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On the Costs and Effectiveness of Targeting State Employment: Germany in the 1990s and China in the 2000s.

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Abstract

The German unification process imposed a significant price-cost squeeze on eastern firms. Important technology differences between the East and the West generated high pressures on the competitive position of eastern manufacturing firms when product and factor markets integration took place. In order to avoid mayor employment and output costs, the government subsidized eastern firms. A similar process is expected in China after accession into the WTO. The restrictions to foreign firms to access domestic markets have to be lifted, and hence significant cost pressures on native, specially state-owned enterprises, are expected. The projected employment shift from native to foreign firms suggests that the Chinese government may decide to slow down the transition process, as Germany did. This paper estimates the fiscal costs of artificially targeting state employment through product price subsidies rather than allowing factor reallocation. The subsidy needed to increase East Germany's manufacturing employment by 1% was around 0.9% of value-added prices, compared to a 1.2% subsidy if China targets state employment or 18.7% if China targets native employment. These numbers imply that the annual cost per worker targeted in Germany more than 13 times the cost per worker in China.
(JEL: F15, F16, H2. Key Words: Integration, Fiscal Transfers, Technology Gap, Germany, China)

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1 Introduction

The unification process in Germany in the 1990s provides an interesting natural experiment regarding the implications of integrating two different economic systems. The costly transition in the 1990s has raised doubts on whether traditional trade liberalization models can explain the huge employment and output loses in the East. In standard models, integration to world product markets have significant effects on product and factor prices but minor impact on quantities. The competitive position of foreign firms is not altered due to adjustments in returns of internationally immobile factors of production, even if technology differences between native and foreign enterprises exist. However, if integration takes place also at the factor-market level, the factor-price adjustment mechanism vanishes as inputs search for industries and firms with greater returns and firms with backward technologies are condemned to die.

In other words, if two economic systems (countries) liberalize their economies and integrate with each other in product and factor markets, firms with backward technologies cannot keep their competitive position and disappear. This process is leaded by a price-cost squeeze due to product price changes and factor markets pressures that generate a movement of resources from backward to more enhanced firms. Thus, important employment and output costs are possible to rationalize in a liberalization process that includes factor market integration and where factor reallocation is not frictionless and there exist wide technology differences between the two economic systems.

In this context, the German unification process can be seen as a liberalization effort that generated an encounter of backward East with advanced West. The unification of product and factor markets produced a significant price-cost squeeze that jeopardized the situation of eastern industries. Unemployment rates skyrocketed in East Germany from essentially zero in 1989 to 19.7% in 1997. According to the US Bureau of Labor Statistics, manufacturing employment in unified Germany fell by 32% between 1989 and 1997, while the equivalent fall in western manufactures was 15%. Considering the relative employment shares, this implies a fall in eastern employment greater than 66%. Differences in technology levels, product quality, the fall of the communist block and wage pressures from labor unions were the most important sources of real wage pressures in eastern firms.[1] [2] To avoid dramatic costs, the newly unified government gave a high amount of fiscal transfers to eastern workers and firms, specially in the first half of the 1990s. These transfers took different forms - unemployment benefits, social security, wage and product price subsidies and capital investments. To some extent, all were aimed to smooth the transition to a market economy and to enhance the process of technology transfers from the West to the East.

The encountering of two different economic systems where firms in different sectors have significant technology differences is also the case of China's entry into the WTO. China is characterized by a dual economic system. On the one hand, it encourages foreign firms (FIEs) to locate in China, bring their capital and technologies and use the labor force. These firms, present across all sectors, are limited to access domestic markets and are encouraged to export their production through legal and de-facto incentives. On the other hand, native firms - state-owned (SOEs) and collectively-owned enterprises (COEs)- dominate the domestic market that is protected by a highly distorted tariff structure. This system of product price distortions, together with some factor market interventions, supports a dual economy where firms with different technologies coexist even with some degree of factor market integration.[3] Accession to the WTO mandates from China the elimination of such distortions, as national treatment to FIEs is required. This implies that the protective measures for native firms, specially tariffs, have not only to be reduced but also made effective for all firms regardless of their origin or ownership structure. In other words, product and factor price distortions that maintain the competitive position of native enterprises, specially SOEs, have to be removed. As in Germany, a significant price-cost squeeze is expected for native firms.

The paper presents a model of two different economic systems with different degrees of distortions in product and factor markets.[4] Their integration presume the leveling of the competition

[1] See Akerlof et.al., (1991), Dornbusch (1991), Guitien (1991), Dornbusch and Wolf (1994) and Fitzroy and Funke (1998) for discussions about the role of real costs pressures on the outcome of Germany's unification.

[2] There exist ample evidence on technology differences between eastern and western manufacturing firms. See for example Akerlof et.al., (1991) and Funke and Jahn (2002).

[3] See Branstetter and Feenstra (1999), Feenstra (1998), Lardy (1992, 1998), Naughton (1996), Sachs and Woo (1997) and Claro (2002) for discussions regarding the characteristics of China's economic structure and implications of accessing the WTO.

[4] I refer in the paper indistinguishably to economic systems or countries. In the case of Germany, the concept of

field for all firms and industries. The equalization of rules and elimination of distortions affects negatively the firms in the system with greater protective measures. However, the greatest impact of product and factor market integration is due to the existence of technology differences. In the long run, the equalization of factor returns imply that backward firms must disappear unless they catch up with more enhanced technologies. In the short run, the assumed specificity of capital allows a smoother shift in resources in response to the price-cost squeeze.

Within this framework, the main determinants for the wage and employment responses of integration are the size of technology differences between both systems, the degree of technology transfers, the relative size of both systems and the degree of initial product and factor markets' distortions. I analyze the effectiveness and costs for the government of reaching a targeted level of employment greater than what market forces may imply. This kind of industrial policy is studied by estimating the subsidy (measured as percentage of value-added prices) needed to reach the targeted level. The paper does not discuss the welfare implications of such policy but rather focuses on its fiscal implications.

A comparison of the results for Germany and China reveals that the subsidy required to generate a 1% increase in East Germany's employment was around 0.9%, smaller than the 1.2% subsidy needed to increase state employment in China. This difference is due to the greater pass-through of subsidy to wages in China, given the greater relative size of state firms in China and the greater wage elasticity of labor demand. However, given the differences in labor force size, it is 13 times more expensive to generate a one-worker increase in employment in eastern Germany than in state-owned firms in China. If China targets native (state plus collective) rather that state employment, the subsidy is 18.2%. In this case, the pass-through from subsidy to wages is close to one as native firms represent more than 80% of China's employment, lowering the effectiveness of the subsidy.

The paper continues in the following manner. Section 2 presents the model. Sections 3 and 4 present the estimations for Germany and China respectively. Section 5 compares the costs of smoothing the transition via price subsidies against the payment of unemployment benefits to those workers that become jobless in the transition.

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country is relevant as the unification took place between two different countries. However, two different economic systems coexist in China.

2 The model

I consider a simple multi-sector model of two small economic systems (countries) A and B that produce the same set of tradable goods. Industries in these two systems face different degrees of protection from foreign product competition and are composed by identical firms so I refer to industries or firms indistinguishably. At the same time, factor markets have different degrees of distortions. Markets are perfectly competitive, and firms in each sector produce with CRS technologies and two factors of production: labor that is mobile across sectors in each country and capital that is sector-specific in the period of interest. I assume that firms in A have more backward technologies than firms in B in each sector.

In the pre-unification situation some degree of integration in product and factor markets may exist between both countries. Germany and China represent two particular cases of this framework. In Germany, no integration whatsoever existed before 1990. The West was an open market economy while the East was a centralized economy with several price distortions. Factor markets were not integrated. In the case of China, although the native economy is subject to important product price distortions, some integration in factor markets exists, as foreign and native firms hire labor from the native (and partially distorted) labor market. At the same time, some degree of competition in capital markets exists between state and collective firms (Brandt and Zhu (2000)).

Initial differences in factor returns are relevant for two reasons. First, they provide an idea regarding the size of the adjustment in factor returns after integration. Second, with some degree of factor market intervention, differences in factor returns provide a measure of the distortions required to sustain a pre-unification equilibrium with some degree of integration in factor markets. In general, differences in wage and rental rates between systems will depend on technology differences, product and factor markets' distortions and the degree of mobility of factors across systems. I consider that the rental rate on capital is similar across sectors in the pre-integration situation in each country.[5] After unification, rental rates may differ in the short run due to capital specificity.

Consider the following notation. Product prices faced by producers in each industry in A are $p_i^A = (1 + \tau_i^A) p_i^B$ where τ_i measures product price distortions, like tariffs, and p_i^B is the price of the

[5] With two sectors there exists a unique rental rate consistent with production in both industries. With more sectors than factors the well-known indeterminacy in production arises. I assume that initially all sectors are producing with the same rental rate, and hence unit-value isoquants in all sectors are tangent to the unit-value isocost.

same good in system 2 (that is equal to the international price).[6] Additionally, $a_{Li}^A = (1+\delta_i)a_{Li}^B$ and $a_{Ki}^A = (1+\delta_i)a_{Ki}^B$ with $\delta_i \geq 0$ where a_{ji}^C is the amount of factor j required to produce one unit of product i in country $C = A, B$ and δ_i is a measure of the productivity gap between firms in A and B.

There are four possible scenarios to establish initial differences in factor returns, depending on whether there exists integration in labor and capital markets or not. If neither capital markets nor labor markets are integrated before unification, differences in factor returns are given by technology and product price differences, following the traditional Hecksher-Ohlin model. In such a case, that adequately represents Germany pre-1990, it is possible to get an expression for the rate of wages in A and B of the following form: $w_A/w_B = f(\tau_i^A, \delta_i, p_i^B, a_{ji}^B)$. A similar expression follows for r_A/r_B. Ceteris paribus, wages are greater in B if $\delta_i > 0$. Price distortions will affect relative factor returns depending on the sectoral bias of such interventions.

If labor markets are integrated wages tend to equalize. Consider the presence of some exogenous distortions (regulations or migration restrictions) that impede wage equalization so that $w_A/w_B = 1+\pi_0$ with $\pi_0 < 0$. r_A/r_B follows from manipulating the zero profits conditions. In each industry of A we have that

$$p_i^A = a_{Li}^A w_0^A + a_{Ki}^A r_i^A \tag{1}$$

that can be written as

$$(1+\tau_i^A)p_i^B = (1+\delta_i)a_{Li}^B(1+\pi_0)w_0^B + (1+\delta_i)a_{Ki}^B r_i^A \tag{2}$$

Defining $r_i^A = \phi_i r_i^B$ it follows that

$$\phi_i = \frac{1+\tau_i - (1+\delta_i)(1+\pi_0)\theta_{Li}^B}{(1+\delta_i)\theta_{Ki}^B} \tag{3}$$

Interestingly, in the two-by-two case, the two conditions implicit in (3) are consistent with equalization of rental rates across sectors within economies. In other words, for any π_0 there exists a unique τ_1 and τ_2 such that, given rental rates equalization across sectors, the return to capital

[6] As discussed below, other distortions may be also in place that τ_i accounts for. For example, artificially high demand from the communist block in the case of eastern Germany.

is also equal across countries.[7] This implies that any equilibrium with complete integration of capital markets can be supported with a combination of product and factor market's interventions (π_0, τ_1, τ_2).

Equation (3) reveals that differences in rental rates depend on wage and price distortions and technology differences. According to (3), $\partial\phi_i/\partial\delta_i < 0$, implying that the higher the technology gap between industries the greater the difference in rental rates. Also, for a given ϕ_i $\partial\tau_i/\partial\delta_i > 0$ so that the greater the technology gap the higher the degree of protection required to reach a certain gap in capital returns. In particular, if $\phi_i = 1$ (complete integration of capital markets), $\tau_i^A = \delta_i + \pi_0\theta_{Li}^B$.[8] For a given level of labor market distortion π_0, technology differences have to be compensated with greater price distortions.

The situation of Germany and China represent two particular pre-integration cases of this model. East Germany had distortions in product markets before 1990 and it was not integrated in factor markets with West Germany. In the case of China, the native system has product market distortions, but it shares a partially integrated labor market with the foreign-oriented sectors. Expression (3) provides the differences in capital returns consistent with those distortions or, conversely, it reveals the vector of product and factor markets' distortions consistent with a given degree of capital markets' integration.

I estimate the short run wage and employment changes due to integration in product and factor markets. For that, I consider variations in product prices, wage equalization following the removal of distortions and (eventual) productivity changes due to technology diffusion. As just mentioned, labor is mobile across sectors but capital is assumed immobile in the short run, so that rental rate differences may appear.

The variation in product prices has three components. One, changes in relative prices due to tariff changes. This is specially relevant for the case of China as entry into the WTO imply a significant change in the tariff structure. Second, possible changes in prices due to changes in product demand. In the case of Germany, CMEA disappeared and eastern Germans shifted their

[7] The condition for rental rate equalization in both sectors in A and B are $\left(p_1^C - a_{L1}^C w^C\right)/a_{K1}^C = \left(p_2^C - a_{L2}^C w^C\right)/a_{K2}^C$. These two conditions are satisfied if $\pi_0 = (\tau_1 - \delta_1)/\theta_{L1}^B(1+\delta_1) = (\tau_2 - \delta_2)/\theta_{L2}^B(1+\delta_2)$, that imply $r_1^A = r_1^B$ and $r_2^A = r_2^B$.

[8] Assuming $\pi_0 \cdot \delta_i \sim 0$. In general, for any π_0 the return to capital is equal across sectors and countries if $\pi_0 = (\tau_i - \delta_i)/\theta_{Li}^B(1+\delta_i)$ for all i.

consumption toward previously unavailable western products. In the case of China, this may reflect a fall in demand due to differences in product quality. A third component of the (exogenous) price change may related to the elimination of subsidies that may have existed before the integration. This is also relevant for the case of China[9]

Integration affects employment and factor returns in response to changes in the following market clearing conditions where $C = A,B$

i) Labor market clearing conditions:

$$\begin{aligned} L_0^C &= \sum_{i \in C} a_{Li}^C Q_i^C && \text{before integration} \\ L_0^A + L_0^B &= \sum_{i \in A} a_{Li}^A Q_i^A + \sum_{i \in B} a_{Li}^B Q_i^B && \text{after integration} \end{aligned} \tag{4}$$

ii) Full utilization of capital in each sector:

$$K_i^C = a_{Ki}^C Q_i^C \tag{5}$$

iii) Zero profit conditions in each sector:

$$p_i^C = a_{Li}^C w^C + a_{Ki}^C r_i^C \tag{6}$$

where $L_0^C (= L_0^A + L_0^B)$ is the (inelastic) labor supply in the unified economy and Q_i^C is output of sector i in country C. The percentage change in wages in A that clears the new aggregate labor market and that results from the elimination of product and factor markets' distortions is given by

$$\widehat{w^A} = \frac{\sum_i A_i(\widehat{p_i^A} + \widehat{t_i^A} + s_A) + \sum_i B_i(\widehat{p_i^B} + \widehat{t_i^B}) + \frac{\pi_1 - \pi_0}{1+\pi_1} \sum_i B_i}{\sum_i A_i + \frac{1+C}{1+\pi_1} \sum_i B_i} \tag{7}$$

where $A_i = \lambda_{Li} \frac{\sigma_i}{\theta_{Ki}}$ for $i \in A$, $B_i = \lambda_{Li} \frac{\sigma_i}{\theta_{Ki}}$ for $i \in B$, λ_{Li}^C is the share of employment in industry i in country C in total employment, σ_i is the elasticity of substitution between labor and capital in sector i, θ_{ji}^C is the share of factor j in value-added in industry i in country C, and $(1 + \pi_0)$ and $(1 + \pi_1)$ are the pre and post unification ratio of wages in country A to country B.[10] $\widehat{p_i^C}$ and $\widehat{t_i^C}$ are the percentage change in prices and multifactor productivity in industry i in country C[11] and

[9] Section 4 presents a wider discussion of this issue.

[10] $\pi_1 = 0$ if full convergence of wages takes place. In general, it can be smaller than zero if some distortions remain.

[11] $\widehat{t_i^A} = \phi^A \delta_i / 1 + \delta_i$ with $\phi^A \in [0, 1]$ is the percentage of the maximum productivity growth available for firms in A as a result of technology diffusion from firms in B.

s_A is a price subsidy (policy instrument common across all sectors) to firms in A as percentage of value-added price. Likewise, $\widehat{w^B} = (1 + \widehat{w^A})(1 + \pi_0)/(1 + \pi_1) - 1$.

According to (7), a fall in product prices in A generates a rise in real wages, while productivity gains have a positive effect on real wages. Moreover, the equalization of wages necessarily pressures up wages in A if $\pi_0 < \pi_1$. Although s_A does not distort relative prices across sectors originally in A, it does distort relative prices within sectors across firms originally in A and B, causing a fall in real wages for firms in A. Finally, increases in prices or productivity in B firms produce a rise in wages.

The employment change in A employment is given by

$$\widehat{L^A} = \frac{1}{\lambda_A} \sum_i A_i \left(\widehat{p_i^A} + \widehat{t_i^A} + s_A - \widehat{w^A} \right) \tag{8}$$

where $\lambda_A = L_0^A / L_0^C$. The negative effect on A's employment of the price-cost squeeze associated with the integration is evident from (8), as the fall in price distortions and wage equalization generate a rise in real wages for firms in A. These effects can be compensated with increases in productivity due to technology diffusion or price subsidies. Ceteris paribus, productivity gains pressure up wages and unambiguously increase employment in A. Of course, the distribution of technology transfers across sectors determine the relative winners in A. The price subsidy s_A required to reach an employment target of L_*^A after integration is

$$s_A = \left(\frac{L_*^A}{L_0^A} - 1 \right) \frac{\lambda_A (1 + \pi_1) K}{(1 + \pi_0) \sum_i A_i \sum_i B_i} - \frac{\sum_i A_i \left(\widehat{p_i^A} + \widehat{t_i^A} \right)}{\sum_i A_i} + \frac{\pi_1 - \pi_0}{(1 + \pi_0)} \tag{9}$$

where $K = \sum_i A_i + (1 + \pi_0)/(1 + \pi_1) \cdot \sum_i B_i$. The subsidy depends positively on level of L_*^A and negatively on product price and technology changes, revealing that the "distance" between employment in A with zero subsidy and L_*^A is shorter the greater price increases or technology diffusion are. However, given a target level, the marginal and average subsidy are constant. Also, $\partial s_A / \partial \pi_1 > 0$, implying that the smaller the final distortions in labor markets the greater the wage pressure on firms in A and hence the greater the subsidy needed to compensate it. Finally, $\partial s_A / \partial \sum_i A_i < 0$. This effect includes two competing forces. On the one hand, greater $\sum_i A_i$ imply a greater response of the labor demand curve to the subsidy. On the other hand, the wage elasticity of the labor demand curve in A is greater, meaning that the wage pressures of the subsidy have greater negative impact on employment in A. Overall, the latter effect dominates.

Figure 1a depicts the labor market adjustment where L_d^A and L_d^B represent the post-unification labor demand curves in A and B. The wage rate that clears the new aggregate labor market is w_1^A in A, and so the employment level is L_1^A.[12] The subsidy required to reach the target level L_*^A is s_1, implying a fall in employment in B from L_1^B to L_2^B. The subsidy works through two mechanisms; it shifts the labor demand curve in A to $L_d^{A\prime}$ but it also rises wages. The net effect is a rise in employment.

It is possible that the market clearing wage change detailed in (7) requires a negative employment level in country A.[13] This is due to the correction of initial wage differences between the two systems. This is of course not a possible outcome, as employment in A has to be non-negative. In such scenario, I estimate the wage level in A (w_2^A) that supports a zero manufacturing employment level in A ($L_2^A = L_d^A(w_2^A) = 0$). $w_2^A < w_1^A$ is the (never observed) shadow wage level in A. Likewise, there exist a wage level in B (w_2^B) that supports the employment of all the labor force ($L_2^B = L_d^B(w_2^B) = L_0^A + L_0^B$), and it is greater than w_1^B in figure 1a. Therefore, the relevant wage change in A is the minimum between w_1^A and w_2^A. This case is depicted in figure 1b. At w_1^A the employment level in A is negative. L_2^B corresponds to the total labor force in the unified economy and the distance $\overline{L_1^B\ L_2^B}$ is equal to $\overline{L_2^A\ L_1^A}$. The shadow wage rate in $A: w_2^A$ is such that given the labor demand function manufacturing employment is zero. The wage rate in $B: w_2^B$ is the one that makes firms in B employ all the aggregate labor force and it is greater than $w_2^A/(1+\pi_1)$.

The effective wage and employment variations (compared to the pre-liberalization equilibrium) can be expressed according to the following expressions

$$\widehat{w_{ef}^A} = \min\left\{ \frac{\sum_i A_i(\widehat{p_i^A} + \widehat{t_i^A} + s_A) + \sum_i B_i(\widehat{p_i^B} + \widehat{t_i^B}) + \frac{\pi_1 - \pi_0}{1+\pi_1}\sum_i B_i}{K}; \frac{\lambda_A + \sum_i A_i(\widehat{p_i^A} + \widehat{t_i^A} + s_A)}{\sum_i A_i} \right\} \tag{10}$$

$$\widehat{L_{ef}^A} = \frac{1}{\lambda_A}\sum_i A_i(\widehat{p_i^A} + \widehat{t_i^A} + s_A - \widehat{w_{ef}^A}) \tag{11}$$

The employment change in country A is bounded between $[-1, L_0^B/L_0^A]$. The subsidy required to reach a target level has now two components. Part of the subsidy generates increases in the

[12] Assuming a positive final wage gap between A and B.

[13] In such case, market-clearing wage levels in A and B: w_1^A and $w_1^B = (1+\pi_1)w_1^A$ such that $L_d^A(w_1^A) + L_d^B(w_1^B)$ $= L_0^A + L_0^B$ imply $L_d^A(w_1^A) < 0$.

shadow wage in A with no effect in the employment level. This is because the shift in labor demand is not big enough to support a positive employment level in A given the wage equalization pressures with firms originally from B that have more enhanced technologies. In terms of figure 1b, s_1 shifts $A's$ labor demand with no employment adjustment, as all the subsidy is absorbed in higher shadow wages. It is not until the wage rate is A equals $w_3^A = w_2^B(1+\pi_1)$ and employment is zero that increases in the subsidy shift labor out of B.[14] Additional subsidies (s_2) generate rises in real wages for firms originally in B and employment in A increases. This second mechanism is similar to the one presented in figure 1a. The total subsidy needed to reach L_*^A is $s_1 + s_2$. It can be expressed as percentage of value-added prices where $\widehat{L_1^A}$ is the percentage change in employment in A with no subsidies.

$$s_A = \left\{ \begin{array}{cc} Z = \left(\frac{L_*^A}{L_0^A} - 1\right) \lambda_A \frac{1+\pi_1}{1+\pi_0} \frac{K}{\sum_i A_i \sum_i B_i} - \frac{\sum_i A_i(\widehat{p_i^A} + \widehat{t_i^A})}{\sum_i A_i} + \frac{\pi_1 - \pi_0}{1+\pi_0} & \text{if } \widehat{L_1^A} \geq -1 \\ Z + \left(\frac{1+\pi_1}{1+\pi_0} \frac{\sum_i B_i(\widehat{p_i^B} + \widehat{t_i^B}) - \lambda_A}{\sum_i B_i} + \frac{\pi_1 - \pi_0}{1+\pi_0} - \frac{\lambda_A + \sum_i A_i(\widehat{p_i^A} + \widehat{t_i^A})}{\sum_i A_i}\right) \left(1 - \frac{1+\pi_1}{1+\pi_0} \frac{K}{\sum_i B_i}\right) & \text{otherwise} \end{array} \right\}$$

The total subsidy depend on two elements. First, it depends on the employment target and the effectiveness of the subsidy in generating a fall in real wages for firms originally in A. These effects are discussed in equation (9). Second, it depends on the difference between the wage level consistent with no employment in A and the wage level consistent with full employment in B (w_2^B and w_2^A). The second term in the bottom expression is greater than zero if $w_2^B > w_2^A/(1+\pi_1)$.

3 German Unification

Before 1990, West Germany had an economy integrated with world markets. However, East Germany had a relatively closed economy, highly controlled, centralized and subject to important distortions. On the external front, it belonged to a common market composed of communists countries named Council for Mutual Economic Assistance (CMEA), that kept an artificially high demand for products with much lower valuation in world markets.

The unification of both economies in 1990 had significant effects on the eastern economy. On the one hand, integration of factor markets and pressures from labor unions produced significant

[14] At w_1^A and w_2^B the wage differences are greater than $1+\pi_1$, so convergence to the final gap pressures employment in A to the negative side again.

increases in factor costs that eastern firms were not able to absorb due to high technology differences with the West. On the other hand, a whole new set of goods available to eastern Germans shift product demand toward western products. At the same time, demand from countries in the CMEA fell dramatically due to the fall of most communist regimes in that period. As a consequence, a price-cost squeeze for eastern firms was evident, and a recession dominated the transition in the 1990s. With this scenario the new unified government implemented several policies to avoid a dramatic fall in employment and output in the East and to provide a smooth transition toward the new competitive production structure. This section tries to replicate the employment consequences of unification and the fiscal transfers made by the government.

According to the model presented in last section, we need data on initial wage differences, wage convergence, measures of technology differences between eastern and western firms, product price changes associated with the unification, and data on the production and employment structure of East and West Germany at the moment of the unification. Initial wage differences at the 3 digit ISIC industry level are obtained from UNIDO Database, that has data on employment and total wages and salaries for 28 manufacturing industries in eastern and western industries for 1989. Accordingly, eastern annual wages were about 37% of western wages before unification. A similar number is reported by Sinn (2000), while Akerlof, Rose, Yellen and Hessenius (1991) (ARYH hereafter) and Fitzroy and Funke (1998) report ratios of 35% and 30% respectively. The initial wage gap in each industry based on UNIDO data is detailed in the second column of table 1. According to Sinn (2000), the ratio of east to west wages rose to 72% in 1996 to stabilize at that level. Fitzroy and Funke (1998) argue that the wage-push in Germany brought eastern wages from 30% in 1991 to 60% in 1993 of western levels. There are several explanations for the lack of full convergence in wages, like differences in skills, non monetary benefits, frictions to migration or union interventions. I take the position that the persistent wage gap is related to exogenous labor market interventions. Sinn (2000) presents a wider discussion on the reasons for the halt in convergence in per capita output, wages and productivity in 1996.

Productivity differences are estimated from ARYH, who present for 9 aggregated industries estimates for eastern firms of the short-run average variable cost of earning one Deutsche mark in trade with non-CMEA countries in 1990 (after unification).[15] In other words, the variable

[15] The industries are: Chemicals; Metallurgy; Machinery; Transportation Equipment; Electronics; Textiles; Furni-

cost of selling in international markets one Deutsche mark, after correcting for price and factor costs changes associated with the unification process. A value greater than 1 reveals that the firm is not viable in the sense that the unitary variable costs of producing are greater than the price. In terms of the model just presented, we can proxy short-run average variable costs for the unitary employment costs after considering the capital stock in the short run as immobile. The ratio presented in ARYH can be interpreted as $a^e_{Li} w^e_1 / p^e_{i1} = \theta^e_{Li1}$ where the subscript 1 indicates after-unification values and the superscript e refers to eastern firms. It is an estimation of the labor share in value-added in each eastern industry with new product and factor prices. Because these measures are for the end of 1990 and the unification started in mid 1990, they implicitly consider pre-liberalization technology levels. This is a desirable feature for we want to capture the technology gap at the moment of integration. Like the interpretation of ARYH, if $\theta^e_{Li1} > 1$ the return on capital is smaller than zero, and the firm is not viable in the absence of fixed costs.

The (hicks-neutral) technology gap between eastern and western firms is implicit in the definition of θ^e_{Li1}, and it can be written as

$$\theta^e_{Li1} = \frac{(1+\delta_i) a^w_{Li} \cdot w^e_0 (1+\widehat{w^e})}{p^e_{i0}(1+\widehat{p^e_{i0}})}$$

implying that[16]

$$\delta_i = \frac{\theta^e_{Li1} p^w_{i1}}{a^w_{Li} \cdot w^w_0 (1+\pi_0)(1+\widehat{w^e})} - 1 = \frac{\theta^e_{Li1}}{\theta^w_{Li0}(1+\pi_0)(1+\widehat{w^e})} - 1 \tag{12}$$

where π_0 is the initial wage ratio, $\widehat{w^e}$ is the (endogenous) wage change in the east, $\widehat{p^e_{i0}}$ is the percentage change in output prices that equates the price of similar goods in the East and the West and δ_i is a measure of technology differences between eastern and western firms such that $a^e_{fi} = (1+\delta_i) a^w_{fi}$. We can compute the variables in the right hand side of (12) for each 3-digit ISIC industry. Data on θ^e_{Li1} is obtained from ARYH using the mapping described in column 1 of table 1. The share of labor in total value-added in western industries at the moment of unification - θ^w_{Li0} - is calculated for each 3-digit ISIC industry in 1989 from UNIDO Database, and it is detailed in column 3 of table 1. The wage change considered is the 42% increase in the period first quarter/October 1990 in each eastern industry reported by ARYH while the initial wage gap is computed from the

ture and Toys; Glass, Ceramics and Papers, and Food, Drinks and Tobacco.

[16] By definition $p^e_{i1} = p^w_{i1} = p^w_{i0}$.

UNIDO database as described above. Columns 4 to 6 detail the variable cost ratio, the implicit parameter δ_i obtained from computing equation (12) and the corresponding maximum total-factor productivity gain available for eastern firms ($\delta_i/1+\delta_i$). On average, eastern firms were able to obtain productivity gains up to 85% by adopting western technologies.

I follow two alternative strategies to estimate the effects of unification on wages and employment reallocation. First, I estimate the wage change consistent with full employment in the new aggregated labor market, and estimate the corresponding employment reallocation from the East to the West for different technology transfers assumptions. Additionally, I compute the price subsidy that delivers an employment change in eastern manufacturing sectors that matches the observed employment change. An alternative strategy is to estimate the employment reallocation suggested by the evolution of effective wages (that may differ from the market-clearing one), and compare the fiscal transfers required to match observed employment changes with the observed ones. I focus on the period 1990-96 because it provides a long enough sample to discuss the implications of employment reallocation and it is short enough to make the assumption of sector-specific capital reasonable. Besides, 1996 marks the halt of convergence according to several measures discussed in Sinn (2000). Therefore, the evidence post 1996 may be affected by other events not included in the model. The results are robust to alternative periods.

3.1 Market-clearing wage changes

The wage change that clears the new aggregate labor market is computed using equation (7). I consider a 1996 wage ratio of 72% reported by Sinn (2000). Wage changes are estimated for different degrees of technology diffusion and product price adjustment for eastern products. These are the two determinants of equation (7) over which we have less information. Table 2 reports the values of the coefficients of the model used to compute the parameters. The elasticity of substitution between labor and capital is estimated in Claro (2002). (See appendix 1). The wage adjustment in East Germany ($\widehat{w^e}$) with no subsidies is given by the following expression

$$\widehat{w^e} = \min\left[0.591 + 0.375 \cdot \widehat{p^e} + 0.302 \cdot \phi ; 0.903 + \widehat{p^e} + 0.81 \cdot \phi\right] \tag{13}$$

where $\widehat{p^e}$ is the percentage change in value-added prices (common across all sectors in eastern Germany) and $\phi \in [0,1]$ is the percentage of the initial technology gap between eastern and western firms that is closed. The assumption of a common ϕ implies that multifactor productivity gains differ across sectors. Implicit in (13) is the combination of price and productivity changes that sustain manufacturing sectors in eastern Germany with market-clearing wage changes and no subsidies, given by $\phi > -0.61 - 1.23\widehat{p^e}$. Thus, with no technology diffusion eastern manufacturing employment is not sustainable for price falls beyond -50%. Likewise, employment in the East is positive even with no subsidies if $\phi > 0.63$, regardless of the change in product prices.

As discussed in section 2, the subsidy s_e required to reach an employment target of L^e_* will also depend on the relative size of π_1 and π_0, $\widehat{p^e}$, and ϕ. Accordingly,

$$s_e = \left\{ \begin{array}{ll} 1.445\left(\frac{L^e_*}{L^e_0} - 1\right) - \widehat{p^e} - 0.81\phi + 0.95 & \text{if } L^e_1 \geq -1 \\ \\ 1.445\left(\frac{L^e_*}{L^e_0} - 1\right) - 0.4\widehat{p^e} - 0.324\phi + 1.25 & \text{otherwise} \end{array} \right\}$$

As expected, the condition for the subsidy to be smaller in the case that $L^e_1 \geq -1$ is indeed $\phi > -0.61 - 1.23\widehat{p^e}$, that is the same condition to sustain a positive manufacturing employment level in the East without subsidies.

There exists some evidence with respect to the degree of technology diffusion between 1990 and 1996 from western to eastern firms. According to the Deutsche Bundesbank Monthly Report of July 1996, average east/west output per worker $(1/1+\delta)$ was 0.53 in 1994. Considering the evolution of employment and output per worker in West and unifies Germany using BLS data, I estimate a similar ratio of 0.15 in 1990. Moreover, with information from the Bundesbank Monthly Report in 1998 we can estimate the same ratio for 1996 in 0.59. This implies an average productivity growth between 1990 and 1996 of 75% approximately.[17] In terms of our notation, $\phi = 0.89$. With this degree of technology diffusion, eastern manufacturing employment was sustainable for almost any demand shift. This is a first important conclusion. Also, between 1990 and 1996 eastern manufacturing employment fell approximately by 66%, from more than 2.5 million workers to less the 900 thousands, implying a value for $L^e_*/L^e_0 = 1/3$.

The change in prices consistent with a fall in eastern employment of 66% in the absence of any subsidy is a 71% fall computed using equation (11). However, we know that several transfers to eastern firms took place. Several sources report annual transfers to eastern Germany around 90-billion dollars (representing around 40% of East Germany manufacturing GDP between 1990

[17] The initial East/West ratio in output per worker of 0.15 implies a δ of 5,6. This implies a maximun productivity gain of 85%. This is close to the values reported in table 2 from Akerlof et.al., (1991).

and 1996).[18] According to Bach and Vester (2000), transfers varied from US$ 39 billions to US$ 80 billions each year between 1991 and 1996 (between US$ 27 billions and US$ 63 billions excluding unemployment benefits). The Bureau of Economic Analysis of the U.S. Department on Commerce in several issues of the "German Report on Economic Practice and Trade" estimates total transfers from western to eastern Germany were about DM 152 billions annually (US$ 92 billions). According to Sinn (2000), public transfers represented 4.5% of West German GDP, and this number rises to 5.6% if east German public borrowing is accounted for. These numbers represent roughly transfers between 90 and 115 billion of dollars annually. Considering a share of manufacturing sector in Eastern Germany around 50% of tradable industries, this implies a subsidy of 24% of value-added prices. With this subsidy, the changes in prices consistent with a fall in employment of 66% is a 95% fall. This implies a wage increase of 59%, much smaller than the 95% reported by Sinn.

Alternatively, the change in prices consistent with a 95% increase in wages and a 24% subsidy is a 1,6% rise. This number is clearly inconsistent with the evidence. Moreover, these numbers imply a null change in eastern employment, inconsistent with the observed 66% fall. Therefore,an analysis of the employment and fiscal implications of the German unification based on market-clearing wage adjustment does not adequately replicate the evidence. Several authors suggest that the wage response in East Germany reflected important pressures to equalize wages with western workers.[19] I thereby consider observed wage changes in the first half of the 1990s as exogenous and estimate the employment and fiscal transfers' implications of such variations in workers' compensations.

3.2 Observed wage changes

The response of eastern employment is given by the following relationship computed using equation (11): $\widehat{L^e} = -1.107\widehat{w^e} + 0.893\phi + 1.107\widehat{p^e} + 1.107s_e$. The impact of a rise of 1 percentage-point in real wages is a fall of 1.1 percentage-points in employment. Similar employment response is

[18] In 1991 manufacturing value-added in eastern Germany was approximately US$ 258 billions, falling to almost US$ 164 billions in 1996. The figure of US$ 1,276 billions is the sum of eastern manufacturing value-added from 1991 to 1996, implying an annual average manufacturing value-added in the East around 212 billion dollars. These estimations are based on the evolution of manufacturing employment and output per worker in the East provided by the US Bureau of Labor Statistics.

[19] See Akerlof et.al., (1991) and Sinn (2000).

expected for price subsidies, while the response to productivity gains is smaller because a 1 point increase in ϕ implies a productivity gain smaller than 1%. The subsidy required to reach L^e_* is estimated according to the following formula that assumes a zero pass-through from subsidy to wages

$$s_e = \frac{\lambda_e}{\sum_i E_i}\left(\frac{L^e_*}{L^e_0} - 1\right) - \frac{\sum_i E_i(\widehat{p^e_i} + \widehat{t^e_i})}{\sum_i E_i} + \widehat{w^e} = \frac{L^e_* - L^e_1}{(L^e_0 + L^w_0)\sum_i E_i} \tag{14}$$

where L^e_1 is the employment level in the east after unification with no subsidies. In (14) the subsidy has a compete pass-through to employment due to its null impact on wages. Compared to the case of endogenous wage adjustments, the size of the subsidy differs for two reasons. As just mentioned there is no pass through from subsidy to wages, so the effectiveness of the subsidy is greater. However, for any vector of exogenous shocks, wage increases above market-clearing ones imply a greater difference between L^e_* and L^e_1, affecting the size of the subsidy. Computing (14) we get

$$s_e = 0.903\left(\frac{L^e_*}{L^e_0} - 1\right) - \widehat{p^e} - 0.81\phi + \widehat{w^e}$$

Consider values of $L^e_*/L^e_0 = 1/3$, $\phi = 0.87$ and $\widehat{w^e} = 0.95$. A subsidy of 24% is obtained with price fall around 59%. This number is similar to the 51% reported by ARYH for 1990. The subsidy needed to generate a 1-point increase in employment is 0.9%. This implies that the average cost per worker of reaching an employment target of $L^e_* = L^e_0/3$ is USD 76,600 in the case of exogenous wage determination, with a rise in eastern employment of more than 1 million workers ($L^e_* - L^e_1$). This is also the marginal cost of increasing eastern employment in one worker considering an average manufacturing value-added in the East of 212 billions of dollars and an employment level of approximately 2.5 millions. This implies that the difference between L^e_* and L^e_1 is more than 1 million workers. The cost of increasing eastern employment by one worker is estimated in USD 122,500 if wages are endogenously determined. The greater cost is explained by the positive pass-through from subsidy to wages, estimated in 37.5%. Alternatively, a 1.45% subsidy is needed to increase eastern employment by 1%.

4 China's entry into the WTO

In the case of China, the dual economic system is characterized by the interaction of two types of firms. Foreign firms are encouraged to bring their technologies and capital, produce in China and export their production. Some degree of integration in labor markets exists, generating cost pressures on native firms with backward technologies. In order to keep them competitive, two types of distortions are in place. First, native firms sell mainly in domestic markets that are subject to tariff protection, while foreign firms are significantly limited to sell in those markets. According to Branstteter and Feenstra (1999), the limited access to domestic markets by foreign firms is explicit as well as de facto, introducing a price gap that eventually compensates for technology differences. Second, some degree of labor markets distortions exist affecting both the requirements to hire employment by foreign firms and the mobility of labor across regions. These imply a wage premium paid by foreign firms between 18% and 47%.[20] Within the native economy, State-owned enterprises (SOEs) are subject to intensive competition from Collectively-owned enterprises (COEs) which have better technologies and are more flexible to take production decisions. In such context, the subsistence of the former may be due to extensive subsidies financed by the central government.[21]

Entry into the WTO implies integration of both systems, eliminating product price and factor market distortions. Real cost pressures to state firms similar to those in Germany are expected to arise. Specifically, China's accession to WTO implies a change in the tariff structure vis-a-vis the rest of the world, as well as an end to the dual economic structure. In other words, free access of FIEs to domestic factor and product markets, including protected product markets with new tariffs, and the elimination of distortions in the native economy.

Claro (2002) presents an analysis of the economic structure of China and estimates technology differences between native (state - SOEs and collective - COEs) firms and foreign firms in each industry at the 3-digit ISIC level. Appendix 2 summarizes the methodology.

Table 3 taken from Claro (2002) reports measures of technology differences between state and foreign firms and between collective and foreign firms for 3-digit ISIC manufacturing industries using data from 1997 and 1999 China´s Statistical Yearbook, where TFP refers to the multifactor productivity gains attainable with full convergence.[22] Two messages follow from it. First, COEs

[20] Strictly speaking, it is not possible to determine whether wage differences reflect differences in skills or productivity, foreign firms' policies or distortions in factor markets.

[21] See Brandt and Zhu (2000) for a discussion of the way the Bank of China benefits SOEs over COEs through credit allocation.

[22] Appendix 2 summarizes the methodology, also taken from Claro (2002).

have more enhanced technologies than SOEs, consistent with the observed crowding out of the former by the latter in domestic markets. According to Brandt and Zhu (2000), subsistence of SOEs is supported by subsidized credit from the Bank of China. Second, technology differences with foreign firms (either in collective and state enterprises) are greater in industries with higher tariff protection.[23] This is the way the government protects less developed native firms from foreign competition as equation (3) suggests. By limiting access of foreign firms to protected product markets, it allows native firms to compete in factor markets with backward technologies.

Technology differences are high enough so that the leveling of the competition field puts significant pressures on the competitive position of native firms, specially SOEs. Given technology differences and price changes, I estimate the wage and employment implications of the integration process, as well as the transfers required to reach state or native employment targets. I consider a wider version of the model presented in section 2 with three types of firms in each sector: state, collective and foreign. (See Appendix 3). Unlike the German case where we are making an ex-post analysis of the data, in China we are estimating the ex-ante potential impact of entry into WTO on wages and employment. Thus, we do not have data on technology changes, price changes (other than those due to tariff changes[24]), and final wage ratios. We estimate the effects on native firms as functions of these variables, and compare them with the implications for Germany. Table 4 details the data used to compute the parameters of the model.

Considering an initial wage ratio of state to foreign firms of 0.68 and a ratio of collective to foreign wages of 0.85 and assuming full convergence of wages we can represent the change in wages relevant to SOEs with the following expression:

$$\widehat{w^S} = 0.491\widehat{p^S} + 0.535\widehat{p^C} + 0.281\phi^S + 0.056\phi^C + 0.491s_S + 0.534s_C + 0.0373$$

where $\widehat{p^S}$ and $\widehat{p^C}$ represent the percentage change in product prices for state and collective firms that exclude the effects of tariff changes.[25] These ones are included in the last term, that also

[23] The correlation coefficients between the series TFP 2 in table 3 and the initial level of tariff (τ_0 in table 4) are positive and significant at 5% when excluding Tobacco and Beverages industries.

[24] Obtained from the US-China Business Council. Unclassified Copy of US-China Bilateral Market Access Agreement as Released by USTR on March 14, 2000. This agreement establishes a tariff reduction schedule until 2008.

[25] This equation assumes the possibility of technology convergence to foreign firms' levels. However, as table 4 suggests, this may imply a productivity fall in some collective firms. I also perform the estimation assuming potential convergence to the best technology available. In such case, the maximum technology improvements are 62.3% rather

incorporate the impact of wage equalization. The effect on state employment with no subsidies is given by

$\widehat{L^S} = -0.241 + 0.845\widehat{p^S} - 0.887\widehat{p^C} + 0.483\phi^S - 0.093\phi^C$

The positive effect of $\widehat{p^S}$ and ϕ^S on state employment reveal that the shift in labor demand due to price increases or technology improvements dominates their indirect impact on wages. For similar degrees of technology diffusion in state and collective firms ($\phi^S = \phi^C = \phi$) and considering only price changes in SOEs, $\widehat{L^S}$ is given by $\widehat{L^S} = -0.241 + 0.845\widehat{p^S} + 0.39\phi$, implying that with no technology diffusion state employment is viable unless price falls are greater than 90%. Alternatively, for $\phi = 0.87$ and $\widehat{p^S} = -0.59$ as in Germany, the change in state employment is -40%. If convergence takes place to maximum productivity available, the fall in state employment is 55%, as the greater productivity gains are dominated by further wage increases.

The fall in state employment can be either absorbed by collective or foreign firms. The change in collective and foreign employment are given by

$\widehat{L^C} = 0.076 - 0.4296\widehat{p^S} + 0.62\widehat{p^C} - 0.2457\phi^S + 0.0641\phi^C - 0.4296s_S + 0.62s_C$ and

$\widehat{L^f} = 0.3548 - 0.4063\widehat{p^S} - 0.4422\widehat{p^C} - 0.2324\phi^S - 0.0463\phi^C - 0.4063s_S - 0.4422s_C$

With no subsidies, $\phi^S = \phi^C = 0.87$, no price changes for collective firms and fall in value-added prices for state firms of 59% the rise in collective employment is 17,1% and the rise in foreign employment is 46,6%. Foreign firms are mostly benefited due to the fall in wages. Without technology diffusion, the change in state, collective and foreign employment is given by -71%, 31% and 57,8% respectively, revealing that overall technology convergence benefits mostly state firms and hurt COEs and FIEs because wage pressures dominate productivity gains.

In the case of Germany where market-clearing wage adjustments took place, the change in eastern employment is given by $\widehat{L^e} = -0.66 + 0.69\widehat{p^e} + 0.56\phi$ assuming no subsidies. In a scenario where $\phi = 0.87$ and $\widehat{p^e} = -0.59$ the fall in eastern employment is 69%. The impact of technology convergence is greater in Germany than China because technology differences are greater in the former. However, one percentage-point increase in multifactor productivity in state firms in China generates an increase in state employment of 0,87% ($= 0.483 \cdot 0.01/0.555$) while a similar productivity growth implies a increase in East Germany's employment of 0,64% ($0.56 \cdot 0.01/0.87$).

than 55.5% in state firms and 23.6% rather than 11.5% for collective firms on average, and the coefficients on ϕ^S and ϕ^C are 0.317 and 0.124 respectively.

The different effect of price changes reflects two forces. On the one hand, the shift of the labor demand curve due to a price change is greater in China, because the state sector is more biased toward the production of labor-intensive goods than in East Germany. Moreover, state firms in China are more labor intensive than East German firms within each sector. These two effects are compensated by the greater impact of wages on employment due to the same reason: the real wage elasticity of labor demand in greater in state firms in China than in eastern Germany. Moreover, the pass-through from prices to wages in greater in China because of the greater relative size of state firms in China in aggregate employment. Overall, price shocks have greater impact on China's state employment.

Additionally, initial wage differences were much greater in Germany than what they actually are in China, so pure integration in factor markets generates a much greater cost pressure on German firms. This last effect is reflected in the constant term in the last two expressions for $\widehat{L^S}$ and $\widehat{L^e}$. Furthermore, this difference is minimized by the fact that the coefficient for China already incorporates the effect of tariff changes that hurt state firms and the coefficient for Germany assumes a final wage ratio smaller than 1. The pure wage equalization pressure is more than three times greater in Germany.

The cost of keeping one worker employed in state firms in China is \$ 5,560 dollars. This is significantly smaller than in Germany, regardless of whether we consider or not a positive pass-through from subsidies to wages. The explanation for such dramatic differences is related to labor force sizes. The subsidy needed to generate a 1% increase in China's state employment is 1.2%, while the subsidy required to increase eastern employment by 1% is 0.9% with no pass-through and 1.45% with pass-through. As just discussed, the price subsidy generates a greater net impact on employment (net effect of shift in labor demand and wage increase) in China than in Germany. But a 1% increase in state employment in China represents more than 325,000 workers, more than 13 times the equivalent number in Germany. This difference explains why it is much more expensive to increase East Germany's manufacturing employment by one worker than in China while the cost of rising target employment by 1% is more similar across countries. Also, manufacturing value-added (the base of the subsidy) is smaller in China (154 vs 212 billion dollars), and so the cost is smaller.

Different are the results if China targets native (state plus collective) employment rather than state employment. In this case, the response of native employment is given by

$$\widehat{L^n} = -0.043 + 0.049\widehat{p^S} + 0.054\widehat{p^C} + 0.028\phi^S + 0.005\phi^C + 0.049s_S + 0.054s_C$$

Several issues arise. First, it is cheaper to reach native employment targets by subsidizing collective firms alone rather than both state and collective. Manufacturing value-added of SOEs and COEs are similar (US$ 153.4 and US 154.5 billions of dollars), therefore the cost of increasing native employment by one worker is US 36,000 dollars if only state firms are subsidies while the equivalent cost if only collective firms are subsidized is US$ 32,880. This difference is due to dissimilar wage elasticities of labor demands and pass-through from subsidies to wages.

A second element to notice is that any of these cost are significantly higher than those of reaching state employment targets but still much smaller than the equivalent cost in Germany. The difference in costs is mainly due to the size of native employment in China. By representing almost 90% of all employment, very high subsidies have to be in place to generate substantial changes in relative prices that shift employment toward foreign firms. In this case, the pass-through from subsidies to wages is very high, and so the net effect on employment low. A 1% increase in native employment requires a 18.5% subsidy, much higher than the 1.5% value for Germany. However, the cost of increasing target employment by 1 worker is dominated by the relative sizes of the labor force.

The results reported for China consider that the fall in prices relevant for state firms have two components. First, the fall in prices due to the new tariff structure. Second, a fall in prices due to potential shifts in the demand for native products. There exists however a third source of price changes for state firms related to the eventual elimination of subsidies originally in place for state firms. It is argued that given the product price, factor price and technology differences between state and collective firms, the subsistence of the former can be only sustained by subsidies or targeted credit. According to measures on the World Bank, subsidies to state employment in manufacturing sector represent around 2,6% of GDP. This value is equivalent to an average price subsidy of 29% of value-added prices. These subsidies imply that the technology differences reported in table 4 are underestimated, as they assume a similar return on capital between state and collective enterprises with no subsidies. In other words, the potential TFP gains from convergence may be as high as 29 points greater than those reported in table 3 under TFP 2 for state-owned firms (column TFP 3). At the same time, the liberalization imply a fall, additional to the two described above, of 29% in value-added prices.

This additional effect suggests a much greater fall in state employment than the ones just discussed. But this effect is decreasing as the technology gap between state and foreign firms close. Indeed, if full convergence takes place ($\phi^S = 1$), the negative effect from a lower subsidy is exactly compensated by a greater increase in multifactor productivity. Furthermore, regardless of the zero-subsidy change in state and native employment, the subsidy required to generate marginal increases in employment is not affected by the new vector of productivity and price changes. This is because shifts in labor demand and wage pressures are independent of the fall in product prices and productivity gains in state firms. However, the total cost of reaching a target state or native employment level is greater as the difference between a given target and the post-liberalization zero-subsidy equilibrium is greater.

5 Subsidies versus Unemployment Benefits

Are these costs worthy? If employment reallocation is costless, it is clear that subsidizing state or native employment in China or eastern employment in Germany is not optimal and has only a redistributive effect. But if the reallocation of workers is costly and unemployment arises, it might be optimal (at least from the workers point of view) to give subsidies to the shrinking sectors to avoid drastic unemployment increases. The experience of eastern Germany suggests that the employment costs of reallocation may be quite high. Without getting into the intertemporal discussion of whether the subsidies just postpone the unemployment costs or effectively reduce the intertemporal costs of adjustment, I present a simple comparison for Germany and China of the costs of keeping employment high via subsidies against paying benefits to unemployed workers.

Consider that a proportion $\lambda \in [0, 1]$ of workers released from shrinking firms fall in the unemployment pool. There are two possible strategies to 'protect' workers. The first one is to subsidize production in the shrinking sectors, with a cost of c dollars per worker targeted. This implies a cost per unemployed worker of c/λ. An alternative option is to give unemployment benefits to those workers by $b \cdot w$, where w is the average or reference wage the worker was receiving before being unemployed and $b \in [0, 1]$ is the percentage of the annual wage that is paid as unemployment benefit. Given an average manufacturing wage of US$ 8,800 in eastern Germany and US$ 820 in state firms in China, the policy of subsidizing firms is more costly than paying unemployment benefits. Indeed, the number of reference wages required to make the subsidy policy a cheaper one for $\lambda = 1$ is 8,7 for Germany and 6,8 in China. These numbers are definitely way above the benefits paid in other countries with unemployment insurance policies, that roughly move between 30% for Italy to 90% for Denmark according to the 1999 edition of "Benefits System and Work Incentives" from OECD.

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APPENDIX 1: ESTIMATION OF THE ELASTICITY OF SUBSTITUTION

Consider a simple CES production function of the form $q = (aK^{\rho} + bL^{\rho})^{1/\rho}$. When combining the first order conditions with respect to capital and labor, we get $\ln w/r = \ln b/a + (\rho - 1)\ln L/K$.

The estimation of this equation using 28 3-digit ISIC manufacturing cross-country data for 1996 from UNIDO provides an estimator of the elasticity of substitution $\sigma = 1/(1-\rho)$. 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 the following table, which also reports the R^2 of each regression as well as the number of countries. For industries that comprise more than one 3-digit industry I use a simple average of the elasticities of substitution. The results are not affected by alternative aggregations.

ELASTICITY OF SUBSTITUTION BETWEEN LABOR AND CAPITAL

Industry (ISIC Code)	$\rho-1$	σ	R-Square	n
Food Prod. (311, 312)	-1,32	0,76	0,58	32
Beverage (313)	-1,16	0,86	0,47	25
Tobacco (314)	-0,47	2,12	0,08	20
Textile (321)	-1,08	0,93	0,58	29
Apparel (322)	-1,42	0,70	0,63	26
Leather (323)	-1,16	0,86	0,57	20
Footwear (324)	-1,73	0,58	0,84	23
Wood (331)	-1,41	0,71	0,74	31
Furniture (332)	-1,23	0,81	0,77	23
Paper Prod. (341)	-1,24	0,80	0,69	30
Printing and Publishing (342)	-1,47	0,68	0,67	28
Chemicals (351)	-1,26	0,80	0,67	27
Other Chemicals (352)	-1,35	0,74	0,68	23
Petroleum Refineries (353)	-0,93	1,08	0,43	18
Misc. Prod. of Petroleum & Coal (354)	-1,08	0,92	0,56	13
Rubber (355)	-1,52	0,66	0,78	25
Plastic (356)	-1,69	0,59	0,81	21
Pottery (361)	-1,21	0,83	0,76	14
Glass (362)	-1,04	0,96	0,69	19
Other Non-Metallic Mineral Prod. (369)	-1,58	0,63	0,78	22
Iron & Steel (371)	-1,07	0,94	0,32	27
Non-Ferrous Metals (372)	-1,51	0,66	0,68	19
Fabricated Metal Prod. (381)	-1,09	0,91	0,71	31
Machinery except Electrical (382)	-1,05	0,96	0,43	23
Electrical Machinery (383)	-1,45	0,69	0,71	25
Transport Equipment (384)	-1,13	0,88	0,54	25
Professional & Scientific Eq. (385)	-0,98	1,02	0,55	21
Other Manufacturing Industries (390)	-0,73	1,38	0,39	24

APPENDIX 2: TECHNOLOGY DIFFERENCES IN CHINA

1. Initial data requirement.

1. Measures of relative factor per unit of value-added requirements in different firms in each sector: a_{Lj}^F/a_{Lj}^n where a_{ij}^n is the amount of input i required to produce one unit of value-added in firm $n = (state, collective)$ in industry j.

2. Measures of relative wages and rental rates between foreign and native firms: w_j^F/w_j^S and r_j^S/r_j^F where f_j^m is the return to factor $f(labor, capital)$ in firm $m(foreign, state, collective)$ in sector j.

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

$\theta_{Lj} = a_{Lj}^m w_j^m/p_j^m$ is the cost share of labor in total value-added in industry j, where p_j^m is the value-added price as defined above in section 3.1. It follows that

$$\frac{a_{Lj}^F}{a_{Lj}^n} = \frac{\theta_{Lj}^F}{\theta_{Lj}^n}\frac{p_j^F}{p_j^n}\frac{w_j^n}{w_j^F} \qquad \text{and} \qquad \frac{a_{Kj}^F}{a_{Kj}^n} = \frac{\theta_{Kj}^F}{\theta_{Kj}^n}\frac{p_j^F}{p_j^n}\frac{r_j^n}{r_j^F}$$

For the case of China, data exist on L_j^F/L_j^n, VA_j^F/VA_j^n and w_j^F/w_j^n so it is possible to estimate the ratio of value-added prices with the following formula

$$\frac{p_{vai}^F}{p_{vai}^n} = \frac{p_i^* - \sum_{i\in F} a_{Ii}^F p_j^*}{p_i^*(1+t_i) - \sum_{i\in n} a_{Ii}^n p_j^*(1+t_i)} = \frac{1-\theta_{Ij}^F}{1-\theta_{Ij}^n}\cdot\frac{1}{1+t_i}$$

With this information, it is possible to estimate a_{Lj}^F/a_{Lj}^n. Additionally, by approximating capital stock with the value of total assets in the balance sheets, we calculate $a_{Kj}^F/a_{Kj}^n = K_j^F/K_j^n \cdot Q_j^n/Q_j^F \cdot p_j^F/p_j^n$ and from here the estimation of r_j^S/r_j^F follows.

At this stage, it is possible to estimate the productivity gains as if technologies were of Leontief types. By defining $a_{Lj}^n/a_{Lj}^F = (1+\delta_{Lj}^n)$ and $a_{Kj}^n/a_{Kj}^F = (1+\delta_{Kj}^n)$ it follows that

$TFP1 = \theta_{Lj}^n\delta_{Lj}^n/(1+\delta_{Lj}^n) + \theta_{Kj}^n\delta_{Kj}^n/(1+\delta_{Kj}^n)$

2. Correcting for differences in w/r ratios.

Next, we compare the wage-rental rate ratio between foreign and native firms in each sector and calculate the required change in $(w/r)^f$ in order to be equal to the ratio in native firms.

Let $w^n/w^F = \alpha$ and $r^n/r^F = \beta$. The relationship between foreign and native firms implies that

$$\frac{d(w/r)^F}{(w/r)^F} = \frac{(w/r)^n - (w/r)^F}{(w/r)^n} = \widehat{w_j}^f - \widehat{r_j}^f = \alpha/\beta - 1$$

It is now possible to estimate the new factor intensity ratios between foreign and native firms. By definition of the elasticity of substitution

$$\begin{aligned}\widehat{a^F_{Lj}} &= -\theta^F_{Kj}\sigma_j(\widehat{w}^f_j - \widehat{r_j}^f) \text{ and} \\ \widehat{a^F_{Kj}} &= \theta^F_{Lj}\sigma_j(\widehat{w}^f_j - \widehat{r_j}^f)\end{aligned}$$

It follows that the ratio of factor intensities between foreign and native firms for similar w/r is: $(a^F_{Lj}/a^n_{Lj})' = a^F_{Lj}/a^n_{Lj} \cdot (1 + \widehat{a^F_{Lj}})$ and $(a^F_{Kj}/a^n_{Kj})' = a^F_{Kj}/a^n_{Kj} \cdot (1 + \widehat{a^F_{Kj}})$. (The elasticity of substitution between labor and capital is assumed to be the same across different firms in the same industry, and its estimation is detailed in appendix 4.)

3. Estimation of TFP gains.

The final step is to compute the productivity gain in each native firm associated with technological convergence. By definition, $\widehat{TFP_j} = -\theta^n_{Lj}\widehat{a_{Lj}}^n - \theta^n_{Kj}\widehat{a_{Kj}}^n$. We estimate $\widehat{a_{Lj}}^n$ and $\widehat{a_{Kj}}^n$ such that $a^F_{Lj}/a^n_{Lj} = a^F_{Kj}/a^n_{Kj} = 1$. This implies

$$\begin{aligned}\widehat{a_{Lj}}^n &= \frac{1 - (a^n_{Lj}/a^F_{Lj})'}{(a^n_{Lj}/a^F_{Lj})'} \\ \widehat{a_{Kj}}^n &= \frac{1 - (a^n_{Kj}/a^F_{Kj})'}{(a^n_{Kj}/a^F_{Kj})'}\end{aligned}$$

APPENDIX 3: EXTENSION OF THE MODEL WITH THREE TYPES OF FIRMS

Consider the following wage ratios between native (state and collective) and foreign firms: $w_t^n = (1+\pi_t^n)w_t^f$ where n represents native firms (s, c), $t = 0, 1$ represents pre and post unification and f stands for foreign firms. Unification and the elimination of product market distortions imply a percentage change in wages paid by state firms given by

$$\begin{aligned}\widehat{w^s} &= \frac{1}{K}[\sum_i S_i(\widehat{p_i^S} + \widehat{t_i^S} + s_S) + \sum_i C_i(\widehat{p_i^C} + \widehat{t_i^C} + s_C) + \sum_i F_i(\widehat{p_i^F} + \widehat{t_i^F}) \\ &+ \frac{\pi_1^S - \pi_0^S}{1+\pi_1^S}\sum_i F_i + \frac{(1+\pi_1^S)(1+\pi_0^C) - (1+\pi_0^S)(1+\pi_1^C)}{(1+\pi_1^S)(1+\pi_0^C)}\sum_i C_i]\end{aligned}$$

where $K = \sum_i S_i + \frac{(1+\pi_0^S)(1+\pi_1^C)}{(1+\pi_1^S)(1+\pi_0^C)}\sum_i C_i + \frac{(1+\pi_0^S)}{(1+\pi_1^S)}\sum_i F_i$ and $\sum_i A_i = \sum_{i\in A}\lambda_i\sigma_i/\theta_{Ki}$ where $A = S, C, F$ stands for state, collective and foreign firms. The employment change in state and native firms are given by the following expressions

$$\widehat{L^S} = \frac{1}{\lambda_S}\sum_i S_i(\widehat{p_i^S} + \widehat{t_i^S} + s_S - \widehat{w^s})$$

$$\widehat{L^n} = \frac{1}{\lambda_n}\left[\sum_i S_i(\widehat{p_i^S} + \widehat{t_i^S} + s_S - \widehat{w^s}) + \sum_i C_i(\widehat{p_i^C} + \widehat{t_i^C} + s_C - \widehat{w^C})\right]$$

where $\widehat{w^C} = (1+\widehat{w^s})\left[(1+\pi_0^S)(1+\pi_1^C)/(1+\pi_1^S)(1+\pi_0^C)\right] - 1$

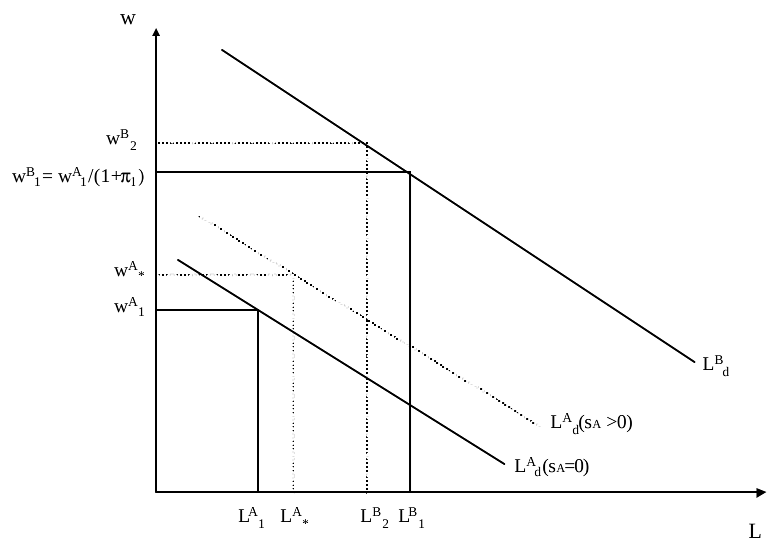

Figure 1a:

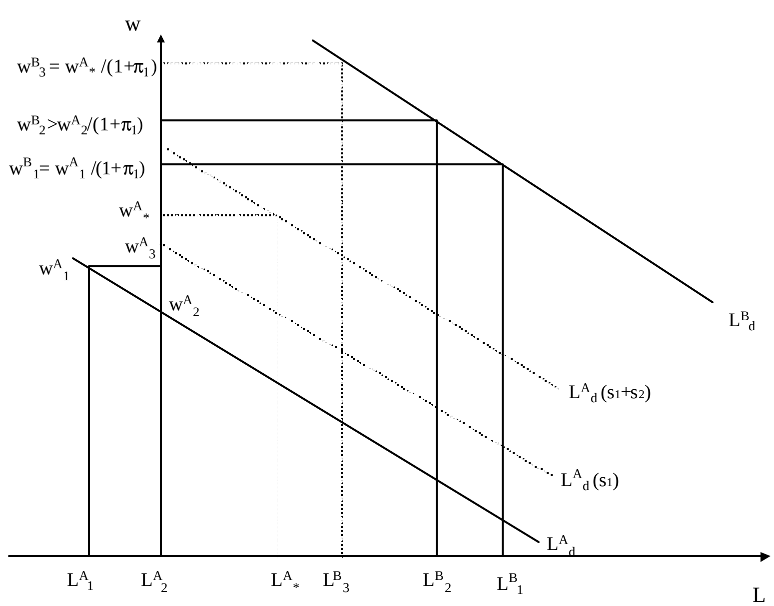

Figure 1b:

Table 1

	1	2	3	4	5	6
	Mapping from ARYH	Wage Gap	Labor Share	Var. Cost Ratio	Tech. Gap	Max. TFP gain
Industry		$\omega e/\omega w$	$\theta^{w}{}_{L0}$	$\theta^{e}{}_{L1}$	δ	$\delta/1+\delta$
Total Manufacturing	Total Industry	0,37	41,3%	19,8%	7,98 *	88,9%
Food	Food, drinks and tobacco	0,42	33,3%	17,1%	26,83	96,4%
Beverages	Food, drinks and tobacco	0,32	23,7%	8,9%	26,83	96,4%
Tobacco	Food, drinks and tobacco	0,29	4,9%	5,8%	26,83	96,4%
Textiles	Textiles	0,42	46,3%	21,2%	4,12	80,5%
Apparel	Textiles	0,54	46,9%	30,2%	4,12	80,5%
Leather	Textiles	0,49	45,9%	29,9%	4,12	80,5%
Footwear	Textiles	0,45	57,3%	38,4%	4,12	80,5%
Wood	Furniture, toys and others	0,39	45,3%	29,2%	7,73	88,5%
Furniture	Furniture, toys and others	0,36	49,5%	25,9%	7,73	88,5%
Paper	Glass, ceramics and paper	0,34	37,8%	29,2%	5,47	84,5%
Printing and Publishing	Total Industry	0,31	57,1%	26,1%	7,98	88,9%
Chemicals	Chemicals	0,27	33,1%	11,1%	9,34	90,3%
Other Chemicals	Chemicals	0,32	35,5%	11,4%	9,34	90,3%
Petroleum Refineries	Total Industry	-	6,0%	-	7,98	88,9%
Misc. Prod. of Petroleum & Coal	Total Industry	-	6,0%	-	7,98	88,9%
Rubber	Total Industry	0,37	46,4%	10,9%	7,98	88,9%
Plastic	Total Industry	0,43	45,0%	12,3%	7,98	88,9%
Pottery	Glass, ceramics and paper	0,44	54,3%	16,8%	5,47	84,5%
Glass	Glass, ceramics and paper	0,34	42,3%	21,6%	5,47	84,5%
Other Non-metallic Mineral Prod.	Glass, ceramics and paper	0,34	36,3%	29,4%	5,47	84,5%
Iron and Steel	Metallurgy	0,35	40,2%	10,3%	5,25	84,0%
Non-ferrous metals	Metallurgy	0,36	40,5%	13,8%	5,25	84,0%
Fabricated Metal Products	Metallurgy	0,38	49,9%	25,4%	5,25	84,0%
Machinery, expect electrical	Machinery	0,33	47,3%	22,7%	1,85	64,9%
Machinery, electrical	Machinery	0,35	44,5%	27,8%	1,85	64,9%
Transport Eq.	Transport Eq.	0,31	49,7%	30,4%	7,10	87,7%
Prof. & Scientific Eq.	Electronics	0,38	53,1%	30,1%	7,61	88,4%
Other Manufacturing	Furniture, toys and others	0,43	43,0%	21,8%	7,73	88,5%

Notes

* Estimated as weighted average of all industries using employment shares

(1) Mapping of industries from Akerlof et.al (1991)

(2) Ratio of Annual Wages and Salaries per employee - UNIDO Statistical Database

(3) Labor share in value-added in western Germany pre unification - UNIDO Statistical Database

(4) Labor share in value-added of eastern firms after unification, correcting for observed wage and price changes

(5) Implicit technological Difference between eastern and western firms - see text

(6) Multifactor productivity gain for eastern firms associated with fulll convergence

Table 2

		East Germany				West Germany			
Industry	σ	λ	θ_L	$\lambda_L * \sigma / \theta_K$	wages per L*	λ	θ_L	$\lambda_L * \sigma / \theta_K$	wages per L
Total Manufacturing									
Food	0,76	7,3%	17,1%	0,020	8467	5,1%	33,3%	0,041	19969
Beverages	0,86	1,6%	8,9%	0,005	8467	1,2%	23,7%	0,010	26089
Tobacco	2,12	0,5%	5,8%	0,003	8467	0,2%	4,9%	0,004	29541
Textiles	0,93	7,3%	21,2%	0,026	8239	3,4%	46,3%	0,041	19501
Apparel	0,70	3,0%	30,2%	0,009	8226	2,1%	46,9%	0,020	15333
Leather	0,86	1,4%	29,9%	0,005	8225	0,3%	45,9%	0,003	16926
Footwear	0,58	1,0%	38,4%	0,003	8226	0,5%	57,3%	0,005	18107
Wood	0,71	1,6%	29,2%	0,005	8226	1,5%	45,3%	0,013	20875
Furniture	0,81	2,5%	25,9%	0,008	8226	2,0%	49,5%	0,022	22576
Paper	0,80	3,2%	29,2%	0,011	8226	2,3%	37,8%	0,020	23969
Printing and Publishing	0,68	0,9%	26,1%	0,003	8226	2,5%	57,1%	0,028	26127
Chemicals	0,80	3,3%	11,1%	0,009	9420	4,4%	33,1%	0,037	34379
Other Chemicals	0,74	2,4%	11,4%	0,006	9419	4,0%	35,5%	0,033	29406
Petroleum Refineries	1,08	3,1%	16,5%	0,012	9420	0,2%	6,0%	0,001	38641
Misc. Prod. of Petroleum & Coal	0,92	0,4%	16,3%	0,001	9419	0,2%	6,0%	0,001	38641
Rubber	0,66	1,0%	10,9%	0,002	9420	1,4%	46,4%	0,012	25345
Plastic	0,59	0,9%	12,3%	0,002	9420	3,8%	45,0%	0,029	22069
Pottery	0,83	0,4%	16,8%	0,001	8224	0,5%	54,3%	0,007	18818
Glass	0,96	1,4%	21,6%	0,005	8226	1,0%	42,3%	0,011	24290
Other Non-metallic Mineral Prod.	0,63	3,1%	29,4%	0,008	8568	2,0%	36,3%	0,014	25261
Iron and Steel	0,94	3,1%	10,3%	0,010	9372	3,8%	40,2%	0,042	26529
Non-ferrous metals	0,66	0,9%	13,8%	0,002	9372	1,5%	40,5%	0,012	25812
Fabricated Metal Products	0,91	6,0%	25,4%	0,022	9017	9,1%	49,9%	0,116	23689
Machinery, expect electrical	0,96	19,2%	22,7%	0,071	9017	16,2%	47,3%	0,207	27311
Machinery, electrical	0,69	12,4%	27,8%	0,035	8889	14,6%	44,5%	0,128	25684
Transport Eq.	0,88	7,7%	30,4%	0,029	9017	13,4%	49,7%	0,165	28992
Prof. & Scientific Eq.	1,02	3,4%	30,1%	0,015	8890	2,1%	53,1%	0,032	23591
Other Manufacturing	1,38	1,3%	21,8%	0,007	8226	0,7%	43,0%	0,013	19240
λ_e		29,8%							
λ_w						70,2%			
$\Sigma \lambda_L * \sigma / \theta_K$				0,33				1,07	
π_0	-0,63								
π_1	-0,28								
Note:									
Source: UNIDO Statistical Database and Sinn (2000)									
* US in dollars									

Table 3

	State-owned Enterprises			Collective Enterprises	
Industry (ISIC Code)	TFP 1	TFP 2	TFP 3	TFP 1	TFP 2
Food (311)	67,2%	69,1%	98,1%	41,8%	41,8%
Beverage (313)	61,6%	61,9%	90,9%	60,9%	62,6%
Tobacco (314)	-29,9%	-1,4%	27,6%	-11,2%	-6,8%
Textiles (321)	61,6%	67,4%	96,4%	-4,2%	-0,9%
Apparel & Footwear (322, 324)	78,4%	87,6%	116,6%	60,5%	63,0%
Leather (323)	84,2%	95,8%	124,8%	68,6%	71,6%
Wood (331)	79,3%	91,2%	120,2%	0,4%	3,7%
Furniture (332)	79,4%	99,2%	128,2%	3,2%	6,5%
Paper (341)	45,4%	45,5%	74,5%	-13,5%	-8,1%
Printing (342)	54,6%	55,7%	84,7%	-10,8%	-9,1%
Chemicals (351, 352)	45,8%	46,7%	75,7%	8,0%	8,0%
Petroleum (353, 354)	-47,2%	-12,1%	16,9%	-137,0%	-70,9%
Rubber (355)	42,3%	42,3%	71,3%	21,2%	21,7%
Plastic (356)	64,9%	73,4%	102,4%	27,0%	27,1%
Pottery and Glass (361, 362, 369)	49,7%	50,3%	79,3%	-99,4%	-65,1%
Iron & Steel (371)	-4,4%	17,9%	46,9%	-74,1%	-33,3%
Non-ferrous Metals (372)	56,8%	57,3%	86,3%	-19,3%	-15,3%
Fabricated Metal Products (381)	68,6%	70,7%	99,7%	-4,8%	2,7%
Machinery, except electrical (382)	42,8%	43,6%	72,6%	-65,6%	-27,2%
Machinery, electrical (383)	79,3%	80,7%	109,7%	71,7%	73,1%
Transport (384)	69,1%	73,6%	102,6%	47,9%	48,1%
Prof. & Sc. Equipment (385)	86,0%	98,0%	127,0%	73,6%	76,2%
Other (390)	74,3%	87,5%	116,5%	41,9%	42,2%

Note:
Source: Author's calculation
TFP 1: Not correcting for differences in w/r
TFP 2: Correcting for differences in w/r
TFP 3: Considering a pre-liberalization subsidy for SOEs of 2.6% of GDP

Table 4

				State-owned Enterprises				Collectivelly-owned Enterprises				Foreign-owned Enterprises			
Industry (ISIC Code)	σ	τ 0	τ 1	L	θ L	λ L * σ / θ K	wages per L*	L	θ L	λ L * σ / θ K	wages per L	L	θ L	λ L * σ / θ K	wages per L
Food (311)	0,76	34%	20%	232	28%	0,025	568	226	14%	0,020	1019	44	8%	0,004	883
Beverage (313)	0,86	59%	15%	80	16%	0,008	581	104	24%	0,012	955	20	8%	0,002	904
Tobacco (314)	2,12	64%	36%	28	4%	0,006	1397	5	0%	0,001	6249	1	20%	0,000	2173
Textiles (321)	0,93	27%	11%	436	59%	0,102	560	579	21%	0,070	761	112	25%	0,014	871
Apparel & Footwear (322, 324)	0,70	32%	16%	34	57%	0,006	600	348	36%	0,039	588	68	16%	0,006	932
Leather (323)	0,86	14%	12%	20	44%	0,003	568	185	33%	0,024	594	36	12%	0,004	883
Wood (331)	0,58	14%	6%	33	69%	0,006	549	100	11%	0,007	364	19	26%	0,002	853
Furniture (332)	0,71	23%	6%	9	83%	0,004	650	63	19%	0,006	449	12	30%	0,001	1011
Paper (341)	0,81	14%	5%	86	35%	0,011	586	154	22%	0,016	794	30	27%	0,003	911
Printing (342)	0,80	9%	5%	54	48%	0,009	771	87	17%	0,009	689	17	29%	0,002	1198
Chemicals (351, 352)	0,68	13%	7%	364	28%	0,035	733	439	21%	0,039	1204	85	15%	0,007	1140
Petroleum (353, 354)	0,80	9%	8%	58	12%	0,005	1275	29	9%	0,003	2434	6	54%	0,001	1983
Rubber (355)	0,74	19%	10%	31	26%	0,003	689	98	28%	0,010	731	19	26%	0,002	1072
Plastic (356)	1,08	17%	8%	31	51%	0,007	625	196	22%	0,028	590	38	18%	0,005	972
Pottery and Glass (361, 362, 369)	0,92	21%	16%	406	65%	0,111	605	573	22%	0,069	875	111	41%	0,018	940
Iron & Steel (371)	0,66	11%	6%	234	27%	0,022	1072	197	33%	0,020	1770	38	72%	0,009	1667
Non-ferrous Metals (372)	0,59	8%	5%	89	42%	0,009	939	56	15%	0,004	1828	11	23%	0,001	1459
Fabricated Metal Products (381)	0,83	15%	10%	72	63%	0,016	702	311	18%	0,032	566	60	33%	0,008	1092
Machinery, except electrical (382)	0,96	15%	6%	447	51%	0,089	695	596	23%	0,077	972	116	50%	0,023	1081
Machinery, electrical (383)	0,63	15%	7%	173	30%	0,016	773	478	28%	0,043	944	93	10%	0,007	1202
Transport (384)	0,94	21%	10%	272	45%	0,047	914	247	23%	0,031	1415	48	17%	0,006	1421
Prof. & Sc. Equipment (385)	0,66	16%	11%	45	58%	0,007	705	76	38%	0,008	919	15	16%	0,001	1097
Other (390)	0,91	22%	13%	31	61%	0,007	643	281	30%	0,038	571	55	20%	0,006	1000
λ s				34%											
λ c								56%							
λ f												11%			
Σ λ L * σ / θ K						0,557				0,606				0,131	
Note:															
Source: China's Statistical Yearbook 1997 and 1999 issues, and author's calculations															
* in US dollars															