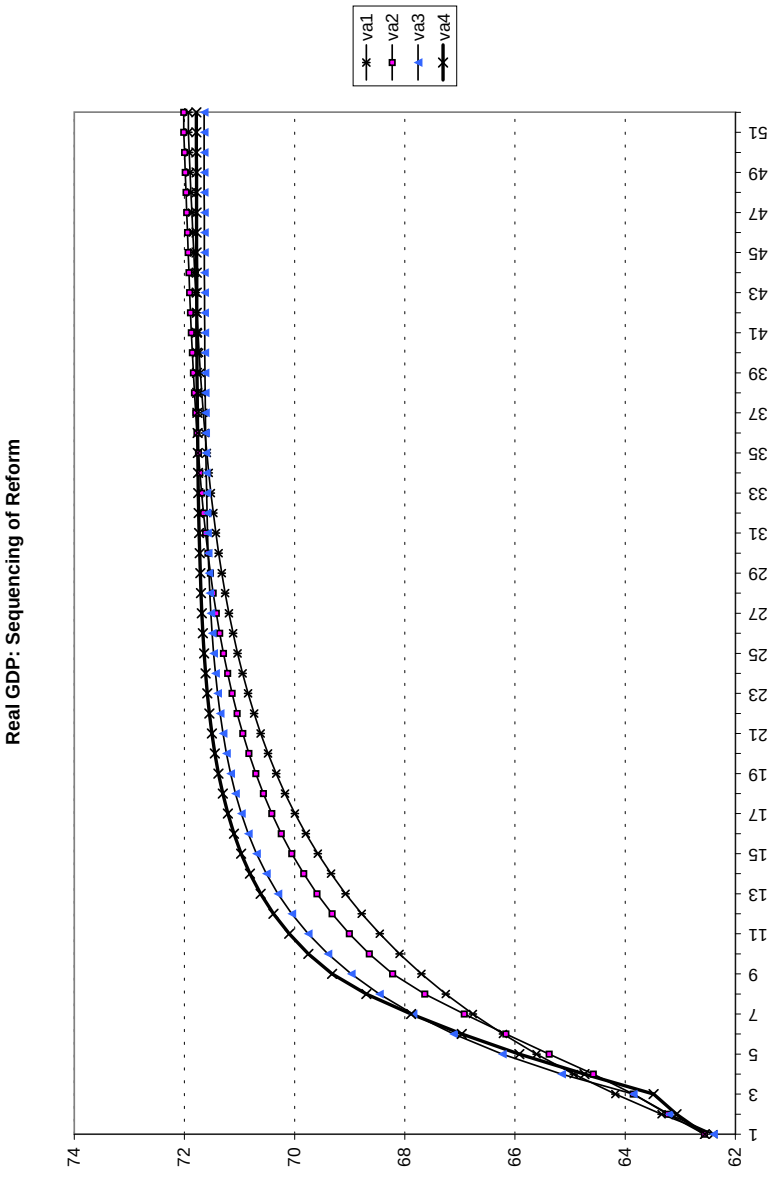

Figure 13: Total Factor Productivity: Sequencing of Reforms

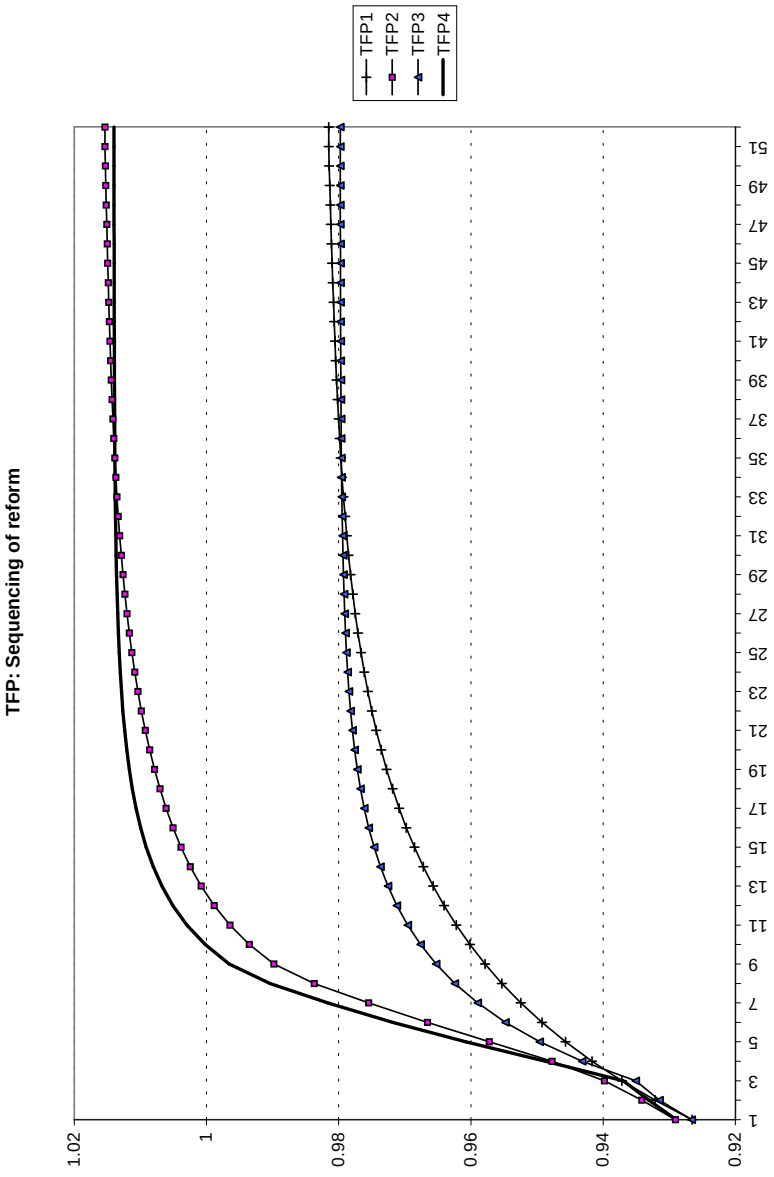

Figure 14: SOE Shares: Sequencing of Reforms

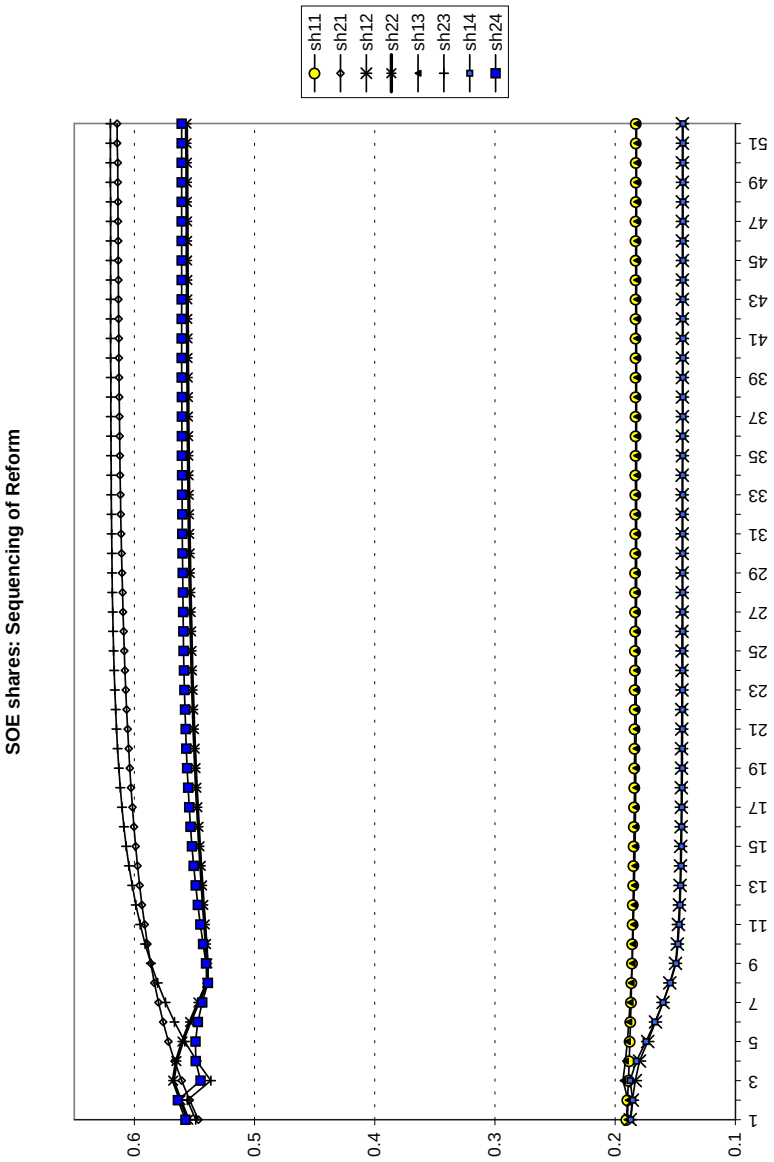

Figure 15: Real GDP: Type of Domestic Reform with Autarky

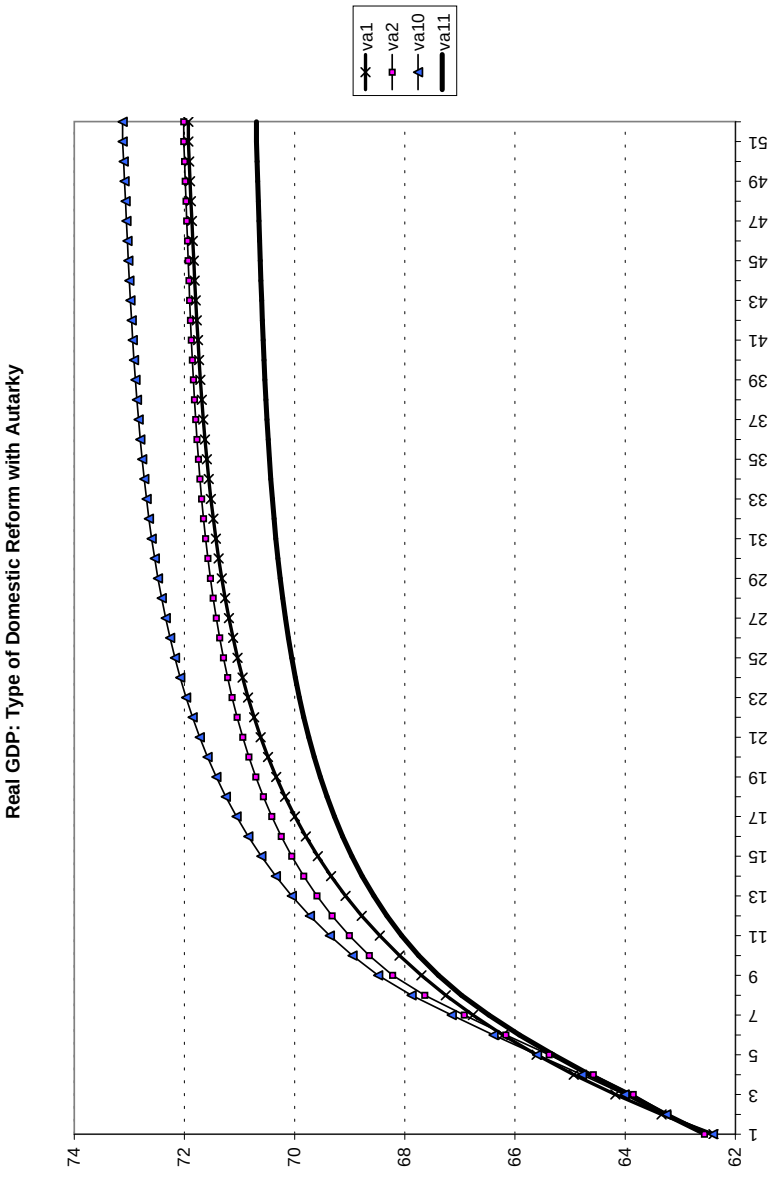

Figure 16: Total Factor Productivity: Type of Domestic Reform with Autarky

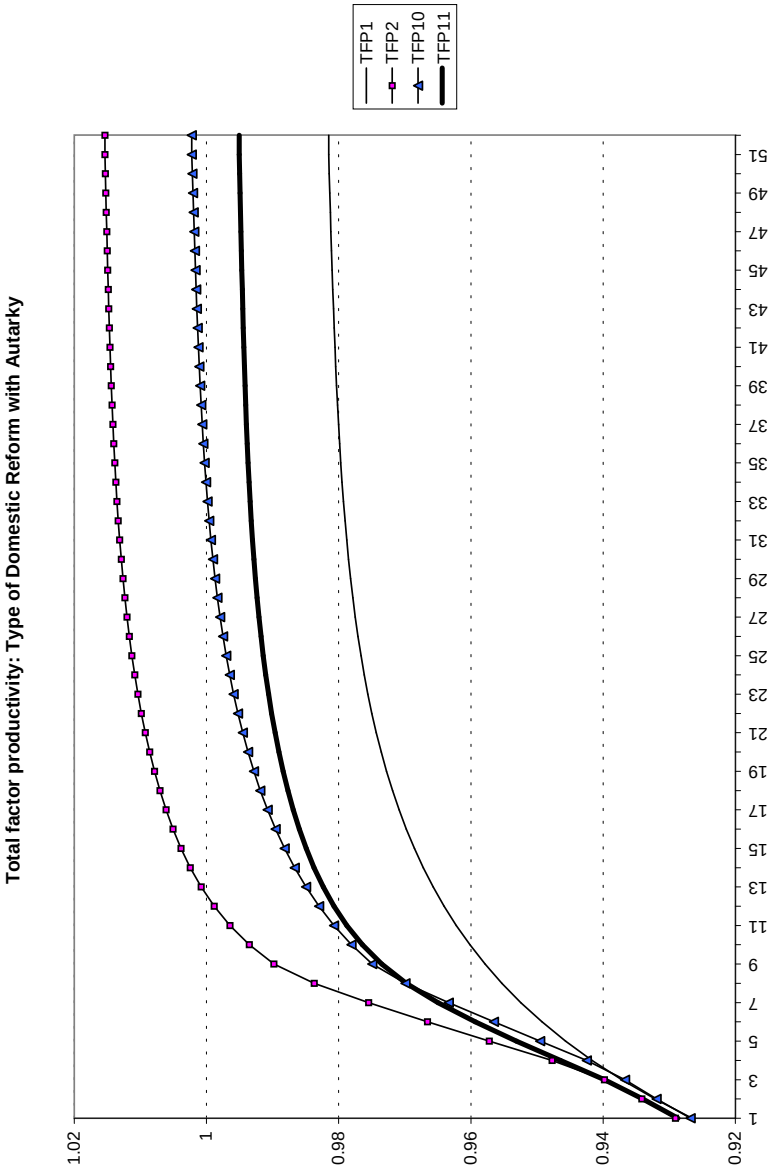

Figure 17: SOE Shares: Type of Domestic Reform with Autarky