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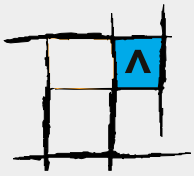

Trade and FDI liberalization: What to expect from China's entrance to WTO?¤

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Abstract

Trade liberalization episodes are usually analyzed in a horizontal dimension, that is, the movement of resources across sectors due to relative price changes. This perspective underestimates an element present in many liberalization processes: the opening access of foreign …rms to produce and sell locally. As long there exist productivity di¤erences between native and foreign …rms and depending on the degree of technological transfers during the liberalization process, the e¤ects on local …rms of direct competition with better-equipped foreign ones within each industry - the vertical dimension - may dominate the resource allocation and factor return e¤ects of traditional tari¤ liberalizations. This paper presents a model to evaluate the outcome of a liberalization process in terms of resource allocation and income distribution when a tari¤ reduction is accompanied by FDI liberalization. The framework presented provides a natural setting to answer several questions present in liberalization episodes: What is the rationale for privatizing native state-owned …rms? How big are the potential short run e¤ects on aggregate employment? Is there a role for …scal and labor policies in sustaining the reform? The model is used to estimate the e¤ects of China's entry to WTO, as a fall in tari¤s is expected together with an end to the dual economic structure. Overall, the results show that FDI liberalization will not a¤ect signi…cantly the outcome in terms of the production structure but it will have a signi…cant impact on the winners and losers of the process. (JEL F1, F2)

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"Earlier this month, also in Tianjin, disputes erupted between workers at a state-owned liquor company and its German partner, which wanted to sell factory parts for scrap metal. The workers blocked a truck, insisting that the pro…ts from the metal were rightfully theirs. Late last year, workers at the formerly state-owned Red Lion Paint Factory in Beijing ended up in a near-fatal stando¤ with the management after a new private owner, a Chinese company from Shandong Province, wanted to close the plant and sell the land." New York Times, August 31, 2000.

Trade liberalization studies usually emphasize the e¤ects of tari¤ changes in the allocation of resources across sectors and factor returns. This horizontal view ignores that in many cases tari¤ liberalization is accompanied by the liberalization of Foreign Direct Investment (FDI). The opening access of domestic markets to foreign production introduces competition in factor markets for native …rms. If there exist technological di¤erences between native and foreign …rms, competition in factor markets provides a clear advantage to …rms with technological superiority that shrinks the competitive position of native …rms, in contrast with competition only in product markets, where technological di¤erences may be compensated by the return of internationally immobile factors in order to keep industries competitive. As a consequence, FDI liberalization may generate an important movement of resources across …rms within sectors - vertical movement - that may compensate the resource allocation and income distribution e¤ects of pure tari¤ liberalization. In this context, the role of technological transfers is crucial in order to determine how competitive native …rms remain.

The explicit consideration of a vertical dimension not only may prove useful to understand the wide variety of outcomes in several liberalization episodes but it also provides a clear conceptual framework to discuss questions that are present in these kind of processes. What is the role that privatization of state-owned native …rms may have in the process?, Who should be in favor of privatizing?, How can we explain important employment and output costs observed in some cases?, Is there any role for …scal or labor policies to support the process in the transition period? All these questions have been at the core of the debate in East European episodes, German uni…cation, Mexican liberalization and many others.

A simple multi-sector model where …rms with di¤erent technologies coexist is presented. The co-existence is supported by alternative protective measures to less-developed …rms. Speci…cally, special protection in output markets that distort product prices and distortions in factor markets are considered. In this setting, it is analyzed the e¤ects of a pure tari¤ reduction process across sectors and compared to the e¤ects of FDI liberalization where the same set of rules are established for all …rms regardless of their technology or ownership structure. Speci…cally, the same …nal tari¤ protection as well as labor market rules hold for foreign and native …rms. In consequence, FDI liberalization necessarily pressures up wages compared with the pure tari¤ liberalization, and so it a¤ects negatively the short run return on capital and employment in native …rms. The change in production structure depends on the relative distribution of tari¤ reductions for native …rms and tari¤ increases to originally unprotected foreign …rms.

If technological transfers take place even higher pressures on wages arise. The e¤ect on capital returns and employment in native …rms depends on the relative size of technological transfers and wage pressure from overall technological convergence. This implies that sectors with more backward technologies are those more bene…ted from technological transfers. Overall, the relevance of technological transfers is twofold. Its size a¤ects the winners and losers of the process while its dispersion across sectors determine the …nal outcome in terms of production structure. In the long run, convergence is inevitable so the

technology set and relative prices of foreign …rms are enough to determine the e¤ects on factor returns and factor allocation.

The framework is used to estimate the e¤ects of one of the most controversial liberalization cases in the last decades: China's entry to WTO. The case of China is important not only due to its geopolitical and economic relevance but also because it represents a case where the consequences of FDI liberalization may easily overtake those of a pure tari¤ liberalization. Although China started an important process of liberalization and transition to a "Socialist Market economy with Chinese Characteristics" in 1978 (see Lardy (1992), Naughton (1996), Feenstra (1998) and Sachs and Woo (1997) and the literature thereafter for a discussion of the transition process of China in the last two decades), important distortions remain that entrance to WTO mandate removing. In particular, the tari¤ structure of China is still highly protective of domestic …rms and the economic system is characterized by a dual structure where foreign …rms are restricted to access domestic markets in several aspects, creating a two-economy country.

China has had important policies to attract foreign investment providing them with special treatment in issues like tax policy and imported intermediate-inputs tari¤ remission. At the same time, important incentives to export their production as well as legal and de-facto restrictions to access domestic markets exist. Indeed, many of the bene…ts mentioned above are conditioned on export performance. Foreign-owned enterprises (FIEs) are mainly located in Special Economic Zones (SEZs) where they can have easy access to foreign markets and in some cases they serve as mere re-exporters of Hong Kong or Taiwanese production, adding small value-added to the process (see Feenstra, Hai, Woo and Yao (1998)) This structure is the basis for the huge expansion in foreign investment and exports observed in the last decades. Domestic …rms (State-owned (SOEs) and Collectively-owned enterprises (COEs)) enjoy several protectionist measures but do not share many of the bene…ts directed to foreign …rms. Native …rms sell mainly in protected local markets and face some restrictions (specially SOEs) to access foreign markets directly. At the same time, they have to pay tari¤s for the imported intermediate inputs and pay higher taxes than foreign …rms.

The rationale for this system has been widely discussed, specially from the perspective of whether the successful transition of China is the result of an experimental set of institutions or just a convergence process towards market institutions (Sachs and Woo (1997)). This paper is probably more is line with the convergence school in the sense that is emphasizes that the dual economic structure serves as a cushion to protect domestic …rms from increasing degrees of foreign competition. Furthermore, within domestic …rms increasing competition between SOEs and COEs has appeared. The latter, semi-private institutions operating without the straightjacket of China's government intervention have crowded-out government production in the last years. As a consequence, the government has assigned increasing amounts of credit to state-…rms to sustain its commitment to state employment and production. In this setting, a smooth opening of domestic markets has been taking place, but the biggest step is still to be seen: the removal of special protective policies to domestic …rms in general and state-owned …rms in particular.

These characteristics of the dual economic structure are not consistent with WTO rules, that prohibit special bene…ts for domestic …rms. As stated by Naughton (1996), the integration process of China has advanced in many aspects but several additional elements are required to be considered part of WTO. In his words, "China's leaders have repeatedly rea¢rmed that the long-range objectives of trade reform are a more open trade regime and membership in the World Trade Organization (WTO). A prerequisite of the latter is "national treatment" for FIEs; that is, that they not be subject to legal requirements

that they do not also apply to domestic …rms. To this end, the Chinese have begun to take a number of steps to reduce, and ultimately eliminate, the di¤erences between the present export promotion and ordinary trade regimes. Some of these changes have been mentioned above: tax breaks on investment goods for FIEs are being phased out, other aspects of tax treatment are becoming more uni…ed; and there are plans to reduce the scope of tari¤ exemptions for all entities, foreign and domestic". Also, "If implemented, these reforms will tend to unify the trade regimes, and the resulting system will be more open than the present dual regime". Finally, "It is important to note that further liberalization will not entail convergence to the extremely open regime under which FIEs in southern China currently operate. Instead, trade in both regimes will be subjected to a uniform set of rules that will make the domestic economy overall signi…cantly more open to the world economy, but will impose more tari¤s and regulations on certain traders than at present".

The paper argues that this opening process is very similar to the one lived by East Germany in its uni-…cation with the West, as wage and technological di¤erences in both sides of the wall generated signi…cant pressures on state-owned dominated production structure of the East. Output and employment costs in this case are mostly associated with the movement of resources across …rms with di¤erent technologies more than with a reallocation of labor across sectors (see Akerlof, Rose, Yellen and Hessenius (1991) and Dornbusch and Wolf (1994) for discussions of the uni…cation process of Germany). As discussed by Fisher and Sahay (2000) in a cross-country study of European liberalization episodes, price and trade liberalization as well as the role of privatization and foreign …rms penetration seem to be more important than macro stabilization (specially …scal adjustment) explaining the evolution of output in the aftermath of the reform.

A key element in the paper is the presence of technological di¤erences between domestic and foreign …rms. A methodology to estimate these di¤erences is proposed and applied to China. The results suggest that technological gap is higher in SOEs than in COEs, consistent with other results in the literature (see Brandt and Zhu (2000)). The results also show that penetration of FIEs is higher in sectors with higher technological gap. The estimation of the model for China reveals that a pure tari¤ liberalization tends to hurt labor intensive sectors for these are the industries with higher fall in tari¤s. The presence of technological di¤erences across …rms does not alter this result because the productivity gaps are quite similar across sectors in state and collective …rms. At the same time, the equalization of tari¤s for all …rms in each sector favors labor-intensive foreign …rms. As a result, no clear pattern of change in the production structure is expected in the short run. Workers in domestic …rms win, specially if technological transfers take place. In the log run, it is revealed that a movement of resources towards capital-intensive sectors is expected.

The paper is divided as follows. Section 1 presents an overview of the Chinese economy with special emphasis on the tari¤ structure and the characteristics of the dual economic system. Section 2 presents the model, while section 3 describes in detail the tari¤ and FDI changes that China's entry to WTO mandate changing. Section 3 also describes the methodology to estimate technological di¤erences between …rms. Section 4 reports the empirical results and section 5 concludes.

1 China's Economy

The objective of this section is not to provide an overview of the evolution of the Chinese economy in the last twenty years but to show some elements of the economy that result relevant to understand the e¤ects of WTO. Special emphasis is put on understanding the implications of the dual economic system as well as the tari¤ structure, the two critical elements that China's entry to WTO demand altering.

China is characterized by a labor force of more than 650 millions workers of which almost a half is employed in the agriculture sector. Manufacturing, the sector target of this paper, employs close to 97 million workers and represents almost 40% of total GDP. As table 1 shows, the 3-digit ISIC sectors[1] with higher employment share are Machinery, except electrical, Textiles and Pottery and Glass. In value-added terms, the highest shares are in Chemicals and Machinery, both electrical and not electrical. Columns 3 to 5 show the distribution of Manufacturing value-added between state, collective and foreign enterprises, revealing a high dispersion of FIEs penetration.

What explains the di¤erent penetration rates of foreign …rms across industries[2]? Two are the main answers o¤ered, one now and the other in section 3 when technological di¤erences are estimated. Figure 1 plots the share of foreign production in total value-added in each industry against a measure of relative capital intensity. Speci…cally, the y-axis variable is the ratio of K=L in each sector divided by the average K=L ratio of foreign …rms operating in the manufacturing sector, where K is the nominal level of total assets in each industry and L is the number of workers. Although the variable used to proxy for capital stock in each industry is not the ideal one, what matters is that the relative level across sectors re‡ects adequately the relative capital stocks. The message of the negative and signi…cant at 1% correlation (-0.65) is that foreign …rms are mainly located in China in order to enjoy low labor costs, bringing their capital and technologies to combine them with local labor. The advantage generated by low wages is higher in labor-intensive sectors, and the incentives to locate in China in very capital-intensive sectors are clearly lower. Di¤erent would be the picture if there were open access of foreign …rms to China's local markets. In this case, closeness and other considerations may attract capital intensive sectors to produce in China, as well.

The share in production does not point to the key aspect of the penetration of foreign …rms in consumption. Although it is well documented (Branstetter and Feenstra (1999)) that several restrictions exist over foreign …rms to sell in local market like exports requirements, location restrictions, limits for domestic access and others, it is necessary to discuss to what degree these restrictions are binding and the concept of a dual economic system is relevant. Table 2 from Branstetter and Feenstra reports the share across regions (no information is available across sectors) of di¤erent sources of supply: Multinational …rms, state-owned enterprises and imports. The share value for region k is calculated as $(Q_{ki} ¡ X_{ki})=(Q_k ¡ X_k + M_k)$ for i = SOEs or FIEs and where $Q_{ki} ¡ X_{ki}$ is the production net of exports of …rms type i in region k and $Q_k ¡ X_k + M_k$ is the total consumption in region k. This simple estimate shows that consumption penetration of foreign …rms is in general very small in all regions but not is SEZs where FIEs are mainly located. Aside from Beijing, Tianjin, Shanghai and in less degree Jianzu, high penetration of

[1] 3-digit ISIC sectors are 29, but China's authorities keep records (at list public ones) for those industries aggregated in 23 categories, that are the ones detailed in the table. Hereafter, all the analysis is done based on those 23 categories.

[2] The data in Table 1 only refers to share in production, and says nothing with respect to where that production is sold.

SOEs coincides with low penetration of FIEs.

Overall, the production and consumption structure in China strongly supports the widely known idea of a dual economic structure. On the one hand FIEs are encouraged to produce in China combining its foreign capital and technologies with local labor force, receiving intermediate inputs tari¤ remission, lower pro…t taxes and several other incentives. On the other hand, they are encouraged to export their production and are limited to sell their products in local markets. In other words, native enterprises (state and collective) are protected from external forces with either high tari¤s or restricted access of FIEs to domestic markets, either explicitly or through illegal surcharges. The protection to native …rms is somewhat compensated with tari¤s for intermediate inputs, higher pro…t taxes than FIEs and restrictions to access foreign markets directly.

Figure 2 shows the tari¤ structure of China as of 1999 and …gure 3 plots the nominal tari¤ levels against the measure of K=L ratio detailed above[3]. The results are suggestive; China protects more the labor intensive industries[4]. According to the Stolper-Samuelson view that protection favors the factor used intensively in that sector this is not an unreasonable result considering that China is a labor intensive country. Another reading of …gure 3 is that China protects those industries that export most.

How can we explain this phenomena? Why is a country protecting the sectors where it has comparative advantage? New trade theory would suggest economies of scale or the "import protection as export promoting" principle as an explanation for this "puzzle". I propose two alternative explanations. First, most of China's exports come from FIEs that as already seen have a clear biased towards labor intensive sectors while protection is directed only to state and collective …rms. This is the nature of the dual economic system, where foreign …rms are allowed to produce in China but have limited access to local protected markets that are restricted to native (state and collective) …rms. Exports of labor-intensive goods come mainly from an economic system that is not subject to the protection structure detailed in …gure 3. The explanation for the high protection levels of labor-intensive industries in local market in discussed in section 3 and it is related to technological di¤erences. Second, as …gure 4 (a) and (b) shows, although China exports the traditional labor intensive sectors like Apparel, Footwear, Textiles and Pottery, overall it is not clear that China's trade structure is one with a clear bias towards exporting labor intensive products and importing capital intensive ones.

2 The model

Consider a simple general equilibrium production framework where …rms use three factors to produce output; labor and capital that are immobile internationally and hence their returns are endogenously determined, and intermediate inputs that are assumed to be internationally traded goods with their price set in international markets (and taken as given by the …rms in the home country). The economy consists on 2 tradable sectors that face international prices and produce with constant return to scale

[3] See appendix 1 on Data Description for details about the calculation of 3-digit ISIC tari¤s.

[4] Excluding Tobacco industries, the correlation of both series is -0.29 and not signi…cant, but excluding Beverage industries also, the correlation falls to -0.43 signi…cant at 5%.

technologies[5]. It is assumed that in the short run capital is …rm-speci…c, so that possible rental-rate di¤erences between sectors exist while in the long run capital movements imply an equalization of rental rates. The simple two-sector model is presented to highlight the basic mechanisms that are not altered in a higher dimensional framework. Indeed, the empirical estimations are done using a n-dimensional version of the model.

There are several reasons to focus in short and long run horizons. As Neary (1978) points out, the traditional long run responses to relative price changes may di¤er substantially from those when some factors are not mobile in the short run. At the same time, the relevance of technological di¤erences between …rms within sectors is di¤erent in the short run when some …rm-speci…c or sector-speci…c factor can absorb all the impact of technological di¤erences. In the long run, all factor end up in the hands of the …rms with best technologies (at least in the CRS case considered in this paper). Another issue where di¤erent horizons of analysis are relevant is the aggregate response of employment. While short run frictions in the reallocation of labor across sectors or across …rms within sectors may have important unemployment consequences, in the long run it is expected that these frictions die out and full employment exists.

This section presents …rst the short and long run e¤ects on a change in relative prices (due to changes in tari¤s) in an economy with only native …rms. The second part discusses the conditions under which …rms with di¤erent technologies may coexist. In this context, it is discussed the e¤ects of trade and FDI liberalization in the economy and conditions under which each one dominates. The third part discusses two complementary issues: the rationale for privatization of native state-owned …rms and the role of technological transfers, and the potential short run employment costs.

2.1 Only Native Firms

Consider an economy with 2 tradable sectors where native …rms (operated with native capital and technologies) produce in a perfectly competitive framework (in both goods and factor markets) with CRS technologies. In this framework, the equilibrium is characterized by factor-market clearing conditions and zero pro…t conditions.

The labor market clearing condition is

$$\overline{L} = \sum_{h=1}^{2} a_{Lh} Q_h \tag{1}$$

where $\overline{L}$ is the total (inelastic) supply of labor in the economy, a_{Lh} is the amount of labor required to produce one unit of value-added in sector h and Q_h is value-added in sector h. The capital market clearing condition di¤ers in the short and long runs. In the short run, capital is sector-speci…c, so

$$K_h = a_{Kh} Q_h \tag{2}$$

where K_h is the amount of capital in sector h at any point in time. In the long run, when capital is mobile across sectors

$$\overline{K} = \sum_{h} K_h = \sum_{h} a_{Kh} Q_h \tag{3}$$

[5] The absence of non-traded sectors does not alter the message or details of the paper, as their interaction with tradable sectors come mainly from the pressures on factor market.

The zero pro…t conditions are given by

$$p_h = a_{Lh}w + a_{Kh}r_h \tag{4}$$

where p_h is the value-added price of good h as faced by producers. In the short run, at any point in time wages are the same across sectors while rental rate on capital may vary. This di¤erences die out in the long run as capital moves between sectors.

In general, the e¤ects of tari¤ liberalization work through changes in relative prices. I suppose that all change in tari¤s is passed to producer prices. Implicitly, I am assuming that prices of foreign goods are set in external markets, and that local goods are close enough substitutes for foreign goods so that producer prices follow the path of foreign goods. Totally di¤erentiating (1), (2) and (4) and combining with the de…nition of the elasticity of substitution between labor and capital[6] we can obtain the short run percentage change in wages and sectorial employment given by

$$\hat{w}^s = \frac{\sum_h \lambda_{Lh} \frac{\theta_h}{\mu_{Kh}} \hat{p}_h}{\sum_h \lambda_{Lh} \frac{\theta_h}{\mu_{Kh}}} \tag{5}$$

$$\hat{L}_h = -\frac{\theta_h}{\mu_{Kh}} (\hat{w}^s - \hat{p}_h) \tag{6}$$

where λ_{Lh} is the share of employment in sector h in total employment and μ_{Kh} is the cost share of capital in value-added. In the short run, wages respond to the relative changes in labor demand in each sector, that depend on the change in prices, the substitution possibilities between labor and capital in each sector[7] that is given by θ_h/μ_{Kh} and the relative size of each sector measured by their employment share λ. The actual change in employment depends of course on the relevant measure of real wages at each sector's level, that is the nominal wage de‡ated by the industry price level.

This results contrast with the long run changes in wages and employment that are given by

$$\hat{w}^l = \frac{\mu_{K1}\hat{p}_2 - \mu_{K2}\hat{p}_1}{\mu_{K1}\mu_{L2} - \mu_{K2}\mu_{L1}} \tag{7}$$

$$\hat{L}_h = -\frac{f(p)\lambda_{Lh}\sum_h \lambda_{Kh}\theta_h}{\lambda_{K2}\lambda_{L1} - \lambda_{K1}\lambda_{L2}} \tag{8}$$

with $f(p) = (\hat{p}_1 - \hat{p}_2)/(\mu_{K1}\mu_{L2} - \mu_{K2}\mu_{L1})$. The response of wages is completely determined by external competitiveness conditions and it can be di¤erent from the short run response, especially because in the long run the size of the sectors do not matter. In the extreme case where $\theta = 0$, it is clear that in the short run the response of wages is null and so is the reallocation of labor across sectors. In the long run though, wages changes depending on the relative factor intensity of the sectors (Stolper-Samuelson e¤ects) while the allocation of labor remains constant.

Figure 5 illustrates the possible di¤erences between short and long run adjustments in a Lerner-Pierce diagram. Consider a relative-price fall of labor-intensive good 2. By Stolper-Samuelson e¤ects, the long run e¤ect is a fall in the real wage (w_L), with BB the long run isocost line. But in the short run it may

[6] By de…nition of the elasticity of substitution and with no technological change, $\hat{a}_{Li} = -\mu_{Ki}\theta_i(\hat{w}_i - \hat{r}_i)$ and $\hat{a}_{Ki} = \mu_{Li}\theta_i(\hat{w}_i - \hat{r}_i)$

[7] Jones (1971) shows that $\theta_i/\mu_{Ki} = (\hat{a}_{Ki} - \hat{a}_{Li})/(\hat{w} - \hat{p}_i)$. This is the elasticity of the marginal productivity of labor of the mobile factor, de…ned as positive.

be the case that the employment share in capital-intensive sector 1 is much higher than in sector 2 or that the technology to produce good 2 allows no substitution between labor and capital, generating a rise in wages to w_S (point C). A di¤erence in capital return in favor of sector 1 arises, that is eventually arbitrated as capital (and labor) moves from the labor-intensive to the capital-intensive sectors. Another strategy to …gure out the long run change in production structure is to compare w_S and w_L. The fact that there is a fall in wages reveal that the relative K=L ratio released by the shrinking sector is smaller that the one of the expanding sector, generating an excess supply of labor that generates a wage fall (see Mussa (1974)).

2.2 Incorporating Foreign Firms

Although I explicitly called 'native' the …rms operating in the economy, nothing fundamental changes had I call them foreign or mixed. The structure of production does not depend on the ownership structure of the …rms. How does then the presence of foreign …rms a¤ect the equilibrium in the economy? It is useful to think that competition between native and foreign …rms can exist at two levels: competition in product markets and in factor markets. In the former, relative prices carry the relevant information to local producers, and its consequences can be analyzed in the framework presented in 2.1.

When foreign …rms produce locally things change because competition arises in factor markets. If foreign …rms have the same technologies than local …rms then because of the CRS assumption there is no e¤ect in the production structure. If foreign …rms bring capital the only e¤ect may come from the Rybczynski derivatives. As long as the economy remains in the same cone of diversi…cation (capital-labor ratio does not rise "too-much") there are no e¤ects on factor returns but the economy moves its production mix to a more capital-intensive one. The competitiveness of native …rms is not a¤ected by the presence of …rms with other ownership structure.

Di¤erent is the case when foreign …rms have better technologies than local ones. Competition on factor markets generate pressures on native …rms that are not able to compete internally with high-tech …rms. Notice that if the …rms with the best technology are located abroad, it is possible for the native ones to subsist as the returns on internationally-immobile factors make the adjustment. Even in the case were there are arbitrage opportunities across countries on capital markets, wage di¤erences can make local …rms remain competitive. But when high-tech …rms are allowed to compete in the same factor markets there are no degrees of freedom to compensate for technological di¤erences.

This section presents a couple of interventions that allow a country to compensate for technological di¤erences across …rms within sectors. The exercise is then to estimate the e¤ects of the removal of those restrictions, leveling the …eld of competition between …rms with di¤erent ownership structure (or strictly speaking, with di¤erent technologies) and to compare them to the e¤ects of changes in relative prices. The parallel to a liberalization process is that the latter refers to a tari¤ liberalization while the former is equivalent to a FDI liberalization.

Labor and capital are allocated to those …rms and industries where they received higher returns. In a non-distorted world, …rms with better technologies concentrate all factors and all other …rms disappear. Can …rms with di¤erent technologies coexist within industries? Several non-competing pre-liberalization alternatives may be assumed. One possibility is that foreign …rms are allowed to produce internally but they are restricted to sell in the same conditions as less developed …rms are, either because native

…rms receive price subsidies or because foreign …rms are not allowed to sell in protected local markets, generating a price advantage on native …rms of the size of the protective tari¤.

Even with integrated product markets, there exists the possibility of distortions in factor markets. For example, labor laws that gives preferences to native …rms or that impose extra restrictions on foreign …rms may introduce a gap in wages that neutralizes the e¤ects of technological di¤erences in rental rates. By the same token, distortions in capital markets against high-tech …rms may make the job. A third possibility is that with integrated product and factor market, capital owners of native …rms are willing to accept lower rental rates. This may be the case of state-owned enterprises with some ideological commitment to state production and employment.

In terms of the model, I consider distortions in product and labor markets that imply an equalization of rental rates across sectors and across …rms with di¤erent technology levels within sectors, so no incentives to capital movement are present in the long run equilibrium. There are native (h) and foreign (f) …rms producing in each sector, and there exists an exogenous gap in wages between native and foreign …rms $w_h=w_f < 1$ and an exogenous product price gap in favor of native …rms $p_{hi}=p_{fi} > 1$ in each sector i. Appendix 2 shows that in the 2-sector case any technological gap between foreign and local …rms can be compensated by a set of price and wage gaps. Totally di¤erentiating the new labor market clearing condition implies

$$\bar{L} = \sum_{i2h} da_{Li}Q_i + \sum_{i2h} a_{Li}dQ_i + \sum_{i2f} da_{Li}Q_i + \sum_{i2f} a_{Li}dQ_i$$

In the special case where foreigners were not producing in the economy, the third term in the right hand side is zero and the last term is just $\sum_{i2f} a_{Li}dK_i/a_{Ki}$ where dK_i is the (exogenous) amount of capital brought by foreign …rms when allowed to produce. The general expression for the short run response of wages as faced by native …rms for tari¤ and FDI liberalization is given by

$$\hat{w}^h = \frac{g(p) - \left[\sum_{i2f} \lambda_{Li}\frac{\theta_i}{\mu_{Ki}}\left(\frac{w_{hi}}{\hat{A}w_{fi}} - 1\right)\right]}{\sum_{i2h} \lambda_{Li}\frac{\theta_i}{\mu_{Ki}} + \sum_{i2f} \lambda_{Li}\frac{\theta_i}{\mu_{Ki}}\frac{w_{hi}}{\hat{A}w_{fi}}} \qquad (9)$$

with $g(p) = \sum_{i2h} \lambda_{Li}\frac{\theta_i}{\mu_{Ki}}(\hat{p}_i + \hat{q}_i) + \sum_{i2f} \lambda_{Li}\frac{\theta_i}{\mu_{Ki}}\hat{p}_i$ with $\hat{q}_i > 0$ is the multi-factor productivity gain associated with the adoption of the foreign technology and Á is the …nal ratio of native to foreign wages (equal to 1 if all labor market distortions are removed). The convergence of the wage gap to 1 after the liberalization process is a disputable assumption because there exist evidence that foreign …rms pay higher wages than native …rms. This case is more di¢cult to support if domestic …rms absorb completely the better technologies available for FIEs. The change in prices in (9) re‡ects both the change in tari¤s for native …rms and the homogenization of product prices for foreign …rms. The associated change in wages relevant for foreign …rms is $\hat{w}^f = w_{hi}/\hat{A}w_{fi}\cdot(1 + \hat{w}^h) - 1$.

It is clear from (9) that a pure tari¤ reduction in local …rms generates a fall in nominal wages. The liberalization of FDI generates a rise in wages compared to the tari¤ liberalization because two forces push in the same direction. On the one hand, the rise in relative price for foreign …rms generates a rise in demand for labor that tends to increase wages. On the other hand, the elimination of the wage gap between local and foreign …rms runs against wages paid by local …rms. If technological transfers to native …rms take place an even higher pressure on wages arise from the shift of labor demand curves in native …rms. As long as the di¤erences in technology are wider the pressure on wages is higher.

Figure 6 depicts in a two-sector setting the impact of technological transfers. Consider that initially labor market distortions introduce a gap in wages paid by foreign and native …rms that compensates the technological di¤erences. The isocost curve for native enterprises is given by AA0 and the isocost for foreign …rms is AA". The removal of this distortion implies an equalization of wages such that the new unique intercept in the L-axis (1/w) is in point B. In the short run and with no technological transfers there exist rental rate di¤erentials between sectors and across …rms in each sector. If technological transfers take place, the unit value-added isoquant for native …rms shift inside to their foreign counterpart level and capital in sector 2 receives a rental rate r_2 higher than the one in sector 1[8]. Rental rate di¤erences within sectors disappear even without capital movements.

The return to capital is also signi…cantly a¤ected by FDI liberalization. It is possible to write the percentage change in capital return in sector i as

$$\hat{r}_i = \frac{1}{\mu_{Ki}}\left[\hat{p}_i + \hat{q}_i - \mu_{Li}\hat{w}_i\right] \tag{10}$$

It follows that a FDI liberalization unambiguously drops the rental rate on capital in native …rms due to the rise in wages. This may be altered with technological convergence because a higher pressure on wages is compensated with productivity growth. The …nal e¤ect depends on whether the rise in productivity more than compensates the higher employment costs due to convergence, that depend on the degree of technological transfers of the overall economy. The condition for the rental rate in native sector i to be higher with economy-wide convergence that without is[9]

$$\hat{q}_i > \mu_{Li}\frac{\sum_{j\in h} L_j \frac{\theta_{ij}}{\mu_{Kj}}\hat{q}_j}{\sum_{j\in h} L_j \frac{\theta_{ij}}{\mu_{Kj}} + \sum_{j\in f} L_j \frac{\theta_{ij}}{\mu_{Kj}}\frac{w_{hj}}{w_{fj}}} \tag{11}$$

If $\hat{q}_i = \hat{q}$ for all native sectors i then (11) always holds and technological transfers bene…ts all capital owners in local …rms. In general, technological di¤erences may vary across industries and (11) reveals that those sectors with less room to catch-up (technologies similar to the foreign ones) are the ones that do not bene…t from (overall) convergence.

If the pressure on wages is high enough and technological transfers do not occur in some native …rms, it is possible that the rental rate that keeps zero pro…t in some local …rms becomes negative. This is more plausible in labor intensive sectors where the rise in wages hit the short run return on capital more than in capital intensive sectors. The relevant decision becomes to scrap the capital or not. If the rental rate is lower than its opportunity cost, then it may be optimal to scrap the capital. But if technological improvements in native …rms take time and eventually will allow a positive rentability, then it may be in the interest of the native capitalists to keep the assets idle until better technological possibilities create a (normal) pro…t opportunity. The critical elements to consider is the speed of convergence, the scrappage value of the assets and the degree of compatibility between the foreign technology and the local capital. This last issue in important because it may be the case that local assets are incompatible with the latest technology. In this case, because convergence is not possible, scrappage becomes the only rational decision.

[8] For graphical purposes it is assumed that technological convergence of domestic …rms does not a¤ect wages, although we know from (9) that that is not the case.

[9] (11) is calculated under the assumption that wage di¤erences are completelly eliminated.

The short run response of employment in domestic …rm i is given by

$$\hat{L}_i = \frac{\theta_{Ki}}{\mu_{Ki}\sigma_i}\left(\hat{w}_i - \hat{p}_i - \hat{\phi}_i\right) \tag{12}$$

As in the case of rental rates, FDI liberalization pressures down employment in native …rms due to the rise in wages. Technological convergence may alter this conclusion because as in the case of rental rates, the shift in labor demand due to technological transfer may compensate the fall in employment due to higher wages. The condition for employment in sector i to increase more or fall less with convergence than without is also equation (11), revealing the important of the distribution of technological transfers across sectors.

The long run e¤ects of FDI liberalization di¤er from the short run e¤ects mainly because convergence in the long run is inevitable. Either native …rms adopt the better technologies and directly compete with foreign …rms or capital ‡y from local to foreign enterprises to get higher returns. In this context, the zero pro…t conditions for native and foreign …rms are given by

$$\hat{p}_i^h + \hat{\phi}_i^h = \mu_{Li}\hat{w}^h + \mu_{Ki}\hat{r}^h \tag{13}$$

$$\hat{p}_i^f = \mu_{Li}\hat{w}^f + \mu_{Ki}\hat{r}^f \tag{14}$$

where $\hat{w}^h$; $\hat{w}^f$; $\hat{r}^h$; $\hat{r}^f$ are the mandated change in native and foreign factor returns required to keep zero pro…t conditions in all sectors. It is possible to show that each equation in (13) for sector i is equal to the equation for sector i in (14) by using the de…nition of $\hat{\phi}_i^h$. In other words, the long run equilibrium is independent of the ownership structure of the economy. The distribution of resources and returns to factors is determined by the technology set regardless of whether domestic …rms adopt the new technologies by themselves or factors or production move to high-tech …rms. If there is no convergence in native …rms, then these …rms get out of the market and only (14) holds. The case with no catch-up is one where the foreign economy continues operating and there is an increase in labor and capital endowment coming from native …rms that by Rybczynski derivatives does not alter the factor returns (as long as we remain producing in the same cone of diversi…cation). As discussed above in section 2.1, a comparison of the short and long run wage e¤ects it is possible to get an approximation of the aggregate change in the production structure.

2.3 Two Complementary Issues

2.3.1 Privatizing state-owned …rms

An interesting view of the rationale of privatizing follows from the model above by considering the case where native …rms are state-owned enterprises with worse technology than foreign …rms. The process of privatizing can be thought of as evaluating the possibility of resources used by domestic …rms to be operated with the new technologies. In terms of the model, it is clear that the rationale for privatizing should be discussed considering mainly the short run impacts of it as in the long run the equilibrium is uniquely determined regardless of whether state-owned …rms converge by themselves or sell their capital to …rms with better technologies.

As discussed above, technological catch-up in the short run unambiguously bene…t workers in state-owned …rms while the e¤ect on the rental rate on state capital is sector-speci…c as the bene…ts of access

to higher technologies may be compensated by higher wages. It follows that if the government is worried about workers welfare, then it should privatize its …rms. If it is more worried about the return on capital then the decision is not too clear. The interesting point is that sectors that should be less willing to an overall privatizing program are those whose technologies are closer to the foreign ones, element that contrasts with the view that the government should keep protecting those sectors with higher disadvantages as workers there will be more hurt.

Two issues may a¤ect the analysis above. First, if the assets in state-owned …rms are incompatible with the foreign technologies then privatizing does not allow capital to operate with the best technology. In this scenario, some governments may prefer to avoid privatizing and keep subsidizing the operations of the state-…rms in order to avoid important employment costs, even if the economically optimal decision is to scrappage the capital. This is not a likely scenario if that capital is in hands of private individuals.

A second issue is the role of …scal and labor policies in sustaining the liberalization process. If a government is not willing to privatize in the short run and expect technological convergence in the medium run it is implicitly giving a subsidy that should be explicitly evaluated. If there are no real costs for privatizing and it is just a redistributive measure, then this implicit subsidy introduces a welfare cost. Di¤erent is the case if a smoother privatizing process avoids important unemployment costs that may have real bene…ts.

A …nal remark is required with respect to …nancial costs of no privatizing. The fall in rental rates in some sectors may impose an important …nancial burden on the …nancial system if important part of the credit is allocated in these state-owned …rms. These issues are discussed in more detailed bellow for the speci…c case of China.

2.3.2 Unemployment

A second issue that is commonly discussed in liberalization processes is the possible unemployment costs associated with movement of resources across sectors. In many liberalization episodes with important output and employment costs it has been argued that more than reallocation across industries due to relative price changes, the big employment costs come from employment changes across …rms with di¤erent technologies. This view is particularly relevant for the experiences of several ex-communists countries, specially East Germany, where the main impact on employment and output was probably the encounter of state-owned …rms with high-tech east …rms that introduce a strong pressures on factor markets that reduces dramatically employment in state-…rms. As long as reallocation is costly, unemployment and output costs arise.

The approach followed here is just a simple exercise aimed to discussed how big the additional employment cost of a FDI liberalization may be. For that, consider the percentage change in aggregate employment in native …rms that is given by the following expression

$$\widehat{L}_H = \sum_{i \in h} \theta_{Li} \frac{\gamma_i}{\mu_{Ki}} \left(\hat{t}_i + \hat{p}_i \right) - \widehat{w}^h \sum_{i \in h} \theta_{Li} \frac{\gamma_i}{\mu_{Ki}} \tag{15}$$

where $\widehat{w}^h$ is de…ned in (10). As discussed above and in appendix 3, any set of technological di¤erences may be compensated with exogenous output price and wage gaps in order to make all …rms competitive and keep a common rental rate. For sake of simplicity, I consider the case where all the burden if put on output prices, so that the pre-liberalization equilibrium is one where wages and capital returns are

equal across …rms and sectors, and technological di¤erences are compensated through price gaps in each sector. In particular $p_g^h = \gamma_g p_g^f$ where g stands for industry 1 and 2 and $\gamma_g > 1$ 8g. I also assume that the price gap is imposed above the tari¤ cost that is also relevant for foreign …rms. This allows us to simplify the though experiment of adding a FDI liberalization (removal of price di¤erences) to any tari¤ liberalization.

In this case, the exogenous price gap re‡ects adequately the size of the technological di¤erences. As a consequence, the di¤erence in domestic employment change (in percentage points) of a tari¤ liberalization with and without (a non-convergence) FDI liberalization is

$$dL_H^C = \sum_{i2h} \gamma_{Li} \frac{\phi_i}{\mu_{Ki}} \left(\frac{1 - \gamma_i}{\gamma_i} - \left[\frac{\sum_{i2h} \gamma_{Li} \frac{\phi_i}{\mu_{Ki}}}{\sum_{i2h} \gamma_{Li} \frac{\phi_i}{\mu_{Ki}} + \sum_{i2f} \gamma_{Li} \frac{\phi_i}{\mu_{Ki}}} \right] \left[\frac{1 - \gamma_i}{\gamma_i} \right] \right)$$

What is the domestic employment change of a FDI liberalization if technological transfers do not occur? Consider a simple case where $\mu_K = 0{:}5$; the share of employment in domestic …rms is 70% and the technological gap implies a cost of production for native …rms 10% higher than foreign ones. In these circumstances, the di¤erence in domestic employment is -3.8 percentage points. In other words, if a pure tari¤ liberalization was traduced in no change in domestic employment, the introduction of a FDI liberalization in the circumstances described imply a fall is employment of 3.8%. This is neither a trivial number nor a big one.

Consider now the case where technological di¤erences are such that the cost of producing for domestic …rms is 2.5 times the cost of production for foreign …rms, implying a productivity gain of convergence of 60%. The estimations for China provided bellow are in this range. Some estimation for East Germany were also in similar ranges. In this case, the fall in domestic employment is of 42 percentage points! If the domestic economy constituted a country itself, like in the German case, it is possible to rationalize important employment and output costs.

If technological convergence take place the e¤ect is reversed. In the speci…c case considered here, the e¤ect is completely compensated because of the assumption that all the distortion is in product prices. In a more general setting like the one presented for China in next section this is not necessarily the case.

3 Trade and FDI liberalization in China

This section presents a discussion of the two main ways through which WTO a¤ects the Chinese economy. On the one hand, WTO mandates a fall in China's tari¤s vis-a-vis the rest of the world, a¤ecting relative prices. The second critical element is the removal of all distortions against foreign …rms that supports the actual dual economic system.

3.1 Tari¤ Changes

The …rst implication of China's entrance to WTO is a fall in tari¤s of China against the rest of the world. I take the signed agreement with the United States[10] as the basis for the proposed change in tari¤ that the Chinese authorities have committed to.

[10] Unclassi…ed Copy of US-China Bilateral Market Access Agreement as Released by USTR on March 14, 2000. Source, US-China Business Council.

The production function implicit in the model is one where labor and capital are used to produce value added, that add to intermediate inputs to produce …nal output. Assuming a …xed technology between intermediate inputs and K and L, what determines the allocation of resources is the evolution of the value added price. In a perfectly competitive setting the zero pro…t condition implies that

$$p_j^h - \sum_{j2I} a_{jh} p_j = p_j^{h;va} = a_{Lj}^h w_j^h + a_{Kj}^h r_j^h \tag{16}$$

where p_j^h is the local product price (including any tari¤s), and a_{xh} is the amount of factor $x = L; K$ required to produce one unit of output. Totally di¤erentiating implies

$$\frac{\hat{p}_j^h - \sum_j \mu_j^h \hat{p}_j^h}{1 - \sum_j \mu_j^h} = \hat{p}_j^{h;va} = \frac{\mu_{Lj}^h}{1 - \sum_j \mu_j^h} \hat{w}_j^h + \frac{\mu_{Kj}^h}{1 - \sum_j \mu_j^h} \hat{r}_j^h \tag{17}$$

where μ_{Lj}^h and μ_{Kj}^h are the share of labor and capital costs in total output in domestic sector j. Considering that local …rms are protected from foreign competition through a tari¤ of t_j in sector j and that they also pay tari¤s for their intermediate inputs, it is follows that $\hat{p}_j^h = \hat{p}_j \cdot t_j/(1 + t_j)$ for …nal product in industry j. By plugging the formula for changes in product prices and intermediate product prices in (17) we get the change in nominal value-added prices for each industry. Implicitly, the method considers a 100% pass-through from tari¤s to local prices. Because of lack of information with respect to the usage of intermediate inputs in each sector, I calculated from the ratio of output to value added the share in cost of intermediate inputs, and assuming that all are imported I applied the average tari¤ change as measure of its price change. Figure 7 shows the relative value-added price change for state-owned …rms associated with the tari¤ reduction against the initial tari¤ level. The strong negative association (-0.78) re‡ects that the sectors most a¤ected with the tari¤ changes are the most protected ones[11]. Being the labor-intensive sectors the most protected, this result suggests that a pure tari¤ liberalization would induce an important movement of resources out of labor intensive sectors in local industries. This represents the …rst important impact that entrance to WTO has on China.

3.2 Uni…cation of Dual Economy

The other crucial element of the liberalization process in China refers to changes in relative protection and access to local markets for …rms with di¤erent ownership structure. China's entrance to WTO considers the opening of the local markets to FDI, that is, freedom of access of foreign enterprises producing in China's borders to access the mainland markets. As discussed in section 1, this refers to equate the level of protection that native …rms receive in product markets and also eliminate any possible labor market distortion between native and foreign …rms[12].

The tari¤ structure of china reveals that protection to foreign …rms will reverse the e¤ect of tari¤ liberalization to native …rms. Indeed, …gure 7 and the high and signi…cant correlation between the initial

[11] A similar result not shown holds for collective …rms, where the correlation between initial protection level and relative value-added price change in -0.84.

[12] Strictly speaking, WTO prohibits discrimination against foreign …rms, but do not prohibit discrimination against native …rms. The position taken here is that the rules for foreign and native …rms are set the same. See section 4.1 for a discussion of the relevance of this assumption.

and …nal tari¤ structure (0.83) reveals that increase in tari¤ protection to foreign …rms bene…t those sectors with higher fall in relative prices due to tari¤ reduction in native …rms. A second impact of the liberalization of FDI concerns the role of technological di¤erences between foreign and native …rms. As the model suggests, these are critical in a scenario of integration between both systems.

3.3 Measuring Technological Di¤erences

Technological di¤erences between state, collective and foreign …rms have been considered as explanations for several stylized facts in China in the last 30 years. The …rst observation is the observed evolution of competition in local markets. In has been well established that being in theory equally treated, there have been an important crowding out of state enterprises in hands of collective ones. The basic reason given is that those companies are more ‡exible in their resource allocations decision and in their contact with external markets, being able to trade without the intervention of government o¢cials. It is probably the better technology of these quasi-private …rms that make them grow at the expense of state-owned …rms. A second evidence of higher technological progress in collective …rms is provided in Brandt and Zhu (2000) explaining the output-in‡ation cycle in China. The argument is that more-productive collective …rms have generated an increase in bank credit directed to them in comparison to state-…rms. The commitment of China's government with state employment and production has been traduced in money creation (soft budget) to …nance their deteriorated position. As long as credit is assigned to those projects (collective-…rms) with higher returns, the economy grows and in‡ation rises. In this context, the existence of state-owned …rms in direct competition with collective …rms is explained by arti…cial subsidies from the Bank of China.

The methodology proposed to estimate technological di¤erences is summarized in Figure 8, where the axis are labor and capital and depicted are the unit value-added isoquants for a typical domestic and foreign …rm in a given industry. In this case, the capital/labor ratio is higher in foreign …rms than in local ones (just for graphical example, although the data shows that this is the most general case). Given the di¤erent observed techniques of production, and in order to disentangle between technique and technological di¤erences, we correct for di¤erences in relative input prices observed between …rms in similar industries. For that, it is estimated the movement along the unit value-added isoquant in foreign …rms for equate the w=r in state and collective enterprises. After correcting for price di¤erences, the distance between AA0 and BB0 isocost lines re‡ect the di¤erences in technology and de…ne implicitly the productivity gains for native …rms associated with convergence. The speci…c steps and data requirement are the following.

3.3.1 Initial data requirement

The data needed to estimate technological di¤erences are:

1. Measures of relative factor per unit of value-added requirements in di¤erent …rms in each sector: $a^F_{Lj}=a^n_{Lj}$ where a^n_{ij} is the amount of input i required to produce one unit of value-added in …rm n = (state;collective) in industry j.

2. Measures of relative wages and rental rates between foreign and native …rms: $w^F_j=w^S_j$ and $r^S_j=r^F_j$ where f^m_j is the return to factor f(labor;capital) in …rm m(foreign;state;collective) in sector j.

How do we compute these variables for the case of China?

$\mu_{Lj} = a^m_{Lj} w^m_j / p^m_j$ is the cost share of labor in total value added in industry j where p^m_j is the value added price as de…ned above in section 3.1. It follows that

$$\frac{a^F_{Lj}}{a^n_{Lj}} = \frac{\mu^F_{Lj}}{\mu^n_{Lj}} \frac{p^F_j}{p^n_j} \frac{w^n_j}{w^F_j} \qquad \text{and} \qquad \frac{a^F_{Kj}}{a^n_{Kj}} = \frac{\mu^F_{Kj}}{\mu^n_{Kj}} \frac{p^F_j}{p^n_j} \frac{r^n_j}{r^F_j}$$

There exist data on L^F_j / L^n_j; VA^F_j / VA^n_j and w^F_j / w^n_j and it is possible to estimate the ratio of value-added prices with the following formula

$$\frac{p^F_{vai}}{p^n_{vai}} = \frac{p^¤_i - \sum_{i2F} a^F_{Ii} p^¤_j}{p^¤_i (1 + t_i) - \sum_{i2n} a^n_{Ii} p^¤_j (1 + t_i)} = \frac{1 - \mu^F_{Ij}}{1 - \mu^n_{Ij}} \cdot \frac{1}{1 + t_i}$$

With this information, it is possible to estimate

$$a^F_{Lj} / a^n_{Lj} = (L^F / Q^F p^S) \cdot (Q^S p^F / L^S)$$

Additionally, approximating capital stock with the value of total assets in the balance sheet we calculate $a^F_{Kj} / a^n_{Kj} = K^F_j / K^n_j \cdot Q^n_j / Q^F_j \cdot p^F_j / p^n_j$ and from here it follows the estimation of r^S_j / r^F_j.

3.3.2 Correcting for di¤erences in w=r ratios

Compare the wage-rental rate ratio between foreign and native …rms in each sector and calculate the required change in $(w/r)^f$ in order to be equal to the ratio in native …rms.

Let $w^n / w^F = ®$ and $r^n / r^F = ¯$. It implies
$\frac{d(w/r)^F}{(w/r)^F} = \frac{(w/r)^n - (w/r)^F}{(w/r)^n} = \hat{w}^f_j - \hat{r}^f_j = ®/¯ - 1$.
It is possible now to estimate the new factor intensity ratios between foreign and native …rms. By de…nition of the elasticity of substitution

$$\hat{a}^d_{Lj} = -\mu^F_{Kj} \sigma_j (\hat{w}^f_j - \hat{r}^f_j)$$
$$\hat{a}^d_{Kj} = \mu^F_{Lj} \sigma_j (\hat{w}^f_j - \hat{r}^f_j)$$

It follows the ratio of factor intensities between foreign and native …rms for similar w=r: $(a^F_{Lj} / a^n_{Lj})' = a^F_{Lj} / a^n_{Lj} \cdot (1 + \hat{a}^d_{Lj})$ and $(a^F_{Kj} / a^n_{Kj})' = a^F_{Kj} / a^n_{Kj} \cdot (1 + \hat{a}^d_{Kj})$. The elasticity of substitution between labor and capital in assumed the same across di¤erent …rms in the same industry, and its estimation is detailed in appendix 3.

3.3.3 Correcting for price di¤erences

The correction for the "observed" price di¤erences between foreign and state and collective …rms will be re‡ected in the wage rate as well as the rental rate. The production technique does not change as seen in the formulae above and the share of labor and capital in value added remains the same. The new wage and rental rate implicitly include the price di¤erences with either state and collective …rms.

3.3.4 Comparing production costs

The …nal step then is to compute the productivity gain in each native …rm associated with technological convergence. By de…nition $TFP_j = -\mu^n_{Lj} a^{n}_{Lj} - \mu^n_{Kj} a^{n}_{Kj}$. We estimate a^{n}_{Lj} and a^{n}_{Kj} such that $a^F_{Lj}/a^n_{Lj} = a^F_{Kj}/a^n_{Kj} = 1$. This implies

$$a^{n}_{Lj} = \frac{1 - (a^n_{Lj}/a^F_{Lj})^0}{(a^n_{Lj}/a^F_{Lj})^0}$$

$$a^{n}_{Kj} = \frac{1 - (a^n_{Kj}/a^F_{Kj})^0}{(a^n_{Kj}/a^F_{Kj})^0}$$

Table 3 reports the changes in multi-factor productivity in state-owned and collectively-owned …rms from adopting foreign technologies. Additionally, it reports the ratio of the cost of producing one unit of value-added in foreign …rms over native …rms estimated as $c^n/c^f = 1/(1 - TFP)$. This ratio, if higher than 1, re‡ects the technological advantage of foreign …rms over local (state) …rms expressed as a proportion of the foreign costs. That is, a ratio of 1.6 re‡ects that the cost of producing one unit value-added in the foreign sector in 37.5% lower (1-1/1.6) than in state …rms. That is the equivalent price increase required for local …rms to compete with foreign ones by paying the unit factor costs or equivalently the productivity gains for native …rms associated with acquiring foreign technologies.

The results show that FIEs have technological advantages over state-owned enterprises in all industries, being the highest gap in Professional and Scienti…c Equipment industries (ISIC 385) and the lowest in Tobacco industries (ISIC 314). Interestingly, the results show that collective …rms that technologies much more in line with foreign ones. Moreover, in 8 out of 23 industries the results show a technological superiority of collective over foreign …rms. Overall, collective …rms have better technologies than state-owned enterprises in 22 out of 23 sectors. Without Tobacco the correlation between technological gap in state and collective …rms against foreign enterprises is 0.68, signi…cant at 1%, revealing that the sectorial distribution of technological de…ciencies is similar in both groups.

Are these estimates reasonable? I answer yes for three reasons.

1. Calculations for COEs and SOEs show that the former have technologies much more in line with international …rms than the latter. As discussed above several empirical features of the economy are explained by a higher technological development of collective …rms.

2. The sectors with higher share of foreign …rms in total output are those where the technological advantage of foreign …rms is higher (see …gure 9). Comparing state and foreign …rms, the correlation between the cost equivalent of the technological gap and the share of foreign …rms in total output is 0.61, signi…cant at 1% level. Although local …rms have a price advantage over foreign …rms because of their protection through tari¤s, …gure 9 reveals that the di¤erent penetration rates of foreign …rms is partially explained by di¤erences in technologies. The equivalent correlation for collective …rms is also positive but not signi…cant.

3. Finally, as a mirror image of point 2, …gure 10 shows that the technological gap is higher in labor-intensive foreign sectors, consistent with the evidence that foreign …rms penetration is higher in labor-intensive sectors and also higher in sectors with wider technological di¤erences. This suggests that the high protection in labor-intensive sectors for domestic …rms is a way to compensate for their technological backwardness.

We have now all the elements required to answer the empirical questions that motivate this paper: What are the factor allocation consequences of China's entrance to WTO?, Who gains and looses in China with WTO?, Is FDI liberalization economically relevant or the tari¤ liberalization dominates the expected outcome?

4 Empirical Results

The estimations presented are based on a generalization of the model of section 2 that allows for three types on …rms in each sector: state, collective and foreign …rms for 23 3-digit ISIC manufacturing sectors. This is critical because the presence of more goods that factors generates a mathematical indeterminacy of the production structure in the long run. As a consequence, the strategy to estimate the long run e¤ects on factor returns and factor allocation has to change. I follow Leamer (1998) who estimates a set of mandated wage and rental rate changes in order to keep zero pro…t conditions in all sectors. It assumes that the initial equilibrium in the economy in one where rental rates and wages are arbitrated across sectors within …rms with di¤erent ownership structure. The long run model to estimate becomes

$$\hat{p}_{fx1} = \begin{bmatrix} \mu_{Lf} & \mu_{Kf} \end{bmatrix}_{fx2}' \begin{bmatrix} \hat{w}^f \\ \hat{b}^f \end{bmatrix}_{2x1} + \varepsilon_{fx1} \qquad (18)$$

The even model in section 2 showed that in the long it does not matter whether foreign …rms adapt the new technologies by themselves or sell their capital to …rms with better technologies: the long run impact on factor returns and factor allocation is independent of who owns the capital if all factors have access to the same technology frontier. The comparison of wage responses in the short and long runs provides a relevant estimation for the long run changes in the production structure.

4.1 Short Run E¤ects

The …rst step is to estimate the equilibrium change in state, collective and foreign wages when tari¤s change in such a way that value-added prices are equal across …rms in each industry and the removal of all restrictions to foreign …rms mandate an equalization of wages across …rms[13]. Computing the value of the right hand side of (10) implies a fall in foreign wages of 44.1%, a rise in state and collective wages of 38.7% and 16.1% respectively if technological transfers take place. Otherwise, there is a fall in wages in foreign …rms of 56.8% accompanied with a mild rise in state wages of 2.5% and a fall in wages paid by collective enterprises of 14.2%, revealing that workers are unambiguously bene…ted with technological convergence in the short run. Table 4 shows the estimations for changes in rental rates and employment in native …rms for the two extreme alternative convergence criteria. Employment changes are computed using equation (12) and rental rate changes are the implicit residual in equation (13). There are several implications.

1. Without technological transfers, employment levels and rental rates are lower than with convergence in all state-owned …rms. This re‡ects that the productivity gains from convergence more than

[13] This assumption is more reasonable if convergence takes place because in that case it is more di¢cult to explain wage di¤erentials. If technological transfers do not exist, then it might be possible that some equilibrium gap in wages remains. In this case, there is a higher rise or smaller fall in wages for all …rms.

compensate the higher wages. Furthermore, the fact that all …rms gains with convergence re‡ects that the technological gap with foreign …rms is similar across sectors. This is not the case on collective …rms, where the gap varies signi…cantly across sectors, and hence the sectors with less productivity gains (or with falls in productivity) are those hurt with overall convergence. Recall that as long as product prices, technologies and wages converge, the return to capital equalizes across …rms within industries even in the short run when capital is immobile.

2. The correlation coe¢cient of rental rate changes with and without technological transfers is 0.83 is state …rms and 0.49 for collective …rms. Similar correlations hold for employment changes. Two factors explain this result. First, changes in relative prices due to tari¤ changes and the productivity gains associated with convergence are not correlated neither in SOEs (-0.01) nor in COEs (-0.13). Second, the dispersion of technological gap in state …rms is low enough so that the employment and rental rate responses are dominated by tari¤ changes. This e¤ect is milder in collective …rms. Overall, technological convergence is critical in the short to establish winners and losers with the liberalization process but it does not a¤ect signi…cantly the change in production structure due to the low enough variance in technological di¤erences between sectors in comparison with the tari¤ changes.

3. Figure 11 plots the change in aggregate sectorial employment in the case of convergence (by adding the net e¤ects in each sector for di¤erent …rms) against a relative measure of capital intensity as used in section 1. No signi…cant pattern of change in the production structure is expected, revealing that the labor-intensive bias of the tari¤ reduction is small enough and partially compensated with the rise in protection for foreign …rms. As discussed above, technological transfers do not alter this pattern. Figure 12 con…rms the result from a di¤erent perspective; there is a close association of (aggregate) sectorial changes with and without technological transfers.

4. The aggregate response of employment in state-owned enterprises provides a good idea of how big the employment costs may be. If technological transfers take place, state …rms are expected to increase their employment level in the short run by 2.9 million workers. Without technological transfers, the shrinkage in state employment is about 6.3 millions of workers. The di¤erence represents almost 10% of total employment in manufacturing, revealing that the employment costs in the "local" economy may be important if labor movements have frictions. Adding both state and collective …rms, the fall in employment is very similar under both convergence assumptions (fall of 4.3 million without convergence and fall of 3.4 millions with convergence). This results is determined by the fact that the pressure on wages from native …rms is high enough so that in general the technological gains in collective …rms are more than compensated by higher wages[14].

So far, it has been assumed that technological transfer are exogenous. Can we say something about them? If there are incompatibilities between local capital and foreign technologies, convergence is not possible. In that case, as discussed in section 2, the decision on capital owners is whether to scrap the capital or not. Considering that the opportunity cost of capital is zero, table 4 reveals that no scrappage is expected for no sectors have a fall in rental rate lower than -100%. In this case, it seems better for capital owners to continue producing until the assets are completely depreciated. The decision

[14] These results assume that technological convergence is to foreign technology and not to the best available technology (recall that some collective …rms appear to have better technologies than foreign …rms). The results are not signi…cantly altered if we consider convergence to the best available technology. Indeed, in this case the fall in total native (state and collective) employment is of 3.5 million workers.

to scrap may be difficult due to employment commitment in state-owned enterprises. If reallocation of employment is not costless, then governments may decide to keep firms producing even with a rental rate lower than its opportunity cost. The experience of German unification is very illustrative because the government decided to keep subsidizing state firms with negative rentability to prioritize employment over employment reallocation. Akerlof et.al., (1991) present and defend this position as the optimal one. Dornbusch (1991) and Guitien (1991) sustain that artificial protection for employment limits resource reallocation, jeopardizing the transformation process and having a negative welfare effect in the long run.

Different is the situation if technological transfers are only possible through privatizing. From a conceptual point of view, it is clear that the value of state capital in private hands (with better technologies) is higher than the value for the government. The degree of competition in the privatizing process will determine how gains that difference. This problem is at the core of the liberalization discussion in Eastern Europe, as many privatizing processes have been delayed not only due to disputes over property rights but also due to lack of competition. Workers are always benefited with privatization unless important unemployment costs arise.

Another implication of the result above are the consequences on the banking system and fiscal accounts. The "irrational" allocation of credit towards state-owned firms in order to keep them producing under increasing competition suggests that drastic falls in the rate of return of those firms can generate an important financial problem to the creditors, as the value of their assets may fall dramatically with important patrimonial losses. On the fiscal side, the extensive use of subsidies to allow a smooth transition and the potential fall in government revenue because of the deteriorated situation of state-owned firms may imply an important rise is fiscal deficits. Again, the comparison with Germany is useful because the West side was the strong support for the policies executed by the newly formed country. As long as no West China appears in the map, fiscal restrictions may impose a sharp adjustment.

A final word is required to discuss the relevance of the liberalization process analyzed. As mentioned in footnote 13, the assumption is that all differences between foreign and native firms disappear, element that does not necessarily follow WTO rules, that prohibit discrimination against foreign firms but not against native ones. In the case where original preferences over FIEs are not altered (tax exemptions and intermediate-input remission) the results (not reported) show that even higher pressures on wages affect negatively employment and rental rates in domestic firms. This reflects an interesting dichotomy for china's authorities, because the removal of preferences for foreign firms benefit workers but hurt themselves. The actions that China take may end up providing a natural experiment on the relative weights that the state puts on workers welfare and its own capital return in the liberalization process.

4.2 Long Run Effects

The main result presented in this sub-section concern the estimation of the long run effects on factor returns of the liberalization process (equation (18)). As discussed in section 2, these results are not affected by the timing or type of (inevitable) convergence. The results of the estimation for 23 ISIC industries is

$$\hat{\mu}_i^f = -0.56 \cdot \mu_{Li}^f + 0.39 \cdot \mu_{Ki}^f + \varepsilon_i$$

The fall in wages in foreign firms of 56% implies a long run rise in state-firms wages of 4.2% and a fall in collective wages of 12.8%. This reveals that the long run impact of the liberalization process benefits

workers in state …rms but hurt all the rest. At the same time, wages fall compared to the short run equilibrium with technological convergence. This is a very important result because convergence in the short run imply equalization of rental rates across …rms within sectors even without capital movements. As a consequence, the result reveals that the long run movement of capital and labor across sectors is from labor-intensive sectors to capital-intensive sectors. The relative K=L released by shrinking sectors is lower than K=L in expanding sectors, generating a fall in wages and rise in rental rates.

This result does not say anything with respect to the long run change in production structure compared to the initial situation, because the rental rate di¤erential across …rms in each sector in the pre-liberalization situation does not allow us to reveal resource reallocation across sectors by comparing wage changes. But considering that the short run results do not show a clear pattern of change in employment across sectors with di¤erent factor intensities, it is possible to conclude that the production structure of China should move towards a more capital-intensive mix in the long run[15].

5 Conclusion

Competition of domestic …rms with foreign sources of production takes place in product markets. The information is transmitted through relative prices, and as long as there is limited international mobility of factors, di¤erences in productivity are traduced in di¤erences in factor returns. The presence of FDI introduces a new place for competition: factor markets. If there are technological di¤erences between …rms, disadvantaged …rms do not have degrees of freedom to adjust and are condemned to disappear. The most relevant element in a trade liberalization episode may not be the change in relative prices through tari¤ reductions but the increasing access to foreign …rms to produce locally.

The case of China and WTO provides a natural experiment for a liberalization process where the access of foreign …rms to domestic markets may overcome the e¤ects of tari¤ changes. Although important steps towards a market economy have taken place in the last two decades, important distortions remain. WTO demands from China a change in tari¤ structure but more importantly a break in the dual economic system. The projected results in terms of income distribution, production structure as well as the situation of public enterprises suggests that the step by the Chinese government is a di¢cult test for the whole liberalization e¤ort.

Overall, the situation of China is similar to the one lived by East Germany at the beginning of the 1990s in its uni…cation process with the West. The encounter of backward East …rms with highly developed West …rms is probably the most signi…cant element in the German uni…cation, and according to the predictions in this paper, a similar phenomena may be lived by inward-oriented China in its encounter with outward-oriented China.

[15] Due only to the fall in distortions after entrance to WTO.

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APPENDIX 1: DATA DESCRIPTION

The data used consists of trade and production data. Production data is disaggregated at the 3 digit ISIC level and comes from UNIDO data set and the 1997 China Statistical Yearbook. Data of Output, value added and employment is provided for enterprises with independent account systems, that represent 69% of total manufacturing employment. It is assumed that this sample is a representative sample of all manufacturing sector. Data is divided between state-owned enterprises (SOEs), collective and share holding enterprises (COEs) and foreign funded and enterprises funded overseas (FIEs). Output and value added is detailed for each industry (23 3-digit ISIC categories, see footnote 1), and employment levels are at each industry are only present for SOEs. Average productivity provided in the Yearbook (Value-added/employment) is used to back up the employment levels in COEs and FIEs. The assumption that average productivity is as twice as high in foreign …rms than in collective …rms is used to back up employment levels is collective …rms, and variations of this assumption does not alter the results.

The data set also provides information on relative wages for state, collective and foreign …rms, and these ratios are assumed to hold in each industry. With that it is possible to calculate the share of labor and capital costs in total value-added, and using the ratio of output to value-added we back up the share of intermediate inputs in total output. The results show that foreign …rms are more capital intensive that local …rms in each sector, and no big di¤erence exist between state and collective enterprises. Also, as expected because of the existent tari¤ exemption regime, FIEs are more intensive in intermediate (foreign?) inputs than domestic …rms.

Trade data is available at the 4 digit SITC level from Robert Feenstra (2000), and is transformed into 3 digit ISIC level in order to make it comparable to the production series. Speci…cally, by assuming linearity between 5 and 4 digit SITC it is possible to use the concordance table between 5 digit SITC and 4 digit ISIC to transform the 4d SITC data into ISIC data. To estimate the tari¤ level at the 3 and 4 digit ISIC level, I used the tari¤ schedule of China at the 10 digit HS for 1999 and the concordance table between HS10 and SITC5. It is possible then to get the "supposed" revenues from 1997 imports by multiplying the nominal tari¤ by the import level at the 5 and then 4 digit SITC. Although it is known that important tari¤s exemptions exist in China, the results are very resistent to di¤erent taxable import vector. By using the concordance table between 4 digit SITC and 4 digit ISIC it is possible then to obtain an estimation of the trade and tari¤ structure compatible with production data.

APPENDIX 2: COMPENSATING FOR TECHNOLOGICAL DIFFERENCES

Consider two sectors with foreign and native …rms. All …rms operate with Leontief production functions. Technologies of native and foreign …rms are such that

$$\begin{aligned} a^h_{Li} &= @^h_{Li} \cdot a^f_{Li} \\ a^h_{Ki} &= @^h_{Ki} \cdot a^f_{Ki} \\ a^h_{Lj} &= @^h_{Lj} \cdot a^f_{Lj} \\ a^h_{Kj} &= @^h_{Kj} \cdot a^f_{Kj} \end{aligned}$$

where $@^h_{l;g}$ is the technology gap in factor $l = K; L$ for …rm type h (domestic) in industry $g = i; j$. Consider a set $(¼; ¸_i; ¸_j)$ such that $w^h = ¼w^f$; $p^h_i = ¸_i \cdot p^f_i$ and $p^h_j = ¸_j \cdot p^f_j$.

Proposition 1 There exists a set $(\frac{1}{4}; \lambda_i; \lambda_j)$ such that for any combination of technological gaps $(@^h_{Li}; @^h_{Ki}; @^h_{Lj}; @^h_{Kj})$ both native and foreign …rms are competitive and there is a unique rental rate in the economy.

Proof. The zero pro…t condition for foreign …rms in sector $g = i; j$ are

$$p^f_g = a^f_{Lg} w^f + a^f_{Kg} r^f$$

As a consequence, given Leontief technologies (known) and international prices (known), there is a unique set of wages and rental rates that make foreign …rms competitive and operative in equilibrium.

The set of zero pro…t conditions for native …rms in sector g is given by

$$p^h_g = a^h_{Lg} w^h + a^h_{Kg} r^h$$

that can be rewritten as

$$\lambda_g p^f_g = @^h_{Lg} a^f_{Lg} \tfrac{1}{4} w^f + @^h_{Kg} a^f_{Kg} r^h$$

It follows that for $r^h = r^f$ there exists a combination of $(\frac{1}{4}; \lambda_i; \lambda_j)$ that satisfy both equations. ■

APPENDIX 3: ESTIMATION OF ELASTICITY OF SUBSTITUTION

Consider a simple CES production function of the form $q = (aK^{\frac{1}{2}} + bL^{\frac{1}{2}})^{1=\frac{1}{2}}$. Combining the …rst order conditions with respect to capital and labor we get $\ln w=r = \ln b=a + (\frac{1}{2} ¡ 1) \ln L=K$.

The estimation of this equation using 29 3-digit ISIC manufacturing cross-country data for 1996 provides an estimator of the elasticity of substitution $\frac{3}{4} = 1=(1 ¡ \frac{1}{2})$. The database provides information on sectorial employment for each country and sectorial capital stock in each country is calculated as the sum of capital accumulation for 20 years using a depreciation rate of 5%. Wages are estimated as total wage bill divided by the number of workers and rental rate is estimated as value-added minus wage bill divided by capital stock. The results are detailed in table 5, that also reports the R^2 of each regression as well as the number of countries with enough data in each industry. For the estimation in the paper, a simple weighted average of the elasticities of substitution was used when the sector aggregation comprised more than one 3-digit ISIC industry. The results are invariant to alternative assumptions.

Figure 1

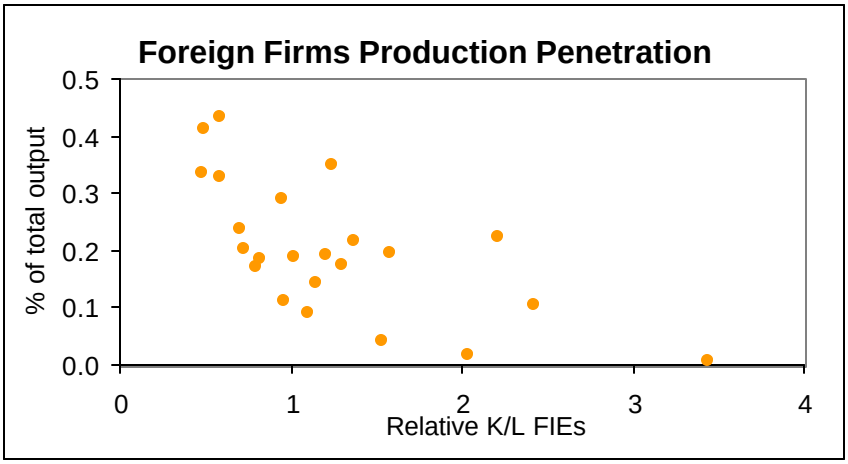

Foreign Firms Production Penetration
% of total output
0.5
0.4
0.3
0.2
0.1
0.0
0
1
2
3
4
Relative K/L FIEs

Figure 2

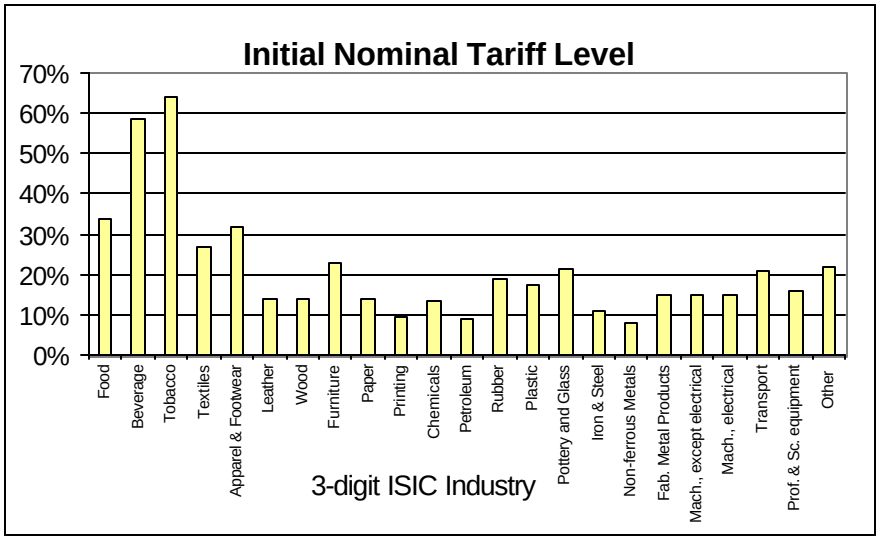

Initial Nominal Tariff Level
70%
60%
50%
40%
30%
20%
10%
0%
Food
Beverage
Tobacco
Textiles
Apparel & Footwear
Leather
Wood
Furniture
Paper
Printing
Chemicals
Petroleum
Rubber
Plastic
Pottery and Glass
Iron & Steel
Non-ferrous Metals
Fab. Metal Products
Mach., except electrical
Mach., electrical
Transport
Prof. & Sc. equipment
Other
3-digit ISIC Industry

Figure 3

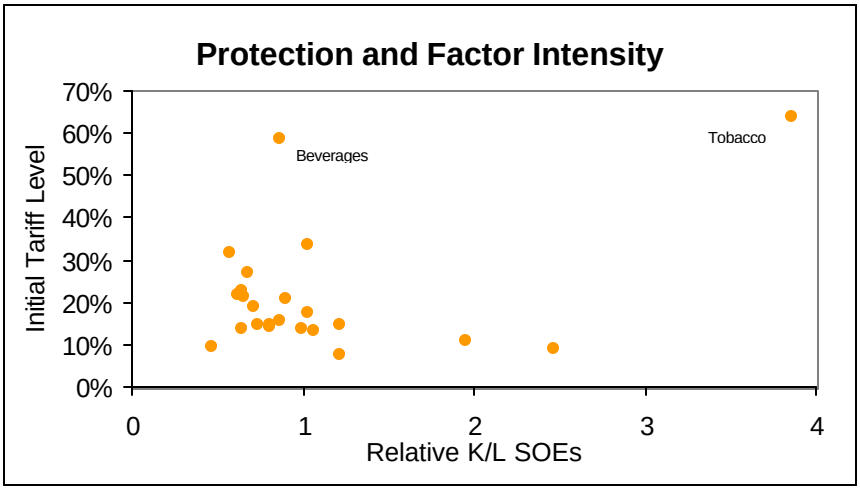
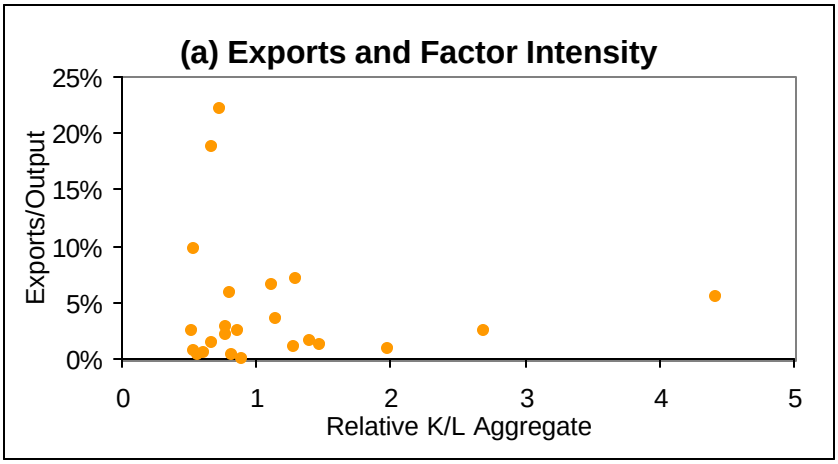

Protection and Factor Intensity
Initial Tariff Level
70%
60%
50%
40%
30%
20%
10%
0%
0
1
2
3
4
Relative K/L SOEs
Beverages
Tobacco

Figure 4


(a) Exports and Factor Intensity
Exports/Output
25%
20%
15%
10%
5%
0%
0
1
2
3
4
5
Relative K/L Aggregate

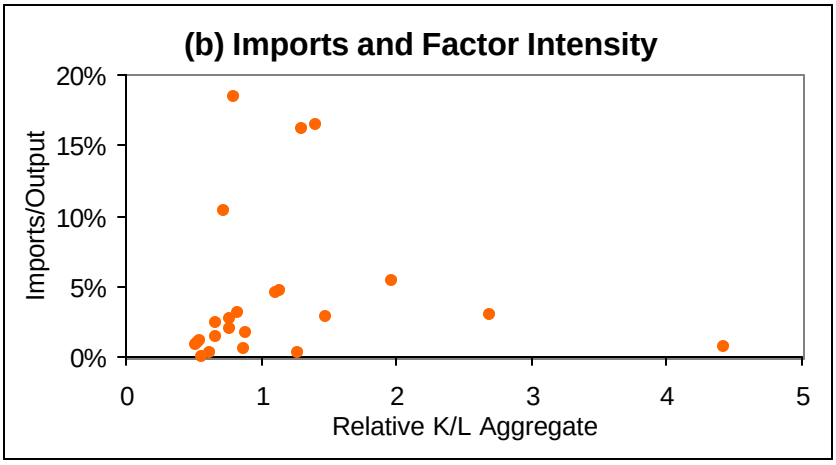

(b) Imports and Factor Intensity
Imports/Output
20%
15%
10%
5%
0%
0
1
2
3
4
5
Relative K/L Aggregate

Figure 5

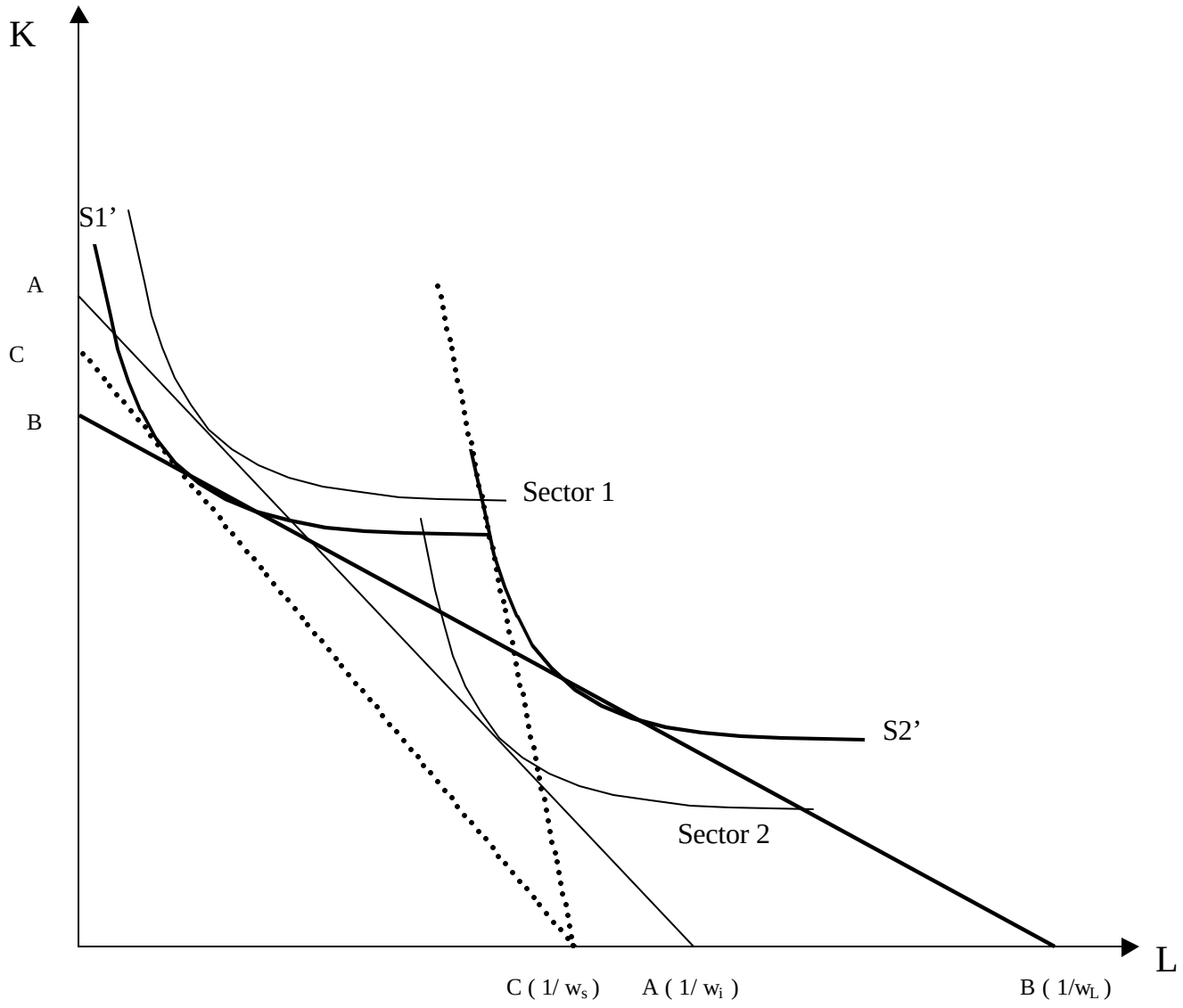


Figure 6

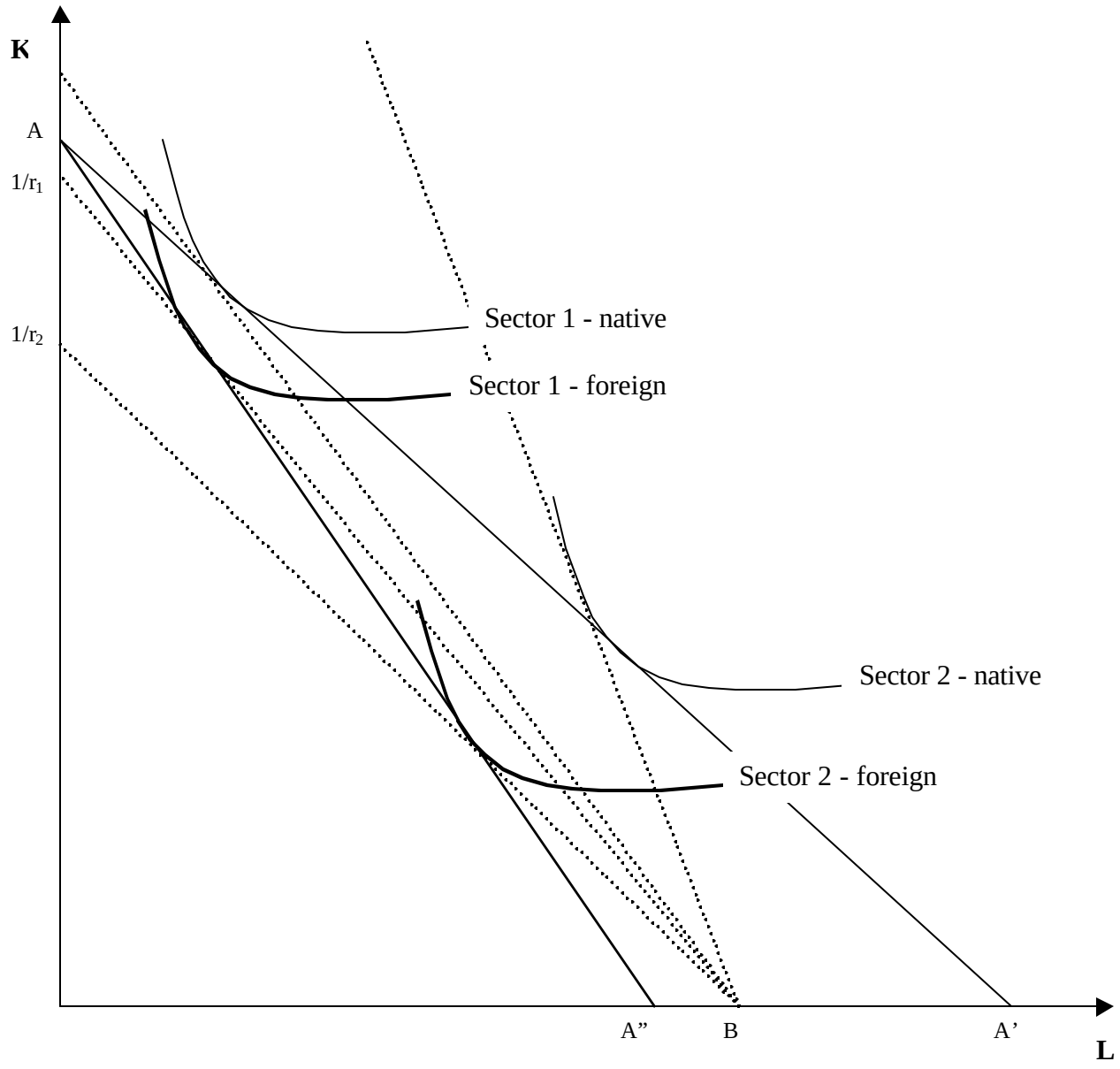

K
A
1/r1
1/r2
Sector 1 - native
Sector 1 - foreign
Sector 2 - native
Sector 2 - foreign
A”
B
A’
L

Figure 7

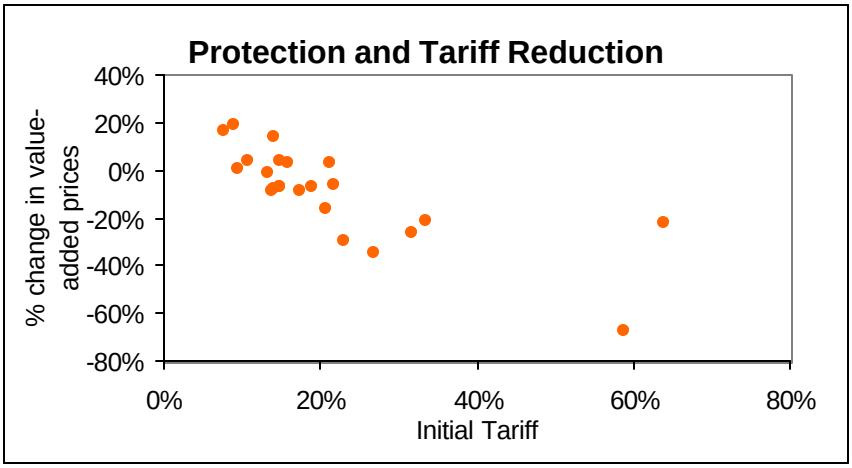

Protection and Tariff Reduction
% change in value-added prices
40%
20%
0%
-20%
-40%
-60%
-80%
0%
20%
40%
60%
80%
Initial Tariff

Figure 8

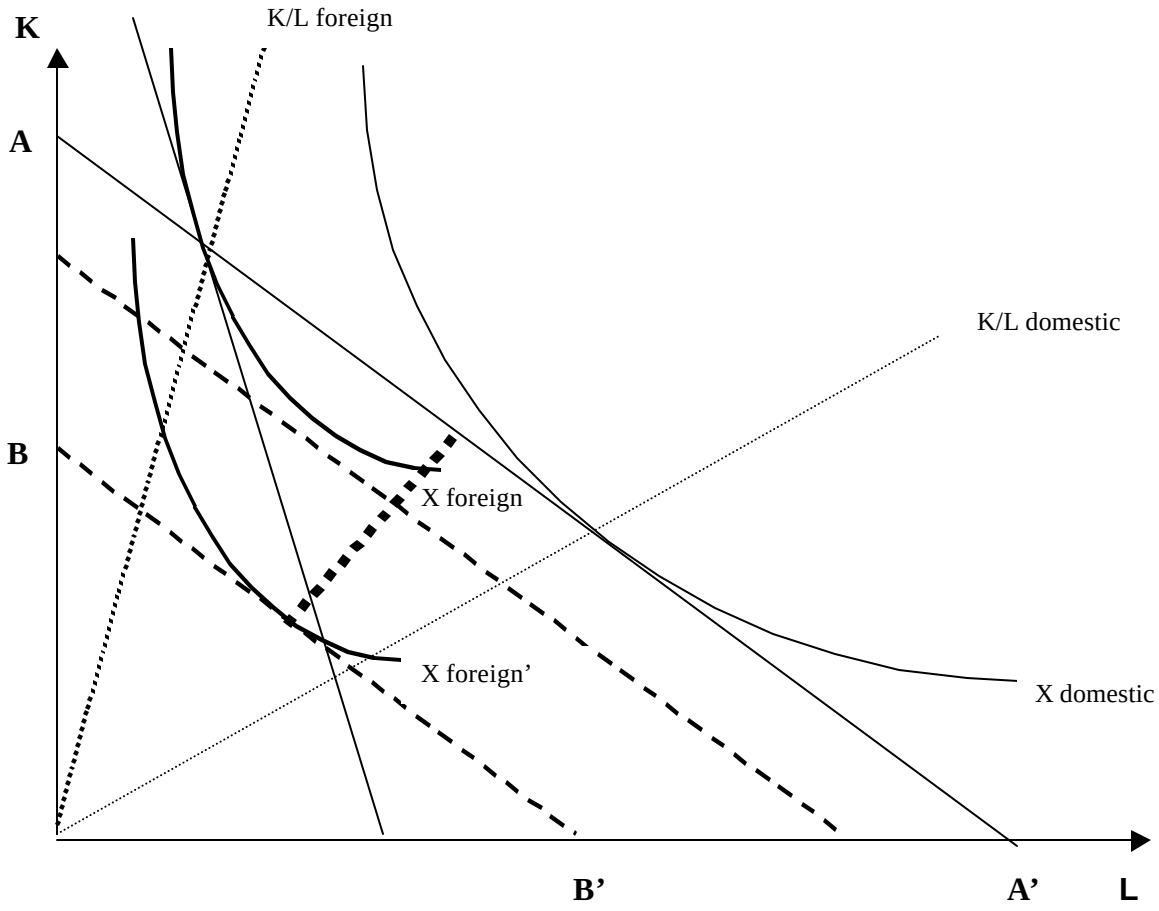

K
K/L foreign
A
K/L domestic
B
X foreign
X foreign'
X domestic
B'
A'
L

Figure 9

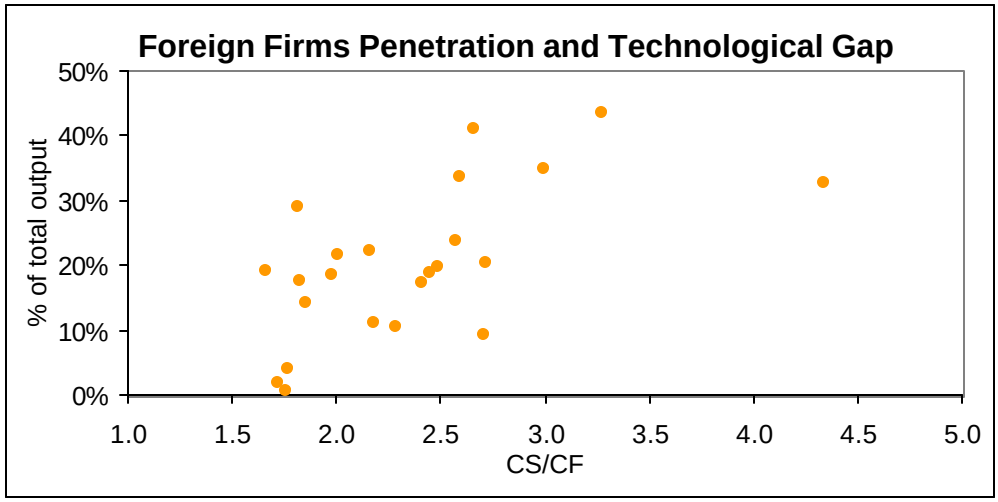


Figure 10

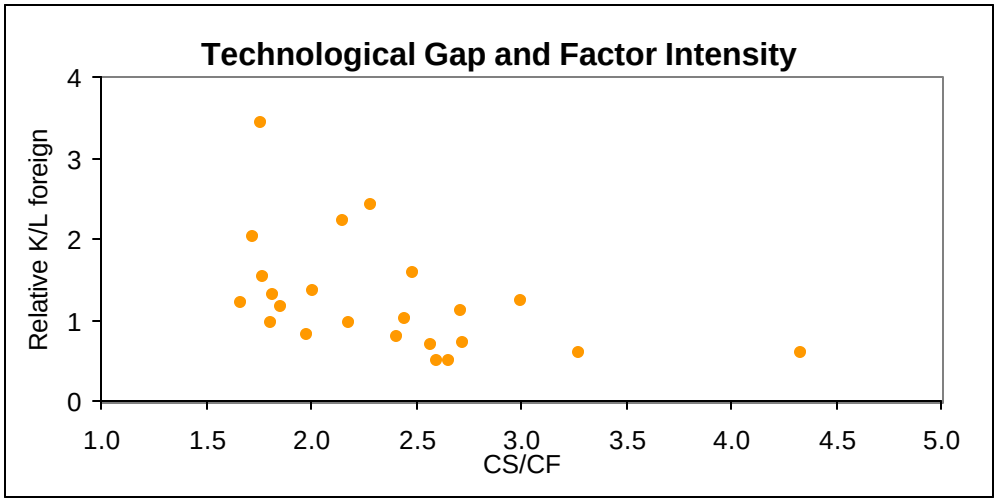


Figure 11

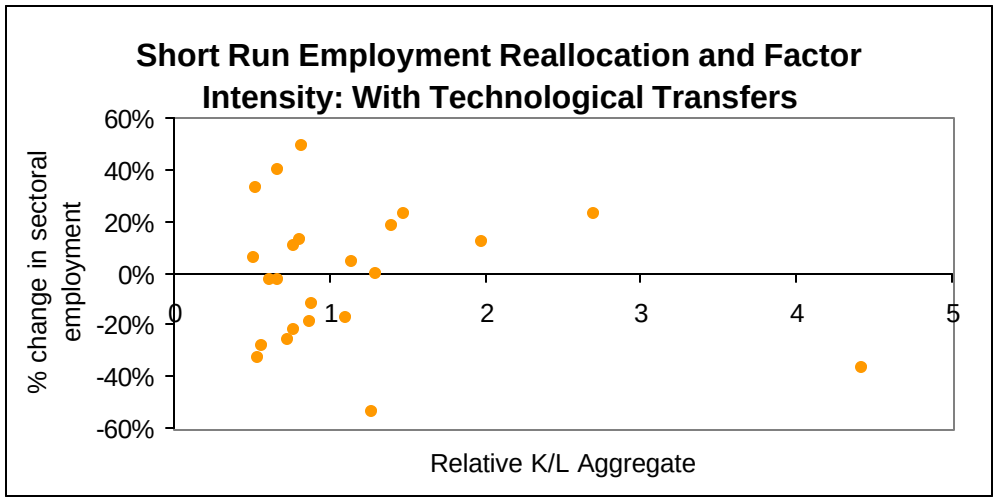


Figure 12

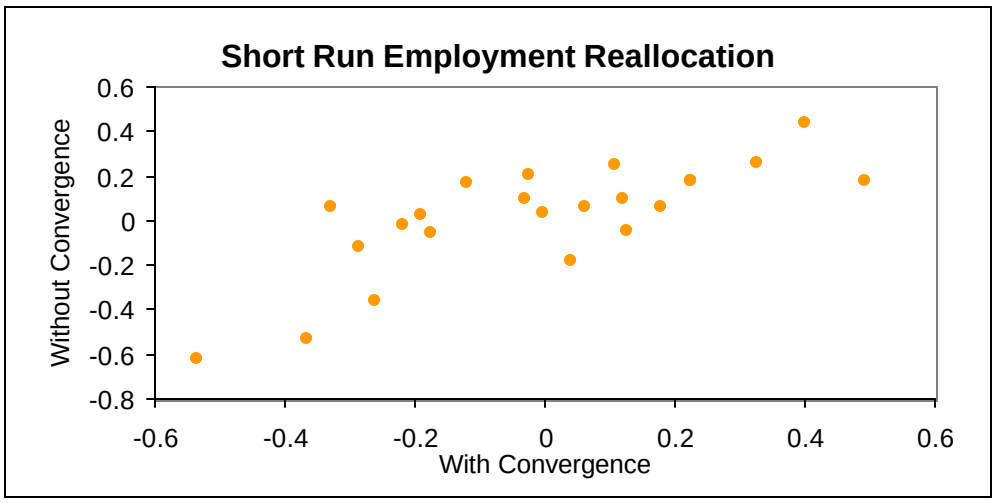


TABLE 1

PRODUCTION STRUCTURE

CHINA 1996

Industry	ISIC Code	Share in Employment*	Share in output*	Share in Industry		
				State	Collective	Foreign
Food	311	5.6%	6.9%	37.7%	40.7%	21.6%
Beverage	313	2.2%	3.2%	51.5%	26.2%	22.3%
Tobacco	314	0.5%	5.2%	98.1%	1.3%	0.6%
Textiles	321	11.9%	7.2%	31.5%	51.2%	17.3%
Apparel & Footwear	322+324	3.8%	3.1%	6.3%	52.5%	41.2%
Leather	323	2.1%	1.9%	7.2%	49.4%	43.5%
Wood	331	1.5%	1.0%	14.6%	65.0%	20.4%
Furniture	332	0.7%	0.6%	6.9%	69.4%	23.7%
Paper	341	2.7%	2.3%	35.1%	50.7%	14.2%
Printing	342	1.6%	1.2%	40.1%	41.3%	18.6%
Chemicals	351+352	9.6%	12.0%	44.0%	38.5%	17.6%
Petroleum	353+354	1.1%	3.9%	85.1%	13.2%	1.7%
Rubber	355	1.4%	1.3%	34.9%	46.0%	19.1%
Plastic	356	2.3%	2.2%	9.5%	61.5%	29.1%
Pottery and Glass	361+362+369	11.4%	7.3%	28.2%	60.7%	11.1%
Iron & Steel	371	5.3%	6.9%	75.0%	21.0%	4.0%
Non-ferrous Metals	372	1.8%	2.1%	51.2%	38.3%	10.5%
Fabricated Metal Products	381	4.0%	3.4%	13.0%	68.1%	18.9%
Machinery, except electrical	382	12.3%	8.6%	39.0%	51.8%	9.2%
Machinery, electrical	383	7.1%	9.7%	25.1%	40.0%	35.0%
Transport	384	6.4%	6.4%	47.7%	32.7%	19.6%
Prof. & Sc. equipment	385	1.4%	1.0%	29.7%	37.5%	32.8%
Other	390	3.2%	2.5%	7.3%	59.1%	33.6%

Note :
Source: China Statistical Yearbook 1997
* Based on firms with Independent Account Systems, that employ 69% of total manufacturing employment
State: State-Owned Enterprises
Collective: Collective-owned and Share-Holding Enterprises
Foreign: Foreign Funded Enterprises and Enterprises funded by Overseas Chinese from Hong Kong, Macao and Taiwan

TABLE 2

CONSUMPTION STRUCTURE - BY REGION

CHINA 1995

	Output	Multinational Share	State-owned Share	Import Share
Beijing	1909	21.5%	55.5%	7.5%
Tianjin	2094	24.0%	28.4%	4.3%
Include "Open Coastal Cities" or SEZ				
Liaoning	4975	4.2%	38.9%	2.2%
Hebei	3996	6.6%	32.7%	0.7%
Shandong	8456	5.4%	27.4%	0.7%
Jianszu	11813	10.2%	17.6%	0.8%
Shanghai	5129	29.0%	29.4%	8.0%
Zhejiang	8088	7.5%	8.2%	1.0%
Fujian	2801	27.0%	6.8%	3.5%
Guangdong	9535	27.1%	0.0%	7.5%
Guangxi	1666	6.5%	35.7%	1.4%
Hainan	193	20.4%	5.4%	34.8%
Do not include "Open Coastal Cities" or SEZ				
Heilongjiang	2204	2.6%	64.8%	1.1%
Jilin	1429	6.2%	57.6%	5.4%
Inner Mongolia	782	4.8%	60.6%	2.1%
Shanxi	1754	1.7%	43.3%	0.5%
Henan	4715	4.1%	32.3%	0.6%
Anhui	3156	3.2%	29.2%	0.5%
Hubei	4103	3.7%	35.4%	1.3%
Jiangxi	1291	4.1%	49.5%	0.8%
Hunan	2451	3.4%	38.5%	0.9%
Guizhou	557	3.2%	64.1%	1.5%
Yunnan	1207	2.8%	64.4%	3.8%
Sichuan	4426	3.4%	37.4%	1.2%
Tibet	9	0.0%	72.5%	25.0%
Qinghai	149	0.6%	82.7%	0.5%
Shaanxi	1183	4.5%	56.3%	1.8%
Gansu	825	4.0%	64.5%	1.3%
Ningxia	198	9.3%	66.5%	0.6%
Xinjiang	803	2.0%	71.5%	0.9%

Source: Branstetter and Feenstra (1999)

Notes:

1. Output is measured in 100 million RMB, where 8 RMB ~ US$ 1

2. The shares are proxis for consumption shares estimated as in text, and do not sum to 100% because there are collective firms and other minor categories left out.

TABLE 3

TECHNOLOGICAL DIFFERENCES BETWEEN LOCAL AND FOREIGN FIRMS

		STATE ENTERPRISES			COLLECTIVE ENTERPRISES	
Code	Industry	CS/CF	TFP change		CC/CF	TFP change
311	Food	2.009	50.2%		0.813	-23.1%
313	Beverage	2.156	53.6%		1.080	7.4%
314	Tobacco	1.760	43.2%		2.476	59.6%
321	Textiles	2.413	58.5%		1.246	19.7%
322+324	Apparel & Footwear	2.659	62.4%		1.435	30.3%
323	Leather	3.278	69.5%		1.341	25.4%
331	Wood	2.722	63.3%		0.703	-42.3%
332	Furniture	2.575	61.2%		1.115	10.3%
341	Paper	1.858	46.2%		0.818	-22.3%
342	Printing	1.981	49.5%		0.803	-24.6%
351+352	Chemicals	1.821	45.1%		0.961	-4.1%
353+354	Petroleum	1.723	42.0%		1.418	29.5%
355	Rubber	1.663	39.9%		0.816	-22.5%
356	Plastic	1.814	44.9%		1.058	5.5%
361+362+369	Pottery and Glass	2.179	54.1%		0.883	-13.3%
371	Iron & Steel	1.770	43.5%		1.318	24.1%
372	Non-ferrous Metals	2.289	56.3%		0.737	-35.6%
381	Fabricated Metal Products	2.450	59.2%		1.111	10.0%
382	Machinery, except electrical	2.711	63.1%		1.087	8.0%
383	Machinery, electrical	3.000	66.7%		1.642	39.1%
384	Transport	2.490	59.8%		1.128	11.4%
385	Professional & Scientific equipment	4.333	76.9%		2.176	54.0%
390	Other	2.596	61.5%		1.541	35.1%

Note:
CS/CF: Cost of producing one unit of value-added in state firm divided by same cost in foreign firm
TFP change: Productivity change in State or Collective associated with adopting foreign technologies

TABLE 4

SHORT RUN EFFECTS

ISIC code	Industry	STATE ENTERPRISES				COLLECTIVE ENTERPRISES			
		RENTAL RATE		EMPLOYMENT		RENTAL RATE		EMPLOYMENT	
		TC	NTC	TC	NTC	TC	NTC	TC	NTC
311	Food	26%	-29%	-10%	-23%	-53%	-19%	-53%	-3%
313	Beverage	-27%	-85%	-57%	-75%	-75%	-79%	-78%	-56%
314	Tobacco	20%	-24%	-40%	-55%	28%	-35%	26%	-44%
321	Textiles	10%	-71%	-27%	-69%	-28%	-41%	-41%	-25%
322+324	Apparel & Footwear	34%	-44%	-3%	-33%	-3%	-33%	-14%	-13%
323	Leather	101%	18%	54%	13%	48%	25%	28%	34%
331	Wood	65%	-13%	15%	-9%	-81%	-5%	-56%	6%
332	Furniture	27%	-51%	-8%	-38%	-42%	-40%	-41%	-18%
341	Paper	37%	-16%	-2%	-15%	-49%	-7%	-53%	6%
342	Printing	63%	-1%	19%	-3%	-44%	12%	-48%	21%
351+352	Chemicals	47%	-3%	5%	-3%	-11%	2%	-19%	11%
353+354	Petroleum	65%	22%	21%	15%	55%	26%	31%	32%
355	Rubber	29%	-12%	-7%	-11%	-47%	-4%	-47%	7%
356	Plastic	35%	-14%	-4%	-17%	-11%	-6%	-29%	9%
361+362+369	Pottery and Glass	77%	3%	35%	1%	-27%	14%	-39%	26%
371	Iron & Steel	51%	5%	8%	1%	45%	28%	19%	28%
372	Non-ferrous Metals	103%	29%	38%	16%	-32%	23%	-28%	22%
381	Fabricated Metal Products	81%	5%	35%	2%	13%	15%	-3%	24%
382	Machinery, except electrical	75%	-19%	35%	-20%	-7%	-4%	-22%	10%
383	Machinery, electrical	67%	-10%	18%	-8%	38%	-4%	14%	6%
384	Transport	49%	-32%	9%	-33%	-12%	-15%	-26%	-1%
385	Professional & Scientific equipment	114%	4%	50%	1%	86%	14%	46%	19%
390	Other	67%	-13%	26%	-14%	38%	0%	20%	13%

Note: TC refers to the case where technological converegence to FIEs level occur in all sectors, while in NTC native firms stay with their original technology level.

TABLE 5

ELASTICITY OF SUBSTITUTION BETWEEN LABOR AND CAPITAL

CES PRODUCTION FUNCTION

Industry	ρ-1	σ	R-Square	n
Food Products (311/312)	-1.324	0.756	0.576	32
Beverage (313)	-1.161	0.861	0.473	25
Tobacco (314)	-0.471	2.124	0.078	20
Textile (321)	-1.076	0.930	0.582	29
Apparel (322)	-1.421	0.704	0.628	26
Leather (323)	-1.159	0.863	0.568	20
Footwear (324)	-1.733	0.577	0.841	23
Wood (331)	-1.414	0.707	0.737	31
Furniture (332)	-1.233	0.811	0.770	23
Paper Products (341)	-1.243	0.804	0.692	30
Printing and Publishing (342)	-1.472	0.679	0.665	28
Chemicals (351)	-1.255	0.797	0.673	27
Other Chemicals (352)	-1.346	0.743	0.678	23
Petroleum Refineries (353)	-0.928	1.077	0.432	18
Misc. Products of Petroleum & Coal (354)	-1.083	0.924	0.556	13
Rubber (355)	-1.522	0.657	0.784	25
Plastic (356)	-1.691	0.592	0.812	21
Pottery (361)	-1.207	0.828	0.761	14
Glass (362)	-1.044	0.958	0.693	19
Other Non-Metallic Mineral Products (369)	-1.582	0.632	0.778	22
Iron & Steel (371)	-1.066	0.938	0.323	27
Non-Ferrous Metals (372)	-1.514	0.661	0.682	19
Fabricated Metal Products (381)	-1.094	0.914	0.707	31
Machinery except Electrical (382)	-1.046	0.956	0.427	23
Electrical Machinery (383)	-1.452	0.689	0.713	25
Transport Equipment (384)	-1.131	0.884	0.542	25
Professional & Scientific Equipment (385)	-0.982	1.018	0.545	21
Other Manufacturing Industries (390)	-0.726	1.377	0.391	24