Economic Effects of Liberalization:

The Case of China's Accession to the World Trade Organization

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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. Accession to the WTO involves provisions to liberalize capital markets and to significantly reduce domestic industrial subsidies to the, usually large, state-owned sector. Therefore, any welfare gains derived from such policies are to be considered as part of the welfare gains of trade liberalization. In this paper we develop a dynamic applied general equilibrium model to quantitatively assess the welfare benefits of capital market liberalization and domestic industrial policy reform, and we apply it to the case of China's accession to the WTO. We find that most of China's benefits of accessing the WTO are derived from the reduction of the state-owned sector driven by the reform in domestic policy required by the treaty. The highest welfare benefits occur when both domestic policy reform and capital market liberalization are jointly implemented. Welfare is enhanced by early opening of the capital markets.

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1 Introduction

The high level of participation of developing countries in bilateral and multilateral trade agreements in recent years poses a paradox for the traditional literature on trade. A large number of developing countries have recently joined, or applied to join, the Word Trade Organization (WTO). China joined the organization in December 2001, and as many as 30 other countries are in the process of accessing the WTO, which already has 145 members. These countries appear to view participation in multilateral trade agreements as a necessary step in the process of modernization of their economies. Yet, traditional trade literature finds very small welfare gains derived directly from trade liberalization (see Shoven and Whalley, 1984, and Kehoe 1994). It seems, thus, that the benefits from signing a trade agreement must go beyond the gains derived from the pure trade effects captured by traditional trade models.

By accessing the WTO countries commit to follow a set of rules and regulations which are aimed at facilitating international trade. These rules and regulations usually involve elements of domestic, market-oriented reforms. In particular, accession to the WTO often requires a substantial reduction or elimination of subsides to state-owned enterprises (SOEs).[1] The effects of these domestic reforms may be substantial, specially in countries with big, heavily subsidized, inefficient state sectors.[2] Given that the domestic policy reforms are promoted by the trade treaty, any welfare benefits derived from these reforms are to be considered as part of the benefits of the treaty and, therefore, they should be added to any welfare benefits derived from pure trade effects.

In this paper we argue that most of the welfare gains associated with accessing the WTO are accounted for by the WTO's indirect role as a promoter of domestic reforms. Circumstantial evidence shows that developing countries are aware of this indirect role of the WTO and may be using participation in the WTO as a way to promote otherwise difficult to implement domestic economic reforms.[3] We develop a dynamic applied general equilibrium

[1] WTO legal document Uruguay Round Agreements, Annex 1A, Agreement on Subsidies and Countervailing Measures. This agreement defines the concept of specific subsidies, and subsidies to SOE is considered specific subsidies and are to be removed.

[2] Schmitz (1997) finds that government's production of investment goods accounted for one-third of Egypt's aggregate labor productivity gap with the United States in the 1960s.

[3] Bacchetta and Drabek, 2002 discusses the positive role of the WTO on the credibility of government policies, and on domestic policy and institutions. The Chinese former Premier Zhu Rongji stated "Joining the WTO, ..., is for the purpose of speeding up our nation's reform and opening up, and the building of socialism modernization." " Joining WTO is a landmark that our nation's opening up to the world has entered a new stage, it can powerfully promote the perfection of the socialism market economic system. It

model in order to assess the welfare benefits of introducing domestic policy reforms, focusing on impacts of removing subsidies to state-owned sectors.[4] The basis of our framework is a two-sector neoclassical growth model of a small open economy (in the spirit of Fernández de Córdoba and Kehoe 1999) modified to allow for two types of producers in each sector to co-exist: SOEs and private enterprises. We assume that SOEs and private enterprises in a given sector produce goods that are perfectly substitutable, using a constant returns to scale technology. In our model SOEs are less efficient than private enterprises.[5] Inefficient SOEs remain in the market thanks to heavy subsidies from the government.

We consider two types of domestic subsidies in the model, both of them widely used by developed countries: 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 inefficient employment levels by picking up any losses the SOEs may have. We use our modeling framework to explore the welfare benefits of capital market liberalization and domestic policy reforms both in steady state and along the transition path. We compare an economy that does not sign a trade treaty (does not introduce any reforms) with an economy where individuals know that a trade agreement will be signed in the third period. The trade agreement requires the opening of the capital markets to international borrowing and a reduction of subsidies to the state-owned sector. As it is the case with most trade agreements, we assume that the reforms are implemented gradually, in a phased-out period of five years.

In order to quantify the possible effects of such reforms, we apply our framework to the case of China's accession to the WTO. The case of China is particularly interesting for three reasons: first, China's effective domestic tariffs are already low and it has had good access to foreign markets through bilateral agreements (China held a Most Favorable Nation status with the US and EU for a number of years before accessing the WTO). Second, China has a large and inefficient state-owned sector, heavily subsidized by the government. Chinese state-owned enterprises (SOEs) are given preferential treatment by the government in terms of credit and subsidies and are also subject to stringent restrictions on employment. Finally, China has tried to reform her SOE sector for nearly two decades unsuccessfully, by the end,

will inevitably facilitate the process of Chinese economic modernization."

[4]Schmitz finds inverse relationship of the share of SOE in manufacturing and the per capita income. Wei,Varela and Hassan (2002) show Chinese SOEs are consistently less profitable and less productive than the other types of ownerships.

[5]This assumption is not imposed in model explicitly, the productivity parameters are obtained by calibration, and the result is that SOE is less productive than the private ownership firms.

WTO accession is pursued actively by China as a instrument to promote reform.[6] China's WTO agreement requires the removal upon accession of all subsidies to loss-making SOEs from both the central government and local governments.

We evaluate the welfare gains of domestic and capital market reforms under two types of transition costs. First, we consider only adjustment costs to capital. In this case we find welfare gains of the WTO-induced capital market liberalization and domestic policy reforms of the order of 15.1%, a large proportion of which (97%) are attributed to domestic policy reform alone. These welfare gains are substantially larger than the welfare gains traditionally associated to trade liberalization.[7] Given that we do not have unemployment in our model and that we allow labor to move freely between sectors and ownerships, our estimate may be overstating the gains from policy reform. As SOEs are restructured, large numbers of government workers will be laid off, some of which may be harder to re-employ, increasing the unemployment rate of the country. The actual magnitude of the unemployment costs due to structural changes associated with trade liberalization are hard to assess. [8] In the paper we estimate the transition costs of unemployment by projectin the percentage of lay offs from SOEs that cannot be readily employed in the private sector over the transition period. By treating these layoffs as a permanent reduction in employment, we obtain an upper bound of the unemployment costs of the reforms. When transition costs from unemployment due to closing SOEs are also considered, the welfare gains of economic liberalization are of 11%, still substantially larger than the values found by traditional trade models.

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 from accessing the WTO are to be obtained from domestic policy reforms, and only minor gains are obtained from capital market liberalization. Furthermore, the biggest gains are realized when both domestic reform and capital market liberalization are implemented at the same time. It is to the extent that trade liberalization induces the country to reform its domestic policies that the countries will benefit from the further liberalization that follows the accession to institutions like the WTO.

[6]The former Premier Zhu Rongji has actively participated WTO negotiation. According to Chinese Chief Negotiator for WTO, Zhu Rongji attended negotiation in person, broke the block between China and the US in 1999. See footnote 3 for his statement on WTO and China's reform.

[7]Kouparitsas 1998 using a dynamic applied general equilibrium model finds that Mexico's welfare gains from the reduction of tariff and non-tariff barriers required by NAFTA to be of the order of 4%.

[8]Michaely, Papageorgiou and Choksi (1992) after studying several liberalization episodes in developing countries conclude that the effects of trade liberalization on unemployment were small, with almost no net increase in unemployment, even at the sectoral level.

Our study also represents a contribution to the literature that advocates the use of dynamic models to study the impact of economic liberalization (see Kehoe 1994 and Kouparitsas 1998). By presenting both steady state analysis and transitional dynamics we obtain that the results of the former may be misleading on the true effects of liberalization. In particular, in the steady state analysis capital market liberalization reduces welfare, since countries need to run trade surpluses in the long run in order to compensate for high trade 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 the need to use dynamic models in order to fully understand the benefits from liberalization.

The study of the transitional dynamics allows us to compare growth patterns along the equilibrium path. We observe that the reforming economy experiences relatively slow growth in the initial periods because individuals are delaying their investment decisions until the economy introduces the reforms. Once the economy starts the reform period, it grows faster than the economy without reforms, converging faster to the steady state.

In the context of our model structure we implement a set of policy exercises in order to shed some light on an important issue on economic liberalization: the timing of economic reforms. We find that the simultaneous introduction of domestic reforms and capital liberalization has superior welfare effects than reforming domestic policies first and opening the capital markets once the domestic reform is completed.

There exists a large literature investigating the benefits of China's accession to the WTO (see, for instance, Martin 2001, Wang 1999, Zhang, Zhang and Wan 1998, and McKibbin and Tang 2000). Most of these studies use static applied general equilibrium models and, thus, cannot account for transitional dynamics which, as we show in this paper, are crucial for a correct assessment of the welfare gains from liberalization. Furthermore, they do not directly model the state-owned sector, missing out the welfare gains from domestic policy reform induced by the agreement. The idea that most of the Chinese gains of economic liberalization may come from internal reforms has been pointed out by other authors. 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. His paper differs from ours in focus and

methodology. He considers a static theoretical model in order to analyze the benefits derived from transfers of technology between foreign and domestic enterprises.

This paper is organized as follows. In section 2 we briefly describe the Chinese economy and the conditions under which China accessed the WTO. Section 3 presents the model economy. Section 4 contains the calibration of the model to the Chinese economy. Section 5 presents simulation results for both comparative statics in steady state and transitional dynamics. Sensitivity analysis on some of the parameters of the model is performed in section 6. Policy exercises regarding the timing of the reforms are performed in section 7, before the conclusion of the paper in section 8.

2 China's SOE Reform and the WTO

The Chinese economy was essentially a central planning economy prior to 1978. That year, China's paramount leader Deng Xiaoping introduced a series of reforms that gradually opened the economy, implemented a market-oriented reform, and allowed non-state ownership to exist and develop. 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, accounting for 78% of industrial output in 1978. Reforming the SOE sector has been a crucial aspect of economic reform in China, with the government trying different approaches since 1983 in order to improve the efficiency and profitability of the sector. The task has proven difficult and, even though the SOEs' share of GDP had been reduced to 25.5% of GDP in 1997, their overall profitability deteriorated during this period.[9]. Furthermore, SOEs remain less productive and less profitable than other types of ownerships.[10]

The existence of SOEs creates a dual market that affects the Chinese economy mainly by promoting an inefficient distribution of resources. Government subsidies, cheap loans from the state owned commercial banks, and laws that protect SOEs' workers against layoffs keep the SOEs operating even though half of them are loss-making enterprises. Despite this inefficiency, the Chinese public sector still accounts for a big share of capital formation (over 65% in the period 1994-97) and consumes most of China's savings (in the order of 70-80%) through cheap loans from state banks. This represents a burden to the financial system,

[9]Lin, Cai and Li, 1998.

[10]See Hay, Morris, Lin and Yao 1994 and Wei, Varela and Hassan 2002 for a description of the SOEs' economic performance.

since as much as 40% of these loans may be non-performing.[11]

An important step towards Chinese economic liberalization was China's accession to the WTO on December 2001. China's WTO agreement significantly deepened the scope of its economic reforms. In particular, China agreed to give a uniform and non-discriminatory treatment to the enterprises of all the WTO members, including financial institutions, as well as to gradually reduce or eliminate most of its tariffs and non-tariff barriers in a period of 3-8 years. The reduction of tariffs will have an heterogeneous effect across sectors. It will be important for a few sectors, like the automobile industry, but for most of the goods imported by China existing exceptions make effective tariffs already low, at an average rate of 2.35% for industrial goods.[12] Therefore, in this paper we abstract from the economic effects of tariff reduction and we concentrate on the effects of reducing non-tariff barriers.

In exchange for these concessions, China gained gradual access to the markets of all WTO members and became a party to the Agreement on Textiles and Clothing, which will completely eliminate quotas on textiles at the end of 2004. This is surely the most important gain in terms of market access that China has obtained from accessing the WTO. As Lardy (2002) points out, the WTO agreement is clearly asymmetric against China, which gains a small accession to the markets of the WTO members in exchange for important reforms in domestic and trade policy and others.[13] Therefore, it is clear that China expects major gains from sources other than market access from the trade agreement. Reports by the former Chinese Premier Zhu Rongji (see footnote 3) suggest that the government is expecting WTO to promote domestic reform, of which SOE reform is one key element for most of the past two decades.[14]

3 The Model

In this section we present a dynamic applied general equilibrium model to quantitatively assess the welfare gains of capital market liberalization and domestic policy reform in an economy where subsidized government enterprises co-exist with private, competitive firms. We may interpret the competitive firms as foreign firms entering the domestic market or,

[11] Chen and Divan (2000).

[12] Tiwari et al. (2002).

[13] China agreed to disadvantageous anti-dumping and safeguard mechanisms for periods that rank from 12 to 15 years.

[14] SOE reform is considered the center of economic reform in most years since 1986, as stated in annual *Report on the Work of the Government* made by the Premier to China's National Parliament Congress.

as in the case of China, as 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. For simplicity, we model the domestic economy as a small open economy, that is, we assume that the country takes the world interest rates as exogenously given. Since developing countries usually have fairly underdeveloped financial markets, we believe that this assumption is not very restrictive. We model the rest of the world (ROW) in a very simplified way: it consists of a demand function for the products of the domestic economy and a deep pocket that lends to the developing economy at a fixed interest rate and exports goods at the prevailing world price.

There are five goods in this economy: two tradeable goods that are imperfect substitutes (one domestically produced and one produced abroad), a non-tradeable good, a composite of the tradeable goods (which is consumed and used as intermediate good), and an investment good that is transformed into capital to be operated in the following period. The goods produced at home can be produced by both the state-owned enterprises (SOEs) and by the non-state sector, denoted in this paper as the private sector. The private sector includes all collective enterprises, entrepreneurial businesses, and foreign enterprises. We designate the state sector with the index 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 of the traded goods. To capture the fact that capital is only partially substitutable across sectors, we introduce adjustment costs on capital that limit its mobility from one sector to another. We allow capital to be perfectly mobile between different types of firms in a given sector.

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 composite of the traded goods (good 1) and the non-traded good (good 2). 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, and TC_t represents the net transfers from the government to consumers. Notice that in the utility function 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 simplicity, 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, k_{it}, and foreign bonds, b_t. Here, q_{it-1} is the return at period t of capital of type i invested at $t-1$ to be used in period t. By treating investment goods in different sectors as different goods we are able to introduce imperfect capital flows between the two sectors and, thus, capture the fact that capital is not completely mobile across sectors.

3.2 Producers

All sectors use capital and labor, as well as the traded and non-traded 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, and za_{Pji} is the amount of good i that the private sector needs in order 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 applied general equilibrium models, simplifies the calibration of the parameters from the input-output tables.[15]

The firm's objective is to choose the amount of inputs and production 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. In particular, firms take as given the ad valorem taxes on their final product, denoted

[15]The choice of a Leontief function on the intermediate inputs and value added is not very restrictive. Kouparistas (1998) calibrates a more general production function and finds the constant elasticity of substitution between intermediate inputs and value added to be .1, close to the Leontief specification.

by t_{Pjt} and t_{Gjt} for the private enterprises and the SOEs, respectively, the subsidies to capital for the SOEs, s_{Gjt}, the labor restrictions for the SOEs, λ_{jt}, and the tariff rates, τ_{Dt}.

Government enterprises have a production function with the same structure as the private sector's:

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

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, za_{Gjit}, as well as the technology parameter in producing value added, A_{Gj}. We take the labor share to be the same in both private enterprises and SOEs. Therefore, in this model government policy captures any differences in the capital-labor mixture that may exist between both types of producers.

The objective of the SOEs is also to maximize profits taking all prices as given. We justify this assumption with anecdotal evidence which states that once the government policy on subsidies and labor controls is taken into account the managers of the state enterprises seem to make their choices on how much to produce with profit maximization in mind.

We model government regulation regarding the SOEs in three ways. First, the tax rates on SOEs may differ from the tax rates on private enterprises. Second, SOEs receive subsidies on capital, s_{Gjt}. These subsidies work as follows: if we denote by R_{jt} the free-market rental rate of capital in sector j, the state enterprise can rent capital at the rate $(1-s_{Gjt})R_{jt}$.[16] Finally, SOEs face restrictions on lay offs in exchange from government subsidies on employment. We capture this fact by introducing a minimum labor requirement, λ_{jt}. The labor requirement represents a lower bound in the amount of labor that the SOEs can employ.

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. In this case, the government picks up the losses and is, thus, passing a subsidy to the SOEs in exchange of their maintaining their workforce.

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

[16]This subsidy can be interpreted as the government providing cheap credit to the SOEs through state banks.

amount. Furthermore, given that private enterprises behave competitively, they only co-exist with state enterprises in a given sector if the labor restriction for the state enterprises is binding (that is, if the SOEs are inefficient relative to the private sector).

In order to account for intra-industry trade, we introduce the Armington aggregator assumption in the tradeable 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_1. The Armington aggregator takes the following form in this model:

$$y_1 = M\left(\mu x_D^{\zeta} + (1-\mu)m^{\zeta}\right)^{1/\zeta}$$

where x_D is the demand for the domestically produced good, and m is the import demand for the traded good produced in the foreign country. In this formulation, $1/(1-\zeta)$ is the elasticity of substitution between the domestically and the foreign produced traded goods, and M is the technology parameter. In what follows, we use the term "traded good", without specifying the origin of production, to refer to the composite of traded goods used in the domestic country (good 1).

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 Fernández de Córdoba 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 sector's capital stock. To take into account the fact that moving capital from one sector to another is costly, we introduce adjustment costs to capital. Following Lucas and Prescott (1971) 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 δ is the depreciation rate, and the adjustment function $\phi()$ is assumed to be strictly increasing and strictly concave in the investment-capital ratio and to satisfy $\phi(\delta) = \delta$ and

$\phi'(\delta) = 1$. These last two properties are necessary for capital to depreciate at a rate δ in steady state. Lucas and Prescott (1971) show existence and uniqueness of equilibrium in a model with adjustment costs with this specific form. The specific adjustment cost function that we use in this paper is adopted from Fernández de Córdoba and Kehoe (1999) and it is a one-parameter function satisfying the conditions listed above. This particular function is:

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

The government in this economy balances its budget every period. The government obtains revenue from taxes on producers of final goods, T, and from tariff revenue, TR.[17] The government outlays are purchases of each of the goods in the economy, g_j, which are determined exogenously, and subsidies to capital and labor employed by the SOEs, S_K and S_L. Any excess funds (costs) are transferred to (born by) the consumer in the form of net government transfers, TC.[18] The budget constraint that the government faces is the following:

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

Subsidies to capital are the total subsidies to each of the industries, and are a proportion of the real return on capital, determined by the market, and the subsidy s_{Gj}.

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

Subsidies to labor are the losses incurred by the SOEs due to the minimum labor restrictions imposed by the government. That is, if we define Π_j as the profits of the SOEs in sector j, the subsidy to labor is:

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

Tax revenues come from taxing production of the domestically produced traded and non-traded goods on both SOEs and private firms:

$$T = \sum_j p_{Dj}(t_{Pj} y_{DPj} + t_{Gj} y_{DGj})$$

[17]The tax rates t_{Pj} and t_{Gj} and the tariff rates τ_D are exogenously given.

[18]Modeled this way, the government balances the budget every period. The net government transfers can be interpreted as the government surplus (deficit if negative).

Government also gets tariff revenue from imports of the foreign good. If we denote by τ_{Dj} the ad valorem tariff on the imported good, total tariff revenues are:

$$TR = \tau_D p_w m$$

where p_w is the world price for the foreign produced traded good and m is the amount of traded good imported.

We model the rest of the world as an import demand function for the domestically produced traded good. The foreign demand, denoted by x_F, is modeled as:

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

where p_{D1} is the price of the domestically produced traded good, and τ_F is the average world tariff rate on imports from the domestic country.

Feasibility in this economy implies that all markets clear and that the balance of payments account 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,

$$p_{wt} m_t + b_{t+1} = p_{D1t} x_{Ft} + (1 + r_t) b_t.$$

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

$$x_D + x_F = y_{D1}$$

The market for the non-tradeable good and the market for the composite tradeable 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:

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

Finally, the markets for labor and capital also have to clear. Feasibility in the factor markets implies that the demand for labor in the country equals the total amount of workers available in the country, and that the total capital used in the country equals its stock of capital:

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

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

3.3 Equilibrium

The equilibrium in this economy, given initial levels of capital in each sector, initial total foreign debt, and 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's decisions $\{c_{jt}, a_t, b_t\}_{j,t}$, private firms' decisions $\{z_{Pj1t}, z_{Pj2t}, k_{Pjt}, l_{Pjt}, y_{DPjt}\}_{j,t}$, SOEs' decisions $\{z_{Gj1t}, z_{Gj2t}, k_{Gjt}, l_{Gjt}, y_{DGjt}\}_{j,t}$, investment decisions $\{z_{I1t}, z_{I2t}, i_t, i_{Pjt}, i_{Gjt}\}_{j,t}$, prices $\{p_{wt}, p_{jt}, p_{Djt}, w_t, r_t, R_{Pjt}, R_{Gjt}\}_{j,t}$, and import decisions $\{x_{D1t}, x_{Ft}\}_{j,t}$, such that the consumer and producers' (SOEs and private enterprises) problems are satisfied, all markets clear, and the laws of motion for capital in each industry and sector are satisfied.*

In the following sections we use this framework to study the effects of capital market liberalization and domestic policy reforms on the Chinese economy. In the next section we calibrate the parameters of the model to match relevant aspects of the Chinese economy. We then use the calibrated version of the model to simulate the evolution of the Chinese economy after implementation of capital market and domestic reforms and to determine the magnitude of the welfare gains from each of these reforms.

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 set

the parameters of the model to match data on the Chinese National Income and Product Accounts, input-output matrix, and SOE's participation in industry for 1997.[19] The input-output matrix, as reported in the *China Statistical Yearbook*, contains 15 sectors which we aggregate into a tradeable and a non-tradeable sector.[20] Two problems arise when we try to adapt the input-output data to the specifics of our model. First, the Chinese input-output matrix does not report tariff revenue as a separate entry. We get around this problem by imposing a tariff rate on the traded sector of 2.35% as reported in Tiwari et al. (2002). Second, the input-output matrix does not distinguish between private enterprises and SOEs, reporting only aggregate output and inputs in each sector. In order to separate inputs and outputs between private enterprises and SOEs, we need additional data. The China Statistical Yearbook reports shares of aggregate output, capital, and employment by ownership. After adjusting the data to the specific assumptions of our model, we obtain that the SOEs' share of output is 20% in the tradeable sector and 50% in the non-traded sector. Regarding employment, we obtain that the share of labor in the state enterprises is 30% for the traded sector and 40% for the non-traded sector.[21] Finally, to divide the capital stock between private enterprises and SOEs in each sector we construct estimates of the total capital stock and of the capital stock owned by SOEs. To this purpose we use the fact, also reported by the China Statistics Yearbook, that 63% of the SOEs' capital is utilized in the traded sector.

The last piece of data that we use is an estimate of the aggregate capital stock. We construct a series for the capital stock using data on investment and SOEs capital from the China Statistical Yearbook. In order to construct the series we first calculate the depreciation rates using investment data and capital stock data that are available for the state sector. Since no good data sources were found on depreciation rates on other types of ownership, we use the depreciation rates we obtained for the state sector to approximate the depreciation

[19]Ideally, we would like to calibrate the model to 1978, when China started its economic reforms. Unfortunately, input-output matrices are not available for that year. Furthermore, China did not adopt standard accounting methodology until the 1990s. 1997 is the only year for which a complete, meaningful input-output matrix for the Chinese economy exists.

[20]We aggregate the sectors is the following way. We consider as 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.

[21]The actual share of private employment in the traded sector reported by the China Statistical Yearbook is 95%. The high share is due to the fact that the traded sector includes the agricultural sector, which is mainly private, accounts for about half of total employment, and is mainly subsistence agriculture. Since we need the shares in terms of labor income, we adjusted down the private share of employment to account for the difference in wages between agriculture and industry.

rates at the aggregate level. The average growth rate of investment is calculated and used to construct investment in the early years for which data are not available. Then the Harberger-type perpetual inventory method is used to construct the capital stock series, using the estimated investment and depreciation rates. We use this estimate of the capital stock, together with the estimate of the depreciation rate, to calibrate the initial interest rate. We obtain a value of 13.4%. Since we assume that the economy is closed in the first period, initial international borrowing is set to zero.

After separating inputs and output by ownership and obtaining an estimate for the capital stock, our calibration follows standard procedures in the calibration of applied general equilibrium models (see Kehoe and Kehoe 1991). We normalize all 1997 prices, except the real interest rate, to be 1, and all quantities but the capital stock to be equal to their monetary value in 1997. We obtain the parameters of the model as follows:

Production parameters. Given our assumption of equal unit costs of intermediate goods for the private and the state enterprises the parameters za_{Pji} and za_{Gji} are derived directly from the input-output matrix. The labor share of income in each sector, $1-\alpha_j$, is calculated from production and input data for private enterprises. Notice that since we have subsidies to capital in the state sector, this share is different from the aggregate labor share in the industry. The technology levels are derived using data on inputs and output by sector and ownership together with the labor share. Parameters for the investment technology are obtained directly from the input-output data and first order conditions.

Armington aggregator. Following Fernández de Córdoba and Kehoe (1999) we set the elasticity of substitution between the domestic and foreign traded goods to be 2, which implies a ζ of .5. The rest of the parameters in the Armington aggregator are derived directly from data in the input-output matrix and first order conditions implied by the model.

Consumption parameters. We take the time period to be one year, so we set the discount factor β to .95. We set ρ equal to -1, which implies an intertemporal elasticity of substitution of .5 (within the range considered by the real business cycle theory). First order conditions and consumption data from the input-output matrix determine the rest of the parameters.

Foreign demand. We calibrate the parameters for foreign demand directly from the input-output data.

Adjustment costs of capital. We take the depreciation rate δ to be 8% (the average depreciation rate for the period 1987-1997), which is the depreciation rate used to construct

the series of capital stock. The adjustment parameter η is taken to be .95 as in Fernández de Córdoba and Kehoe (1999).

Policy parameters. Chinese tariffs are difficult to calibrate, since the actual tariff rates applied to foreign goods are much lower than the official tariff rates. Tiwari et al. (2002) estimate that the effective tariff rate for the traded sector is of 2.35%. They also report an average tariff rate on Chinese exports to the rest of the world of 5.2%. Government purchases are obtained from the input-output matrix. Given that we do not have specific tax rates for private and state enterprises, we assume an homogeneous tax rate in each sector. This assumption allows us to calibrate the tax rates directly from the input-output data. Sectoral subsidies to capital are derived from the first order condition relative to capital for the SOEs and the calibrated tax parameters. Finally, the labor restriction λ is set so that the SOEs level of employment in equilibrium equals the SOEs' employment in 1997.

Table 1 reports the values of the calibrated parameters.

[Insert Table 1 here]

5 Simulations

In this section we simulate the calibrated model and assess the economic effects of a reduction in labor and capital subsidies that closely matches the domestic and capital market liberalization required by the WTO's accession agreement. In particular, we consider the effects of a gradual reduction of the capital subsidy by 70% and a gradual reduction of the labor requirement of 50% in a 5 year period, together with the opening to international capital markets right after accession.

Our estimates of the reduction of capital and labor restrictions are obtained from the following facts. First, the WTO's accession protocol requires that China remove all direct government subsidies to SOEs immediately upon accession. According to the World Bank, these subsidies accounted for about 56% of total SOEs' subsidies in 1994, the other 44% being accounted for by cheap lending to SOEs by state-owned financial institutions (World Bank, 1996). On the other hand, foreign banks will be allowed to operate in China gradually, obtaining national treatment only 5 years after accession. Given that state banks still handle a big portion of Chinese savings and that they will not be exposed to foreign competition until 5 years after accession, we believe that the government will use the state-owned banks to continue subsidizing the SOEs after accession and, therefore, SOEs subsidies will not be

eliminated upon accession but will be reduced gradually during the phase out period. Once the financial system faces competition from foreign banks, the state financial sector will be reduced and so will the ability to use this channel to subsidize the SOEs. Second, half of the Chinese SOEs are loss-making (World Bank 1997). Loss-making SOEs are likely to disappear once government subsidies are significantly reduced. A reduction in the labor restriction of 50% produces a reduction of the SOE's shares of about the same percentage. A reduction of the capital subsidy by 70% is conservative, and captures the fact that the state can still subsidize the SOEs to some extent through state banks.

In what follows we first perform steady state comparative statics to analyze the long run gains of China's accessing the WTO. After that, we perform some exercises to analyze the effects of each of the policies separately. We obtain that most of the long run gains are accounted for by domestic policy reforms. Second, we study the transitional dynamics of the economy after implementing the reforms and we compare them with the dynamics of a benchmark economy that does not implement any reforms. We obtain that the transitional dynamics are crucial for understanding the gains from policy reform and that some of the results obtained in the steady state comparisons may be misleading.

5.1 Steady State Analysis

Table 2 presents steady state results under several scenarios. The first column compares an economy that does not implement any reforms, the *benchmark economy* (labeled in the table as *no reforms-c*), with an economy that implements both domestic reforms and opens its capital markets (labeled *both reforms-o*). We obtain steady state welfare gains of reforming the economy according to WTO procedure of 10.8% in terms of equivalent variation[22]. The increase in steady state output is of 5.3% whereas total factor productivity increases by 14.8%. With respect to the SOEs share of output, it decreases by 70.8% in the traded sector and by 53% in the non-traded sector.

The rest of the columns in the table compare the benchmark economy to economies that implement each of the reforms independently. The objective of this exercise is to investigate which proportion of the gains from liberalization is accounted for by each of the policies. The second column compares the benchmark economy with an economy that only opens its capital markets, but does not reform its domestic policies. We observe that steady state

[22]That is, the consumer in the benchmark economy would need a permanent increase in steady state consumption of 10.8% to be as well off as the consumer in the liberalized economy.

comparisons reveal a welfare loss of opening to international capital markets of 3.7%, together with a slight reduction in GDP. This result is somewhat surprising and it seems to support theories that advocate capital controls. As we will see in the next section, where we study the transitional dynamics, this result is misleading. When the transitional periods are taken into account, we obtain welfare gains from capital market liberalization.

The last three columns in Table 2 study the effect of implementing domestic policy reforms only, without opening to capital markets. Column 5 presents the results of simultaneously reforming both capital subsidies and labor restrictions. Column 3 compares the benchmark economy to an economy that only reforms the labor market (denoted in the table by *labor-only*, and column 4 contains the comparisons with an economy that only reforms the subsidies to capital (denoted by *capital-only*). We observe that the highest improvement in terms of welfare and TFP is obtained when both policies are implemented simultaneously. TFP increases by 14.7% and welfare by 14.2%. The increase in GDP is relatively small, at only 5.6% of GDP. When each policy is considered separately, we observe that both the gains in TFP and in output are driven primarily by the reduction in the labor restriction.

[Insert Table 2.]

To better understand the effect of each domestic policy on the steady state variables, we compare steady state values of real GDP, SOE's share of output and equivalent variation for a wide spectrum of policy values. The results are plotted in Figure 1 for the labor restriction policy, and in Figure 2 for the subsidy to capital. The x-axis of the graphs contains different degrees of policy reduction. That is, a point $(65, y)$ in the graph of GDP means that y is the value of GDP when the policy under study is reduced by 65%. We observe that the labor restriction has an almost linear effect on the output share of the SOEs and on GDP (with the former decreasing and the latter increasing as the restriction is relaxed). Welfare also increases as the restriction is reduced. When considering the subsidy to capital, we observe that real GDP decreases with the subsidy, since the optimal steady state level of capital stock decreases as the subsidy is reduced. Regarding SOE's shares, the effect is different than in the case where the labor restriction is reduced. The SOE's share in the traded sector decreases as the subsidy is reduced, but the SOE's share in the non-traded sector has a hump-like shape: it increases for small reductions in the subsidy to capital, but it decreases once the subsidy has been sufficiently reduced. The intuition is as follows: since the traded good is more subsidized than the non-traded good, private firms concentrate in the production of the traded good, in which they have comparative advantage, and which has

been liberalized further than the non-traded sector in absolute values. Once the subsidy is sufficiently reduced, SOEs stabilize and the dominating effect is that lower subsidies reduce SOE shares in all industries. Summarizing, the hump-like shape shows the trade off between reallocation or capital within and between industries. In terms of welfare, the result is also interesting. The period utility also has a hump-like shape. This result is related to the Golden Rule level of capital, that is, the steady state level of capital that delivers optimal consumption. Given that we have the labor restriction, the optimal subsidy to capital that delivers the maximum consumption in steady state is positive. This result suggests that when labor restrictions are in place, in a world where subsidized firms interact with competitive firms, positive subsidies to capital may be welfare improving.

[Insert Figures 1 and Figure 2 here.]

5.2 Transitional Dynamics

In this section we derive the effects on China's economy of implementing the domestic and capital market reforms required by the WTO protocol when the transitional dynamics are taken into account. Furthermore, we implement several policy exercises to better understand the origin of these economic effects. We assume that the Chinese economy starts at the calibrated equilibrium and that people correctly forecast that there will be a change in policy after three periods. Following the provisions of the WTO agreement we also assume that the domestic policy reform is gradually implemented in a period of 5 years (periods 3-8).

Figure 3 compares the transitional dynamics of an economy implementing both domestic and capital markets reforms with the transitional dynamics of the benchmark economy (economy that does not implement any reforms). The first graph in figure 3 compares the paths of real GDP. We observe that output is higher in the economy with reforms, with the highest growth achieved during and after the reform periods. The economy also converges to a steady state with a higher level of output. It is important to notice the slower growth rates achieved in the initial periods, when the reforms have not yet been implemented but people know that there will be a change in policy in the third period. In these periods capital is not accumulated as fast as in the benchmark economy, since firms are waiting to invest after the capital markets open (which lowers the interest rate). Once the reforms start, output grows at a faster pace initially, approaching its steady state value faster. Growth rates of output

are presented in the second graph of the figure.[23]

In terms of welfare our model predicts welfare gains from accessing the WTO of 15.1% in terms of equivalent variation, which is higher than the value we obtained when doing comparative statics in steady state. If we compare both numbers, we see that, by only looking at steady state values, we missed out on 50% of welfare gains.

5.2.1 Contribution of each policy reform

In what follows we analyze the effects of each policy reform separately by comparing simulations of different economies that implement only one of the policy reforms, in a similar way to what we did in the comparative statics' section. In the first exercise we compare the benchmark economy (labeled *no-c*) to an economy that implements all reforms (*both-o*), to an economy that only implements domestic policy reforms, while keeping the capital markets closed (*both-c*), and to an economy that only opens its capital markets but does not implement any of the domestic policy reforms (*no-o*). The results of the simulations are shown in Figure 4. We observe that opening the economy slightly reduces output in the initial periods as firms wait until the interest rates are reduced (after the capital market is liberalized) before they make their capital investments. However, the rate of growth after the initial periods is higher in the open economy, as firms borrow from abroad and the economy approaches its steady state faster. The pattern for TFP is similar to the patterns for output. These comparisons are robust to implementing domestic reforms. We conclude that opening the economy accelerates growth after the initial periods and, therefore, delivers faster convergence to steady state. Domestic policy reforms translate into convergence to a higher level of GDP per capita. They also deliver higher growth both when implemented in an open as well as in a closed economy. In terms of welfare, most of the welfare gains from reforming the economy come from implementing domestic policy reforms: a 14.7% increase with respect to the benchmark economy. The welfare gains from opening capital markets without reforming domestic policies account to only .04%, a very small number. Notice that the increase is small but positive (compared to the 3.7% welfare loss obtained in the steady state comparisons), and that the total welfare from implementing both reforms surpasses the sum of welfare gains of implementing them separately. There is, therefore, a gain of .3% that comes from jointly implementing the reforms.

[23]Notice that growth rates are small in this model. The reason is that we have not introduced technological progress. Growth in this model comes only from capital accumulation in both sectors of the economy.

Since the major welfare gains come from domestic policy reform, our second experiment studies the effect of each of the domestic policy reforms considered in this paper: reduction of subsidies to capital and relaxation of the labor restriction. To completely isolate the effects of each policy, we run the simulations in a closed economy environment. Figure 5 presents the results of this experiment. From the evolution of GDP we observe that most of the relative "slowdown" observed in the initial periods is due to the labor restriction. Firms wait to make their investments until labor is allowed to reallocate. Capital market reforms reduce the steady state's level of output and capital stock, since now the SOEs do not demand as much capital as in the situation where capital is subsidized at a higher rate. The SOEs' share of output helps explain the path of GDP. The reduction of the SOE share during the reform period is mainly due to the relaxation of the labor restriction. The effect of the reduction in the subsidies to capital on the SOE share deserves special attention. Since the non-traded sector is less subsidized than the traded sector, a 70% reduction in the subsidy affects, in absolute terms, the traded sector more than the non-traded sector. We observe that when capital reform is implemented, the share of SOEs' output in the traded sector is lower than in the benchmark economy and it declines gradually. For the non-traded sector, the share is actually higher than in an economy that does not implement the reform. The private sector is moving resources away from the non-traded sector and into the traded sector, where it has comparative advantage. In terms of welfare we obtain that about two thirds of the welfare gains are due to reforms in the labor policy whereas only one third are due to reforms in the subsidies to capital.

6 Sensitivity analysis

In this section we study how sensitive our results are to the values of some of the parameters of the model. We consider two types of parameters: policy parameters and parameters the value of which we have taken from existing studies.

The first policy parameter that we consider refers to the transitional costs of unemployment. As SOEs are restructured during the reform period, large numbers of government workers will be laid off. Some of them may not be able to find jobs in the private sector, due to their age or lack of skills. This reduction in employment may offset some of the welfare gains of domestic policy reform. Our purpose is to assess the magnitude of the welfare loss from the increase in unemployment that may be associated with the domestic reforms. The

actual magnitude of the unemployment costs due to structural changes associated with trade liberalization are hard to assess. Michaely, Papageorgiou and Choksi (1992) after studying several liberalization episodes in developing countries conclude that the effects of trade liberalization on unemployment were small, with almost no net increase in unemployment, even at the sectoral level.

In our model economy we have assumed that all the workers laid off by the SOEs are absorbed by the private sector, so the costs of unemployment are taken to be zero. In order to get an idea of the possible effects of considering the unemployment costs of reform, we introduce them in the model in a very straight forward way. We assume an homogeneous reduction of the employed population during the reform periods. We interpret this net reduction in employment as laid off workers who cannot find jobs in the private sector and are left out of the labor force. Complete asset markets within the country imply that the cost of a lower employment rate is shared equally among all individuals. Notice that our estimate is an upper bound on the unemployment costs, since we do not allow the individuals that lose their job to work in the informal sector or to operate a home production technology. Furthermore, we assume that the reduction in the employment rate is permanent, so we do not account for new jobs created after the reform periods.

Using data from China's Premier Zhu's 2003 press report, since 1998 nine million workers laid off from Chinese SOEs have not been re-employed. Assuming that these workers will not be able to find another job, we obtain an average annual reduction of the labor force of .8%. To obtain an upper bound on the unemployment costs, we assume that the employment level shrinks by .8% a year during the 5-year reform period and that it does not recover after the reforms are finalized. Under these assumptions we obtain a welfare cost of unemployment of 3.38%, leaving the welfare gain of domestic reform instigated by the WTO treaty at an still high 11.72%.

Since most of the welfare gains of domestic reforms are derived from reducing the subsidies to labor, we consider next the effects of reducing the scope of the reforms. In particular, we analyze the effects of policy reforms that reduce the SOEs' employment by 25% (half or the calibrated value). In this case, we obtain welfare gains of domestic reform of the order of 11%. The gains in steady state GDP and TFP levels are also smaller.

Finally, we consider sensitivity analysis on two parameters of the model which values were chosen from previous studies: the elasticity of substitution between domestic and foreign traded goods, determined by the parameter ζ, and the capital adjustment costs, determined

by the parameter η. We obtain that higher elasticities of substitution slightly increase the welfare gains of reform. Considering an elasticity of substitution of 10 instead of 2 adds 1.4 percentage points to the welfare gains of liberalization. Increasing the adjustment costs of capital decreases the benefits of liberalization. In particular, a reduction of η from .95 to .85 reduces the welfare gains of liberalization by one percentage point. In both cases, the qualitative aspects of the model do not change.

7 Policy exercises

In this section we use our modeling framework to study the optimal timing of domestic and capital market reforms. In particular, we consider the question of whether domestic reforms should precede capital market liberalization or should be implemented at the same time. Figure 7 compares the evolution of GDP and TFP between an economy that liberalizes its capital market right when it starts reforming domestic policy (capital markets are liberalized at period 3, and domestic policy reforms are implemented gradually from periods 3-8) and an economy that opens to capital markets after the domestic reforms are complete (period 8). We observe that the main differences occur during the transition. Opening capital markets earlier ensures a faster convergence to steady state and, thus, faster growth, only after some initial periods of slower growth and lower levels of real GDP per capita.[24] Early opening produces lower investment in the periods prior to the implementation of the policy. TFP follows a pattern similar to GDP. In terms of welfare, early opening brings welfare gains of .26%. Notice that even though the number is small in absolute terms, it is large if we compare it to the total welfare gains of opening the capital markets, which was established at .04%.

8 Conclusion

In this paper we quantitatively assess the welfare gains of an indirect effect of trade liberalization: domestic policy reform. We develop a dynamic computable general equilibrium model to analyze the economic effects of domestic and capital market liberalization in a country with a significant state-owned industrial sector, and we apply it to the case of China's accession to the WTO. We argue that since these reforms are promoted by the trade agreement, the welfare gains of their implementation are to be considered as part of the welfare gains

[24] Growth rates are compared in the second graph of figure 7.

of trade liberalization. We study the effects of reforms in two domestic policies: government subsidies to capital and to labor targeting the state sector. Our results are two fold. First, even when estimates of transitional costs of unemployment are considered, we obtain welfare gains associated to the implementation of the reforms that are much larger than the welfare gains from trade liberalization found by traditional trade models. Most of these welfare gains are derived from the reduction of the state sector driven by reforms in domestic policies. Furthermore, joint liberalization of domestic and capital markets delivers higher gains than implementing both policies separately.

Our second result is methodological. From our simulations we obtain that transitional dynamics are crucial in understanding the economic effects of policy reforms. Models that rely only on steady state comparative statics not only miss out on part of the economic gains of liberalization, but they may also be misleading on the qualitative effects of policy reforms. Furthermore, the growth pattern on an economy undergoing policy reforms is not smooth: it experiences slow (or even negative) growth prior to the implementation of the reforms and faster growth during the implementation period.

In this paper we also use our modeling framework to shed some light on the important question on the timing economic reforms. In particular, we study whether capital market liberalization should occur before or after the implementation of domestic policy reforms. We obtain that there are economic gains of joint implementation of domestic and capital market liberalization.

Our model has some limitations that we expect to address in future research. First, we include the agricultural sector together with the traded sector. Given that developing countries usually have a large agricultural sector (in terms of employment), the structure of which usually differs from the industrial sector in terms of ownership, we believe that more accurate estimates would be obtained by considering the agricultural sector separately. Second, we do not model the unemployment costs explicitly. Our method of introducing these costs clearly overestimates them, which implies that the true welfare gains of domestic policy reform induced by trade liberalization should be somewhere in between the two estimates presented in the paper.

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Table 1: Calibrated Parameters

Production Parameters

Unit cost of intermediates

Private: za_P	*traded*	*nontraded*
traded	0.54	0.11
nontraded	0.37	0.19
Public: za_G		
traded	0.54	0.11
nontraded	0.37	0.19

Domestic producers

α	0.24	0.44
A_P	5.36	3.06
A_G	2.33	2.34

Armington aggregator

M	1.67
μ	0.72
ζ	0.5

Investment technology

G	1.94	
γ	0.38	0.62

Depreciation

δ	0.08

Adjustment costs of capital

η	0.95

Preference Parameters

Utility parameters

ϵ	0.88	0.12
β	0.95	
ρ	-1.00	

Foreign demand

D	23.97

Initial Value of Variables

capital	*traded*	*nontraded*
k_{P0}	35.49	28.27
k_{G0}	52.50	32.84
investment	9.47	
total labor: l_0	54.59	
interest ratio: r_0	0.13	
foreign borrowing: b_0	0.00	

Policy Parameters

Labor restriction

λ	10.52	11.71

Tariffs

τ_D	0.02
τ_F	0.05

Subsidy to capital

s_G	0.83	0.08

Taxs

t_P	0.13	0.11
t_G	0.13	0.11

Government consumption

g	0.00	11.47

Table 2: Steady state comparisons(data as % change relative to benchmark)

	Closed-Open		Closed		
	no reforms-c vs both reforms-o	no reforms-c vs no reforms-o	no reform vs labor-only	no reform vs capital-only	no reform vs both reforms
Real GDP	5.26	-0.38	8.38	-5.58	5.60
TFP	14.79	0.05	11.78	4.61	14.73
tax revenue/GDP	1.21	0.47	0.77	-0.08	0.74
subsidy to K/GDP	-97.40	-0.23	-54.17	-94.13	-97.40
subsidy to L/GDP	-38.04	-0.23	-54.17	39.99	-37.95
cons. Transfer/GDP	229.10	1.99	181.90	91.90	227.55
tariff rev/GDP	-2.27	-2.50	-1.10	2.18	-0.11
SOE share(1)	-70.78	-0.33	-54.57	-33.71	-70.70
SOE share(2)	-52.92	0.88	-52.83	3.55	-53.29
c(1)/GDP	6.55	-2.70	5.60	7.06	8.88
c(2)/GDP	6.21	-2.87	5.38	7.18	8.70
equivalent variation	10.79	-3.67	13.52	1.52	14.26
imports/GDP	-2.27	-2.50	-1.10	2.18	-0.11
exports/GDP	5.45	6.27	-1.10	2.18	-0.11

Figure 1: Steady state values as the labor restriction is reduced

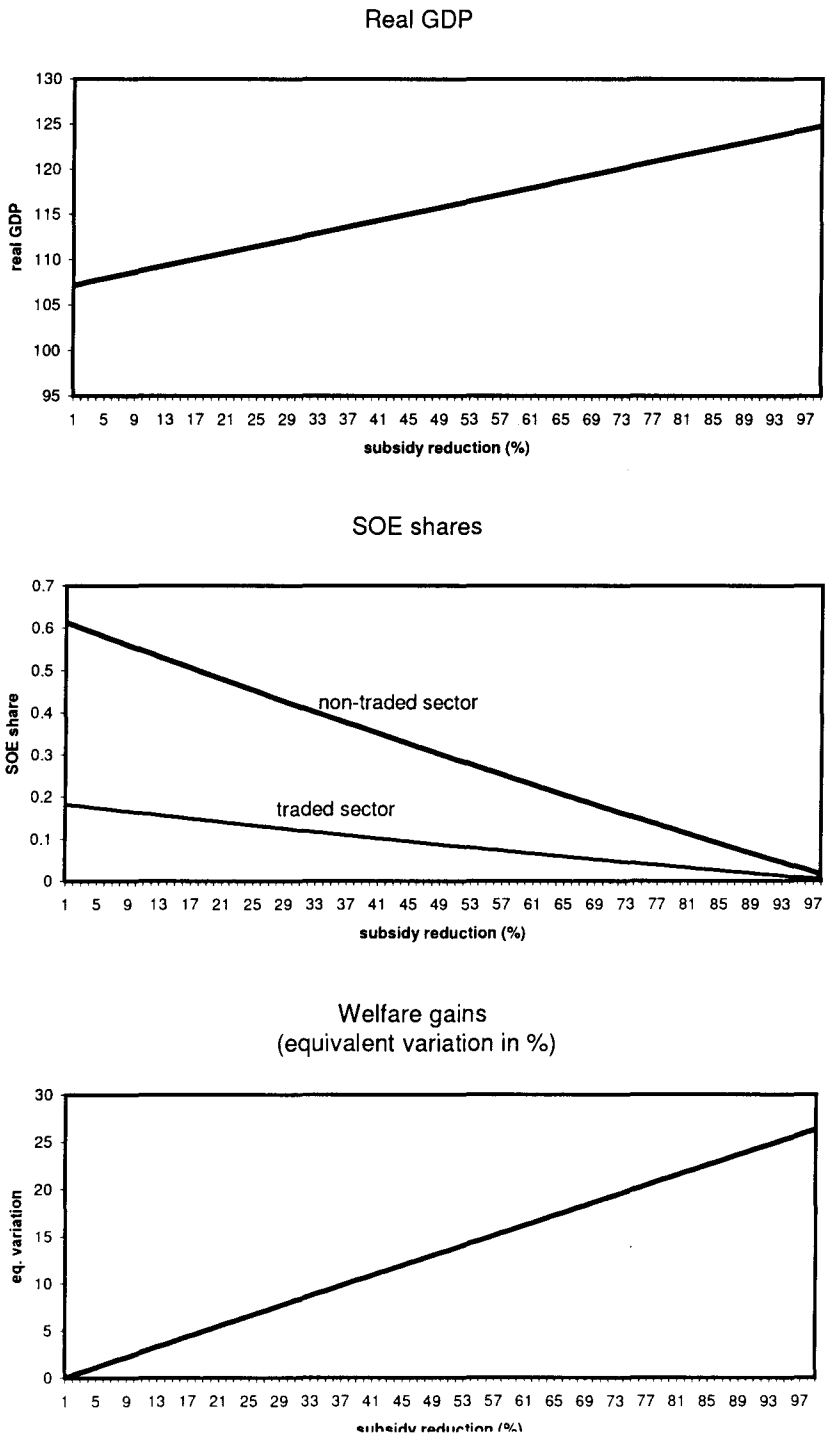
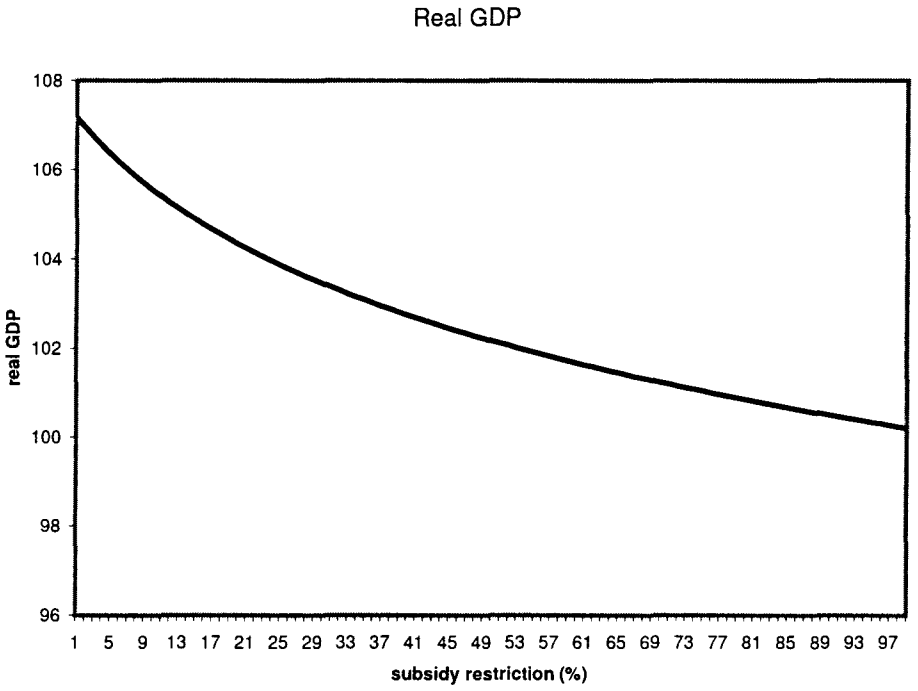


Figure 2: Steady state values as the capital subsidy is reduced



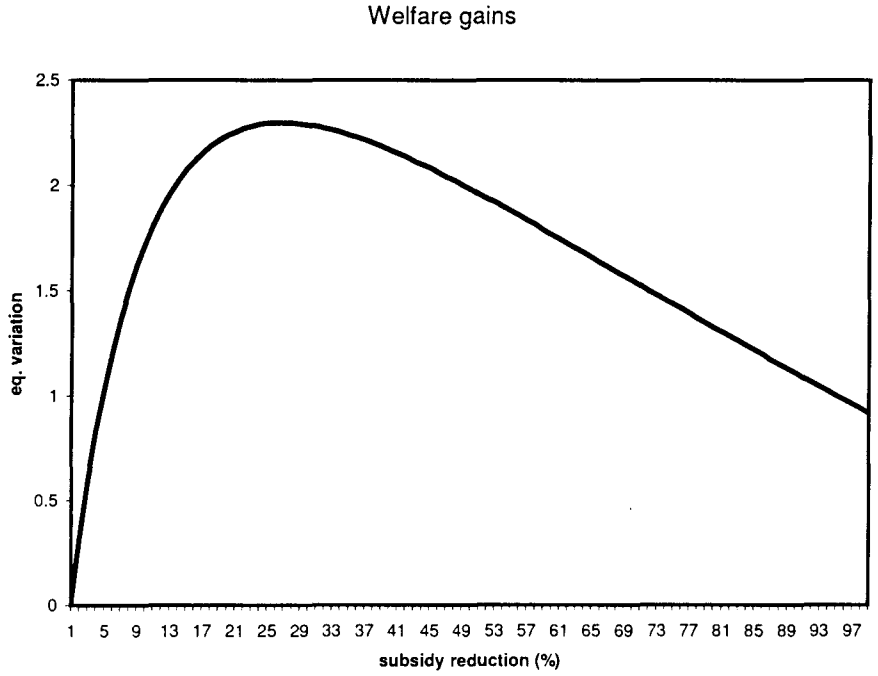
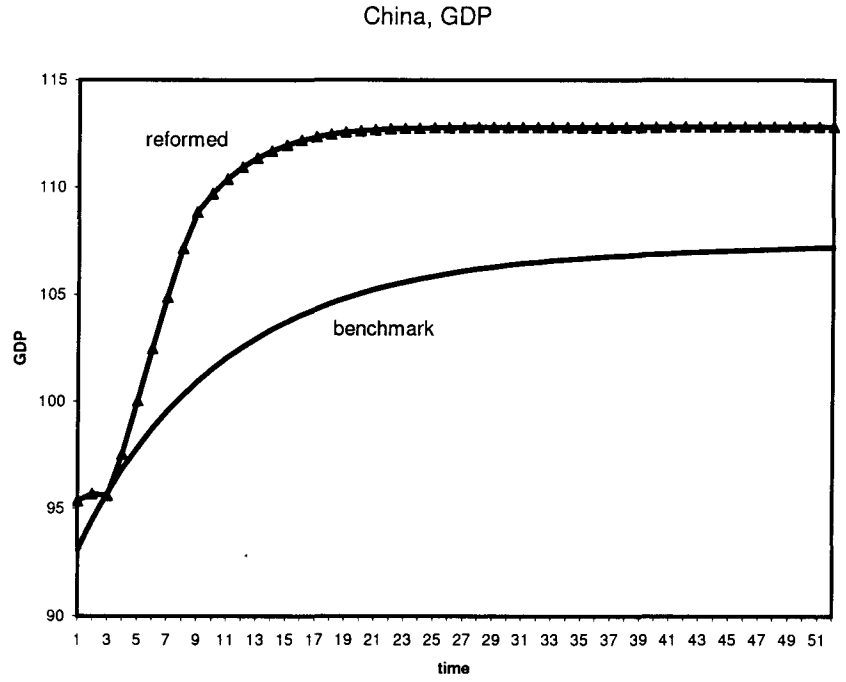


Figure 3: Liberalization (transitional dynamics)



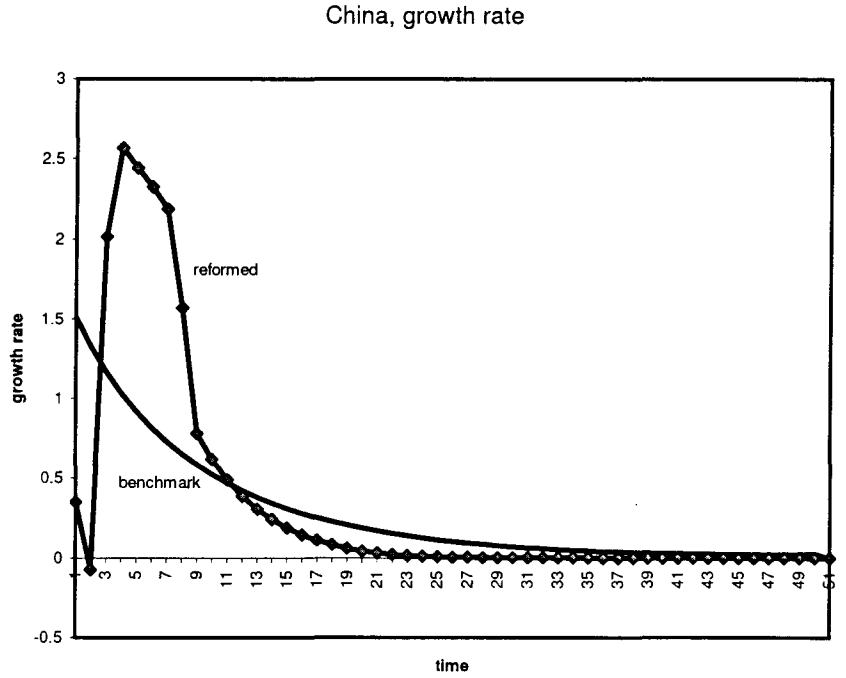
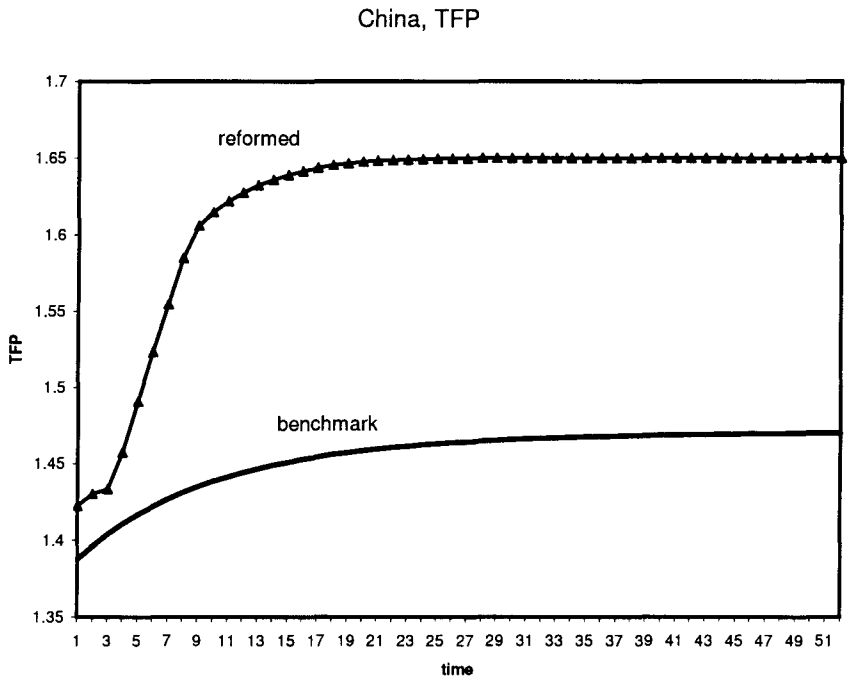


Figure 4: Liberalization (transitional dynamics)



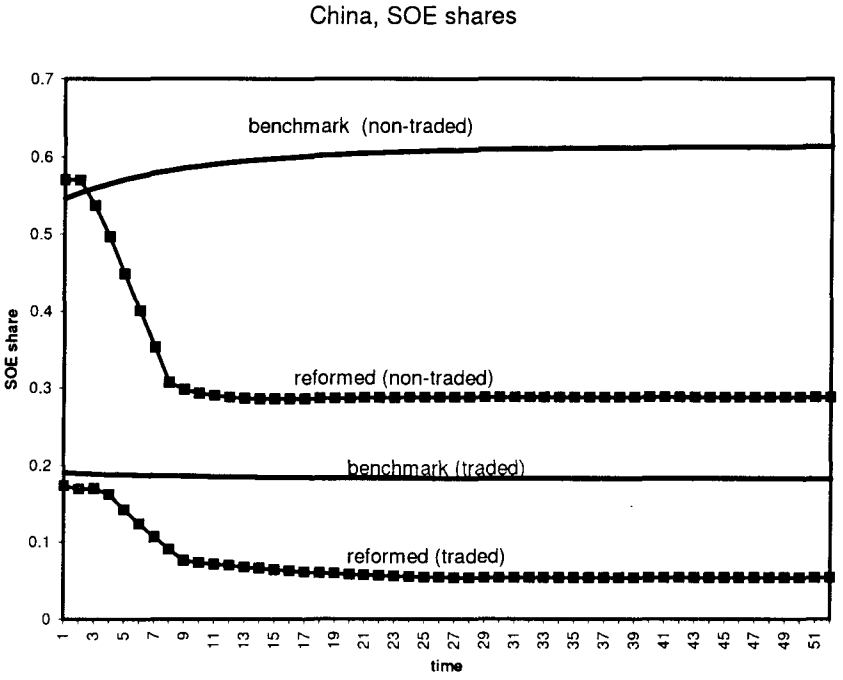
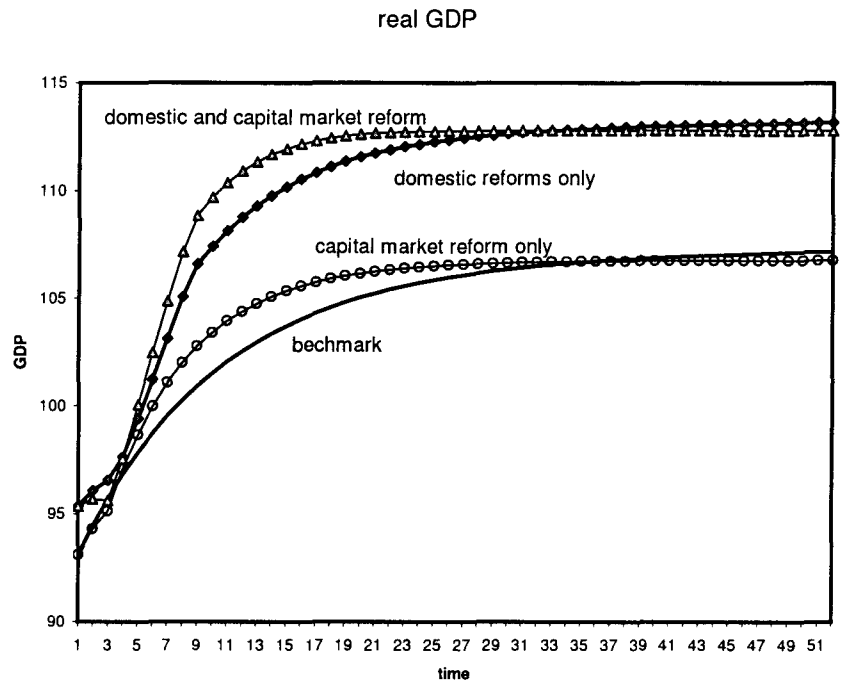


Figure 5: Type of reform (transitional dynamics)



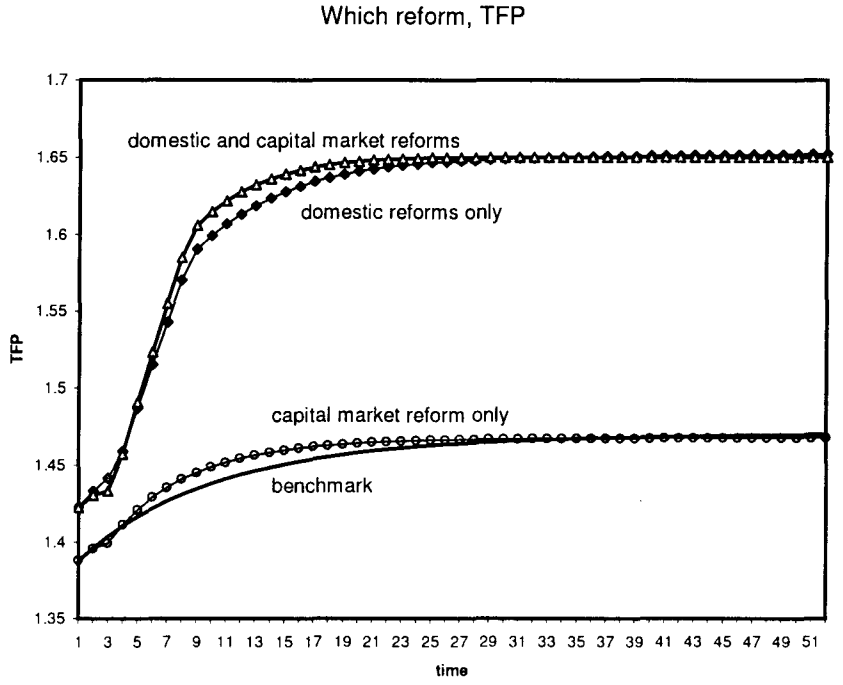
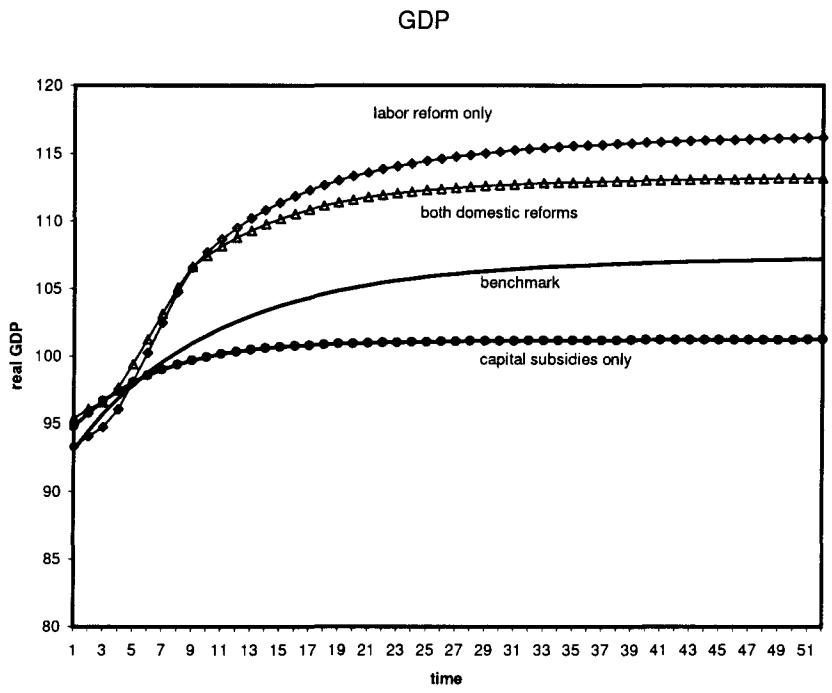


Figure 6: Domestic policy reform (transitional dynamics)



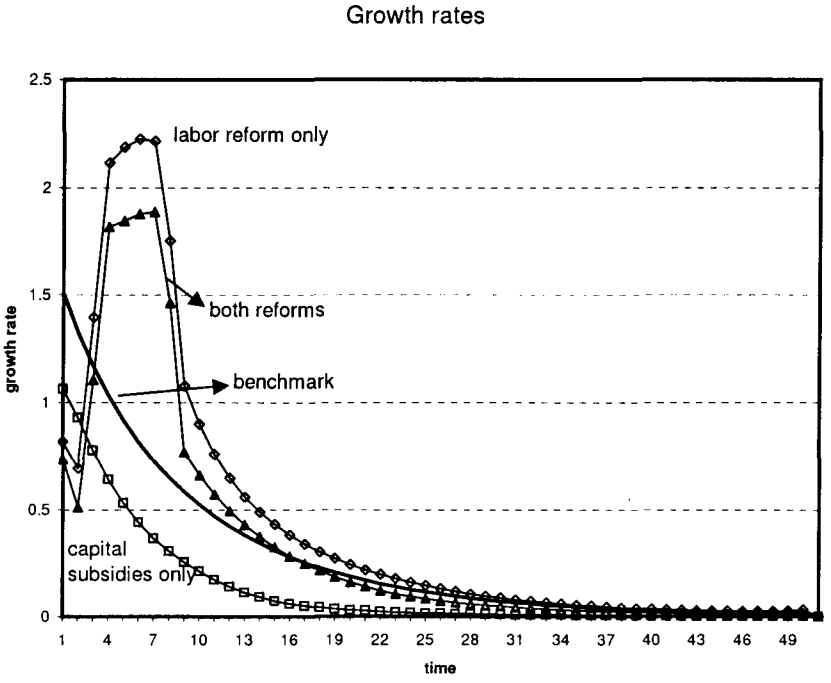


Figure 7: Time of opening (transitional dynamics)