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FDI Liberalization as a Source of Comparative Advantage in China

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Abstract

Three features of China's trade patterns suggest that elements beyond factor abundance explain its export performance. The high penetration in world markets of labour-intensive products has been accompanied by: (i) a high share in exports of productivity-advanced foreign-owned enterprises (FIEs), (ii) a high penetration of FIEs in labour-intensive sectors, and (iii) a relative high sophistication of China's exports. We show that FDI liberalization endogenously introduces Ricardian features to an otherwise standard endowment-based trade model, strengthening China's natural comparative advantage in labour-intensive products. We discuss how capital accumulation, productivity growth, rural-urban migration, incentives for foreign investment and distortions in financial markets affect this bias. We conclude that policies enhancing domestic firms' production, through productivity growth or capital market distortions, implicitly support the capital-intensive sector. In contrast, policies that encourage FDI, like greater access to China's capital and labour market would shift China's comparative advantage even further towards labour-intensive products.

Keywords: comparative advantage, FDI liberalization, labour markets, China

JEL classification: F11, F15, F16

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Acronyms

CRS constant return to scale

FDI foreign direct investment

FIEs foreign-owned enterprises

NBS National Bureau of Statistics (China)

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1 Introduction

Among the many dimensions of China's economic transformation in the last thirty years, the growing penetration of its exports into world markets is one of the most salient features. China's exports have grown at a rate almost twice the growth of exports of the rest of the world, and the export pattern is strongly biased towards labour-intensive products. This roughly corresponds to what traditional endowment-based trade theories predict: trade liberalization increases exports of those goods that use the abundant factor intensively; labour, in the case of China.

However, three features of China's trade performance suggest that elements beyond labour-abundance are behind its export patterns. First, a growing share of China's exports is by foreign-invested enterprises (FIEs). For example, in 1993 FIEs represented less than 30 per cent of total exports, and in 2004 they represented almost 60 per cent of total exports. Second, export growth in labour-intensive goods coincides with the arrival of high-productivity foreign-invested enterprises (FIEs) to labour-intensive sectors, displacing domestic firms towards capital-intensive sectors. Finally, China's exports are more sophisticated than those of countries with similar endowments/income. In particular, the higher sophistication is evident in a wider range of products exported (Schott 2007) and a higher share of exports of products also exported by high-income economies (Rodrik 2006). All these elements suggest that the liberalization of foreign direct investment (FDI) and the arrival of into labour-intensive sectors productivity-advanced foreign-invested enterprises has played a significant role in shaping China's export performance.

Several studies have analysed the role of FDI inflows on China's output and export growth.[1] The evidence shows that foreign investment is positively correlated with export and GDP growth. This paper focuses on a different dimension of FDI liberalization. We study whether foreign investment has affected China's natural comparative advantage in labour-intensive products. For that, we compare China's trade structure with the one the country would have if it were FDI isolated. This artificial counterfactual is useful to distinguish conditions under which FDI liberalization enhances the export patterns predicted by a pure endowment-based model, or whether FDI integration ameliorates or even reverses the trade structure consistent with factor endowment differences. Conceptually, the access of productivity-advanced foreign firms endogenously introduces Ricardian features in the determination of comparative advantage. The bias and relevance of the Ricardian components depend upon the size and sectoral distribution of FDI inflows.

We develop a simple model of FDI in the context of a traditional endowment-based trade theory. Foreign firms have a productivity advantage relative to domestic firms, so FDI liberalization encourages foreign-investment inflows into the low-wage economy. A fixed cost of foreign investment sets a minimum scale that foreign firms can attain for FDI to take place.[2] If foreign firms have access to all domestic factor markets, a trivial solution exists with all productivity-backward domestic firms disappearing. Motivated by China's capital market restrictions, we assume that the government keeps the

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1 See, for example, Chen, Chang and Zhang (1995); Lemoine (2000); Liu, Wang and Wei (2001); Sun and Parikh (2001) and Whalley and Xin (2006).

2 See Rosen (1999) and Huang (2003) for evidence regarding costs of foreign investment.

domestic capital market segmented from foreign firms' competition, so that a low domestic return to capital keeps domestic firms competitive only in capital-intensive sectors. Unless the fixed costs of foreign investment are significantly lower in capital-intensive sectors, FDI takes place in labour-intensive sectors, and the fall in the rental/wage ratio shifts domestic production towards the capital-intensive products. The final effect on trade patterns depends upon how large foreign firms' penetration is.[3] The conditions for net exports of labour-intensive products to expand after FDI liberalization are likely to hold for China according to the parameters of the model, meaning that China's penetration in world markets of labour-intensive products is higher than the level predicted by its factor abundance.

We use this framework to analyse how domestic policies are affected by bias. In particular, we study the impact of changes in the restrictions for foreign investment, of rural-urban migration, of domestic capital accumulation and domestic firms' productivity growth. We show that policies that encourage FDI—like lowering restrictions for FDI or removing migration barriers to urban zones where foreign firms are located—put higher pressures on domestic wages, shrinking even more the domestic capital-intensive sector and enhancing net exports of labour-intensive products. The opposite effect follows from policies that enhance domestic firms' production—like productivity growth—as they lower the scale attainable by foreign producers, lowering net exports of labour-intensive products. Finally, we show that capital market liberalization eliminates the support for unproductive domestic firms in capital-intensive sectors, as they cannot pay the international cost of capital and the wage rate that productivity-advanced foreign firms pay. In consequence, the economy specializes in the labour-intensive product, and the bias in the export pattern towards the labour-intensive goods is even stronger.

The rest of the paper is structured as follows. Next section presents some evidence on China's production and trade patterns to motivate the discussion. Section 3 presents the model. It first discusses the pre-FDI equilibrium, and in the second part it analyses the effects of foreign-investment flows. Section 4 analyses the trade implications of FDI liberalization, and section 5 concludes.

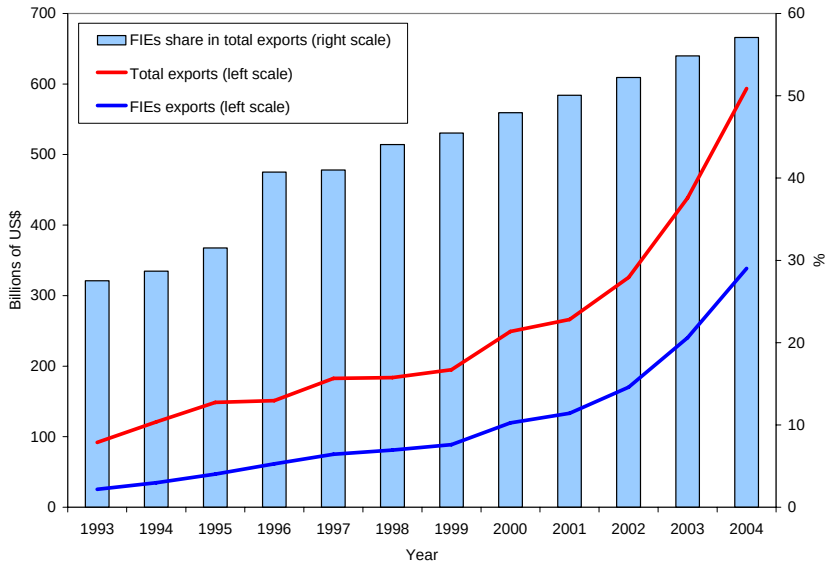
2 Some empirical evidence

In this section we report some evidence on China's export and FDI patterns. Many papers have documented China's trade patterns and the sectoral composition of foreign investment (see Lemoine 2000; Huang 2003 among others), so we focus on some simple features to motivate the hypothesis that FDI liberalization has contributed to enhance China's comparative advantage in labour-intensive products.

Figure 1 plots total exports in China between 1993 and 2004, and the share of foreign-invested enterprises in exports. Total exports have grown from about 100 billion dollars to more than 600 billion in 10 years, which represents an annual growth rate of 21

[3] In a different context, Romalis (2007) analyses how lower taxes on capital in Ireland have encouraged FDI inflows into capital-intensive sectors, shifting Ireland's exports towards high-technology products beyond its natural comparative advantage.

Figure 1
China's exports and FIEs' contribution, 1993-2004
Aggregate data

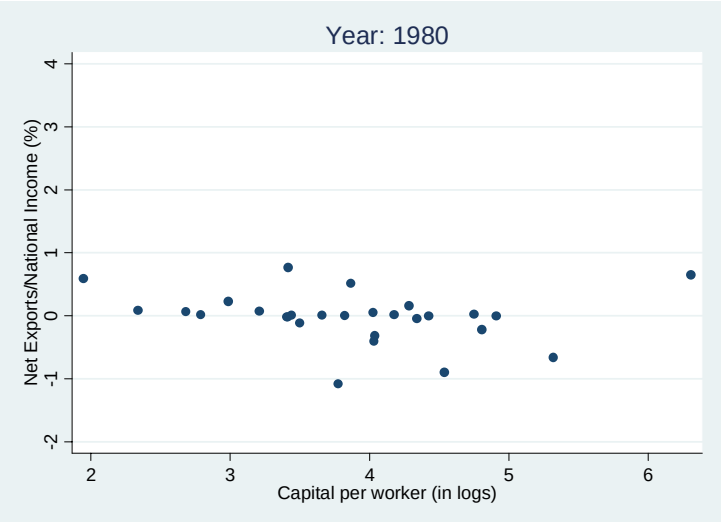


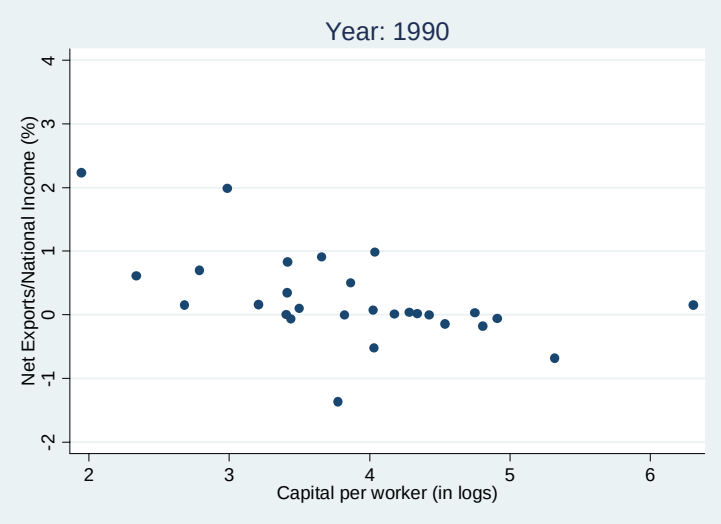
Source: National Bureau of Statistics (NBS) (various issues).

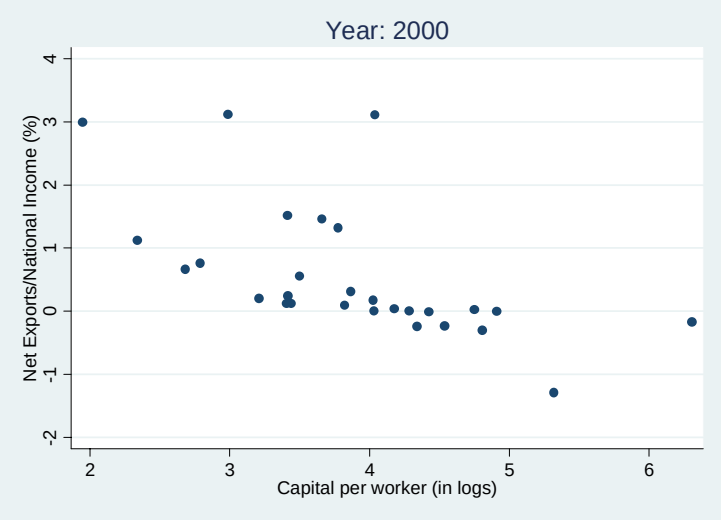
per cent, more than twice the growth in GDP. In the same period, total exports by FIEs have grown from US$25 to US$340 billion, which represents an annual rate of growth of 30 per cent. As a consequence, FIEs' share in total exports increased from 28 per cent in 1993 to 57 per cent in 2004, contributing to almost 63 per cent of total export growth. These figures underestimate the share of FIEs in manufacturing exports, which in 1995 represented 51.2 per cent of total manufacturing exports. Unfortunately, sectoral data on FIEs' exports are not available after 1995.

Figure 2 shows the composition of manufacturing exports across industries with different factor intensity. The figures plot industry-level net exports as a share of national income (for 28 3-digit ISIC level manufacturing industries) against capital per worker (in logs) in 1980, 1990 and 2000, obtained from Nicita and Olarreaga (2006). Capital per worker for the United States in 1994 is constructed using the perpetual inventory method, but these results are very similar if we use other measures of sector-specific factor intensity. In 1980, at the beginning of the reform period, there is no bias in China's trade structure. By 1990, China's has already become a net exporter of labour-intensive products, and this bias strengthens throughout the 1990s. By the year 2000, China has consolidated as a net exporter of labour-intensive goods. Figure 3 plots the year-specific coefficient (and 95 per cent confidence interval) of a panel regression where the dependent variable is net exports in industry i in year t as a share of national income in year t and the independent variables are capital per worker in industry i and year dummies. There is no systematic relationship between China's trade structure and capital intensity until the end of the 1980s, when a negative and significant correlation between net exports and capital intensity appears. This trend is consolidated during the 1990s.

Figure 2
Net trade and capital intensity in China
3-digit manufacturing industries

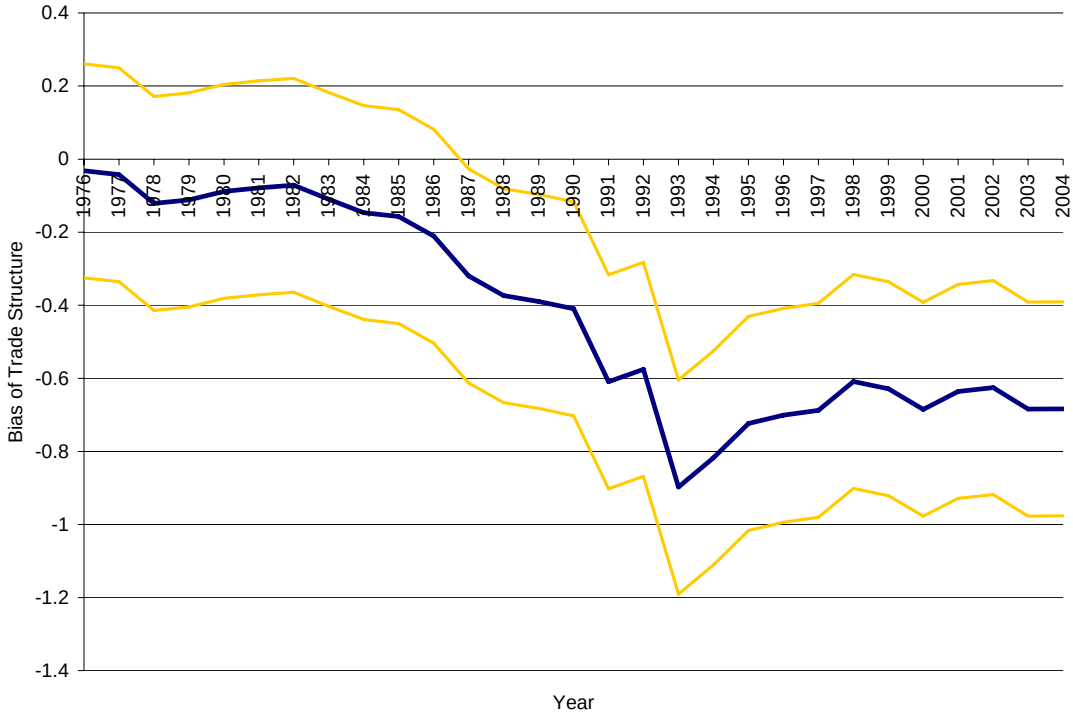






Source: Nicita and Olarreaga (2006).

Figure 3
Bias of China's trade structure,1976-2004



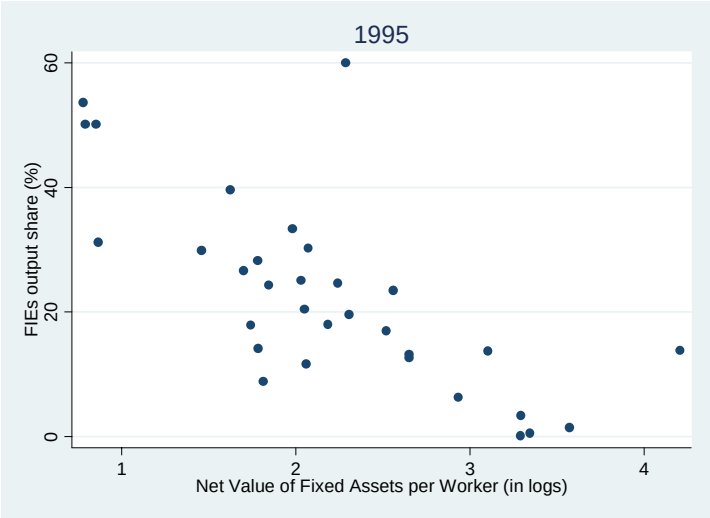
Notes: Bias of trade is the year-specific coefficient of d log NX_{it}/d log k_i;
Point estimate and 95% confidence interval.
Regressions include time fixed-effects.

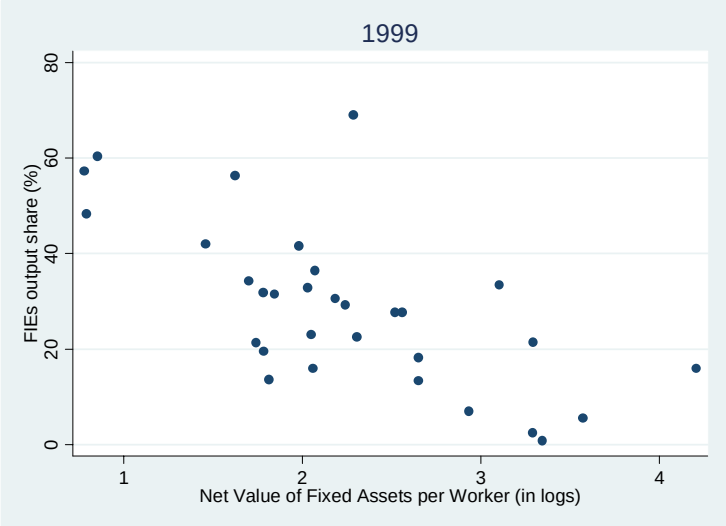
Although these patterns are consistent with China's labour abundance, they coincide with the strong penetration of foreign enterprises in the 1990s, especially in labour-intensive sectors. Figure 4 plots the share of foreign-invested enterprises in sectoral output for 1995, 1999 and 2003. (Unfortunately, sector-specific data on FIEs' output are not available before 1994, so we focus on the period 1995-2003.) The data are from National Bureau of Statistics (NBS) *China's Statistical Yearbook*, which reports output data for different ownership categories for 28 manufacturing sectors that roughly correspond to 3-digit ISIC manufacturing sectors. We use data on aggregate net value of foreign assets per worker in 2003 as the measure of capital intensity, but the results are almost identical if we use alternative measures of factor intensity. There is a strong negative correlation between FIEs' sectoral output share and capital intensity: FIEs' penetration is significantly higher in labour-intensive industries, and this bias is relatively constant over the period.[4] This suggests that the share of FIEs in sectoral exports is higher in labour-intensive sectors, which is the case in 1995 (see Figure 5), the last year for which data are available.

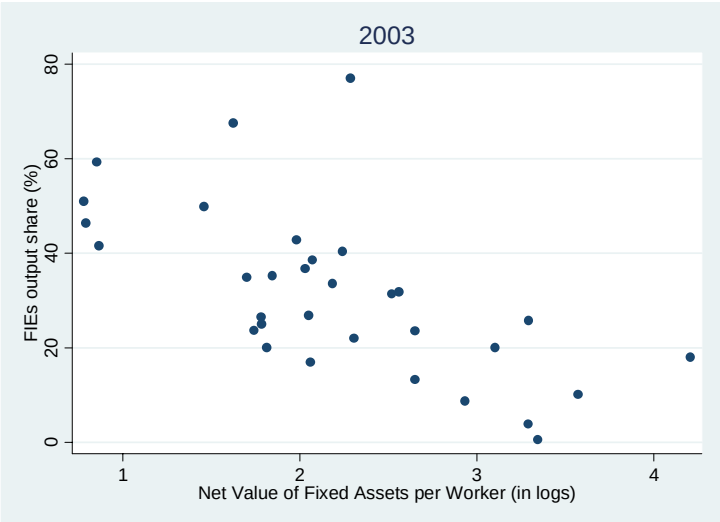
Recently, some authors have shown that China's exports are sophisticated relative to its level of development. For example, Schott (2007) notes that China exports a number of varieties to the United States that are much higher than those predicted by its factor endowment. Rodrik (2006) shows that China has an export basket more similar to that

4 See Claro (2006, 2007) for further evidence on this.

Figure 4
Foreign-invested enterprises share in sector-specific output in China
3-digit Manufacturing industries

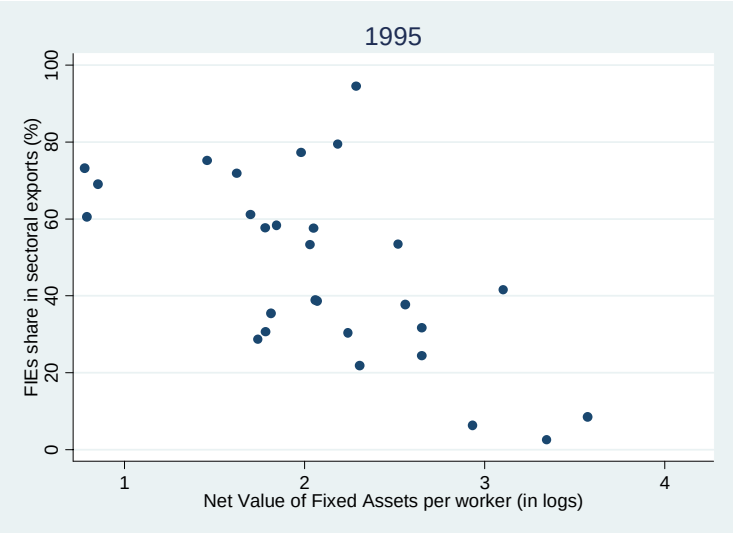






Source: NBS (various issues).

Figure 5
Share of foreign-invested enterprises in sector-specific exports in China
3-digit manufacturing industries



Source: NBS (1996) and Office of Third Industrial Census (1997).

of high-income countries. Together with the dominant role of high-productivity foreign enterprises in China's exports, this evidence suggests that FDI liberalization has not been neutral in shaping the country's trade patterns. The objective of the paper is to explore whether FDI liberalization has been a source of comparative advantage in labour-intensive products in China.

The next section presents a simple model of foreign investment. Within a traditional general-equilibrium endowment-based trade model, we analyse the effect of FDI liberalization on output and trade patterns. The model has two objectives. First, it sets a framework to understand why FDI liberalization in a country like China leads to the arrival of FIEs in labour-intensive sectors, the displacement of domestic firms towards capital-intensive sectors, and the high share of foreign firms in labour-intensive exports. Second, the model naturally yields a counterfactual to compare the actual trade structure with the one predicted solely by endowment differences. In other words, we analyse the impact of FDI liberalization on China's trade structure by comparing China's actual trade structure with the one it would have if it were completely integrated to world product markets but completely isolated from FDI flows.

3 The model

3.1 Segmented factor markets

Consider a small economy that faces international prices for the only two goods in this world: x and z. Both goods are produced with constant-return-to-scale (CRS) production functions and two factors: labour L and capital K, which are internationally immobile. Sector x is capital-intensive, and relative factor endowment $\bar{k} = \bar{K} / \bar{L}$ is such that both goods are produced. The zero-profit conditions for domestic producers in each industry are:

$$1 = a_{Lx} \cdot w + a_{Kx} \cdot r \quad \text{and} \quad p^* = a_{Lz} \cdot w + a_{Kz} \cdot r \tag{1}$$

All prices are expressed in units of good x: p^* is the international relative price of good z, and w and r refer to the real domestic return per unit of labour and capital respectively. $a_{Fi} = a_{Fi}(w/r)$ represent the requirements of factor $F = L, K$ per unit of output $i = x, z$, which depend on technology parameters and relative factor prices. Both zero-profit conditions jointly determine domestic factor prices and factor intensities. Production levels of x and z follow from imposing factor market clearing conditions given equilibrium factor usage.[5]

Consider that the domestic country is productivity-backward with respect to the rest of the world, which is represented by a foreign country that produces both x and z, and where international product prices are set. Productivity differences are represented by the part of cross-country differences in average factor productivity that cannot be explained by differences in relative factor prices. Analytically, international differences in average factor productivity are expressed as:

$$\frac{a_{Li}}{a_{Li}^*} = (1+\delta) \cdot l_i(\omega) \quad \text{and} \quad \frac{a_{Ki}}{a_{Ki}^*} = (1+\delta) \cdot k_i(\omega) \tag{2}$$

where $\delta \geq 0$ is the Hicks-neutral productivity gap between the domestic and foreign countries (common across sectors), and $l_i(\omega)$ and $k_i(\omega)$ measure the effect on average factor productivity of relative factor price ratio $\omega = (w/r)/(w^*/r^*)$, with $l_i(1) = k_i(1) = 1$ and $\partial l_i(\omega)/\partial\omega < 0$ and $\partial k_i(\omega)/\partial\omega > 0$.[6] We assume there are international productivity differences in order to provide a rationale for wage-driven foreign investment, which is arguably relevant for the case of China. We also assume that productivity differences are Hicks-neutral so that in the base scenario—full trade integration but FDI isolation—trade patterns are solely determined by factor endowment differences. Therefore, we can compare trade patterns under FDI integration with those implied by factor-endowment differences.

In equilibrium, because productivity differences are similar across industries, $\omega = 1$ and international factor price differences are given by:

$$\frac{w_a}{w^*} = \frac{r_a}{r^*} = \frac{1}{1+\delta} < 1, \tag{3}$$

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5 The two equations in (1) determine w and r. Both goods are produced in equilibrium as long as $k_x(w/r) > \bar{k} > k_z(w/r)$ where $k_i(w/r) = a_{Ki}/a_{Li}$.

6 Along an isoquant of a constant-return-to-scale production function, $\hat{a}_{Li} = -\theta_{Ki}\sigma_i(\hat{w} - \hat{r})$ and $\hat{a}_{Ki} = \theta_{Li}\sigma_i(\hat{w} - \hat{r})$ where $\hat{x} = dx/x$, σ_i is the elasticity of substitution between labour and capital, and θ_{Fi} is the share of factor F in total output in sector i. It follows that $a_{Li} = (1+\delta) \cdot a_{Li}^* \cdot [1 - \theta_{Ki}\sigma_i(\omega - 1)]$ and $a_{Ki} = (1+\delta) \cdot a_{Ki}^* \cdot [1 + \theta_{Li}\sigma_i(\omega - 1)]$. These expressions define $l_i(\omega)$ and $k_i(\omega)$.

where subscript a denotes autarky (pre FDI liberalization) levels.[7] Assuming identical and homothetic preferences across countries, the trade pattern is identical to the one predicted by the traditional two-sector Heckscher-Ohlin model. A capital-abundant country exports the capital-intensive good while the opposite happens in a labour-abundant country. Finally, income per capita differences are given by:

$$\frac{y_a}{y^*} = \frac{1}{1+\delta} \cdot \frac{(w^* + r^* \bar{k})}{(w^* + r^* \bar{k}^*)} \tag{4}$$

3.2 Capital and technology flows

Factor price differences encourage foreign firms to move capital and technology to the low-wage domestic economy in order to enjoy low labour costs. In particular, we consider that each unit of foreign capital is embedded with foreign advanced technology. Despite the fact that the domestic return to capital is lower than the foreign return r^*, foreign units of capital in the domestic economy can obtain a capital return higher than r^* by employing low-wage domestic labour. We assume that foreign production units only have access to the domestic labour market, while domestic capital cannot be combined with foreign advanced technology. If technology-advanced foreign firms had access to all domestic factor markets, there would be no room for productivity-backward domestic firms. To rule out this case and to allow for positive production of productivity-backward domestic units, we assume that some factors, capital in this case, remain segmented from international competition.[8] The evidence of preferential access to credit by domestic firms in China—especially state-owned—suggests that this is a reasonable assumption. Consequently, the return to domestic capital is endogenously determined.

The attractiveness of low domestic wages for technology-advanced foreign capital is however compensated with a firm- and sector-specific fixed (but not sunk) cost F_i—expressed in units of good x—of foreign production. Notice that the fixed cost is not faced by foreign producers in their home economy. Decreasing average cost of foreign firms' domestic production means that foreign capital will flow to the domestic country in sectors x and/or z as long as

$$1 \geq a^*_{Lx} w + a^*_{Kx} r^* + \frac{F_x}{q^*_x} \tag{5}$$

and

$$p^* \geq a^*_{Lz} w + a^*_{Kz} r^* + \frac{F_z}{q^*_z} \tag{5'}$$

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7 The assumption that cross-country factor endowment differences are not too large rules out the possibility that wage differences are affected by differences in labour abundance. However, all the results of the paper hold if international factor price differences arise from factor-endowment as well as technological differences.

8 It is important to highlight that capital is meant to represent those factors whose markers remain segmented from foreign firms' access.

where w is the post-integration real domestic wage rate and $q_i^* = K_i^* / a_{Ki}^* = L_i^* / a_{Li}^*$ is the output level of the foreign producer in industry i in the host country, with K_i^* being the amount of foreign capital in industry i and L_i^* being foreign firms' employment in industry i. We assume that the foreign economy is large enough so that capital outflows imbedded in FDI flows do not affect factor prices in the source country.

Foreign firms' minimum labour requirement

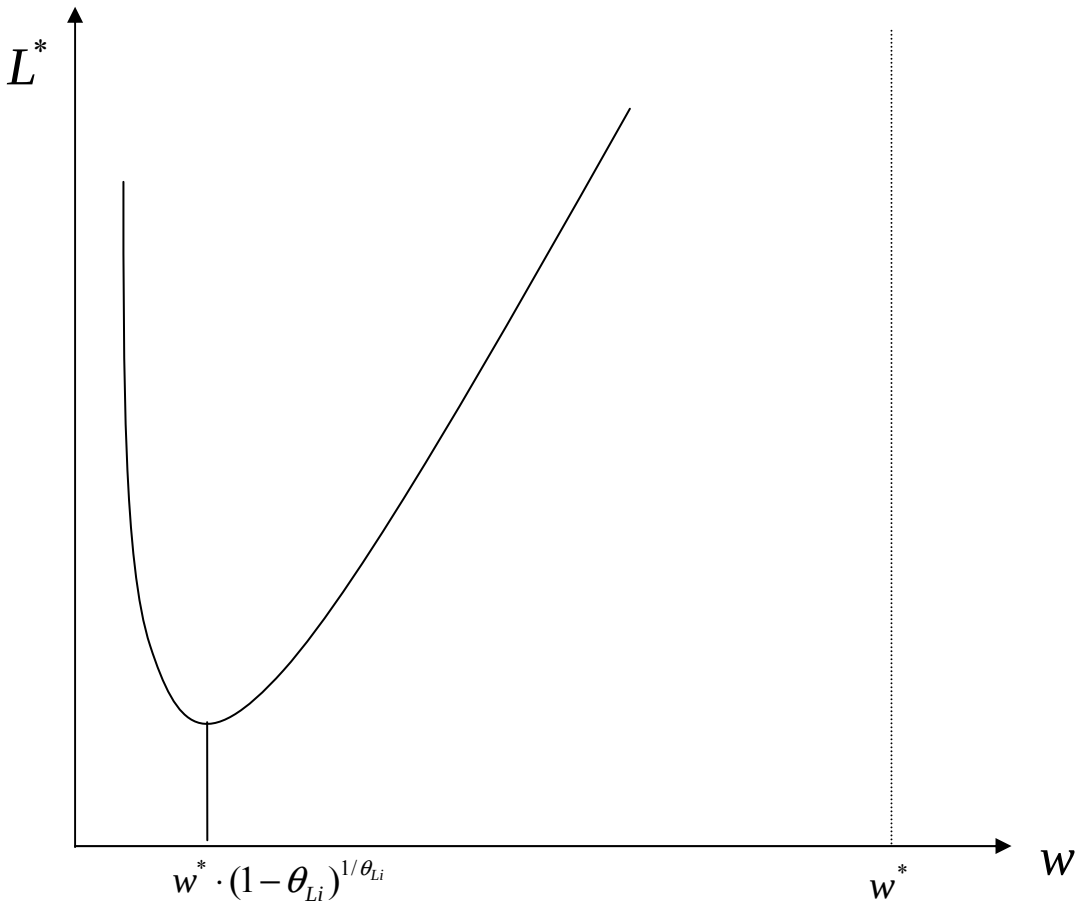
In equilibrium, the marginal unit of foreign capital must be indifferent between producing in its home country and moving to the low-wage country, meaning that (5) and/or (5′) determine the minimum scale of production of a foreign producer in industry i consistent with zero profits. In each industry, this relationship is expressed as $L_i^* = f_i(w)$, which defines the minimum level of employment of a foreign firm L_i^*—and hence production—that is compatible with the zero profit condition for any w. Analytically, $f_i(w)$ is derived imposing equality in (5) and (5'). To obtain a closed-form solution we consider the following Cobb-Douglas production functions in both sectors: $x = AL^{1-\alpha}K^{\alpha}$ and $z = AL^{1-\beta}K^{\beta}$ where $\alpha > \beta$. The total-factor-productivity coefficient in the foreign country is equal to $A^* = (1+\delta)A$ with $\delta \geq 0$. Solving for a_{Fi}^* we obtain the following expression for $f_i(w)$:

$$L_i^* = \frac{\theta_{Li} \cdot F_i}{w^{1-\theta_{Li}} \cdot (w^{*\theta_{Li}} - w^{\theta_{Li}})}. \tag{6}$$

where θ_{Li} is the labour share in industry i, i.e., $(1-\alpha)$ in industry x and $(1-\beta)$ in industry z. The function $f_i(w)$ is U-shaped, with $\partial f_i(w)/\partial w = 0$ for $w = w^* \cdot (1-\theta_{Li})^{1/\theta_{Li}}$. Intuitively, a low domestic wage rate w induces foreign producers to choose a very labour-intensive production technique in the host economy, meaning that the labour requirement consistent with zero profits is very high. Indeed, $\lim_{w\to 0} L_i^* = \infty$. As domestic wages increase, the evolution of foreign producers' labour requirements depends upon two competing forces: while production shifts towards a more capital-intensive technique, labour requirements decline but a higher wage rate shrinks the cost advantage of foreign producers, increasing the scale of production required to compensate F_i. Finally, as w approaches w^*, $L_i^* \to \infty$ as the fixed cost eliminates the possibility of foreign investment. Figure 6 depicts $f_i(w)$, which depends upon two variables. First, labour requirements are higher in the industry with highest fixed cost, as F_i raises the production scale consistent with zero profits. Second, labour requirements are lower in labour-intensive industries (high θ_{Li}^*). In the upward sloping segment of $f_i(w)$—that, as discussed below, is the relevant segment- foreign firms in labour-intensive industries benefit more from low wages, and hence they are able to offer higher labour payments at the same level of employment. Therefore, if $F_z = F_x$ then $f_z(w) < f_x(w)$.

Figure 6
Foreign firms' minimum labour requirement

$$L_i^* = f_i(w; F_i, \theta_{Li})$$



Because the fixed cost is firm specific, if FDI takes place in equilibrium, all foreign investment flows are concentrated in one production unit (firm), meaning that flows of technology-advanced foreign capital are subject to a common fixed cost. The presence of a firm-specific fixed cost implies that wage pressures are the greatest if only one firm brings foreign capital to the domestic economy. This firm belongs to the sector that is able to bid up domestic wages, i.e., the industry with the lowest fixed cost or the labour-intensive industry. This implication is the natural result of the homogeneous-good CRS framework, but we believe it does not weaken the model as long as we focus on the bias of FDI across sectors rather than the dispersion and concentration of FDI within sectors.

Also, w never reaches w^* (because $F_i > 0$) and the wage-rental ratio faced by the foreign producer in the domestic country is lower than in the home country, meaning that the FDI firm chooses a more labour-intensive production technique than firms in the same industry in the foreign country.[9] Finally, as F_i approaches zero, there is no minimum scale requirement for foreign producers, so $f_i(w)$ is vertical at $w = w^*$, which means that

9 See Lipsey, Kravis and Roldan (1982), and Kravis and Lipsey (1988) for empirical evidence. See also Lipsey (2002) for a survey.

FDI inflows generate international factor price equalization. Conversely, if the domestic labour supply is infinitely elastic (Findlay 1978), $f_i(w)$ is horizontal at the level of foreign firms' domestic employment consistent with zero profits.[10]

Residual domestic labour supply

The second equilibrium relationship follows from identifying the residual domestic labour supply available for foreign production. We assume that the domestic capital market remains segmented, which means that equilibrium in the domestic capital market determines the level of domestic firms' employment—as a function of the domestic wage rate—consistent with optimal factor usage of domestic producers. The residual labour supply available for foreign producers is the difference between total labour supply (that is assumed totally inelastic) and domestic firms' employment. In other words, the size of foreign investment and employment is limited by the level of domestic employment consistent with equilibrium in the domestic capital market, which depends upon the domestic wage rate. There are two different scenarios: $w > w_a$ or $w = w_a$. It is not possible that $w < w_a$ because domestic workers can always receive the autarky wage rate.

Consider first that $w > w_a$. If the post FDI equilibrium wage rate is higher than the pre-liberalization level, the labour-intensive domestic industry is rendered uncompetitive. The return to domestic capital r falls below r_a, and all domestic capital shifts towards the capital-intensive industry. For each wage level there is a unique level of employment of domestic producers that assures domestic capital market clearing. The domestic factor requirement in industry x is:

$$\frac{a_{Kx}}{a_{Lx}} = \frac{\overline{K}}{\overline{L} - L^*} \tag{7}$$

where $\overline{K}$ and $\overline{L}$ represent the domestic capital and labour endowments, and L^* is domestic employment by foreign producers. Expression (7) defines an upward-sloping relationship between foreign firms' employment and the domestic wage rate $L^* = h(w)$, with $h'(w) > 0$. Intuitively, a higher domestic wage rate shifts production of domestic firms in industry x towards a more capital-intensive technique, releasing more labour for foreign producers. Recall that the domestic capital return is endogenously determined, which means that a higher domestic wage rate leads to a lower capital return and a lower rental/wage ratio. For the Cobb-Douglas specification described above, $h(w)$ is given by

$$h(w) = \overline{L} \cdot \left(1 - \overline{k} \left(\frac{A^*(1-\alpha)}{(1+\delta)w} \right)^{1/\alpha} \right) \tag{8}$$

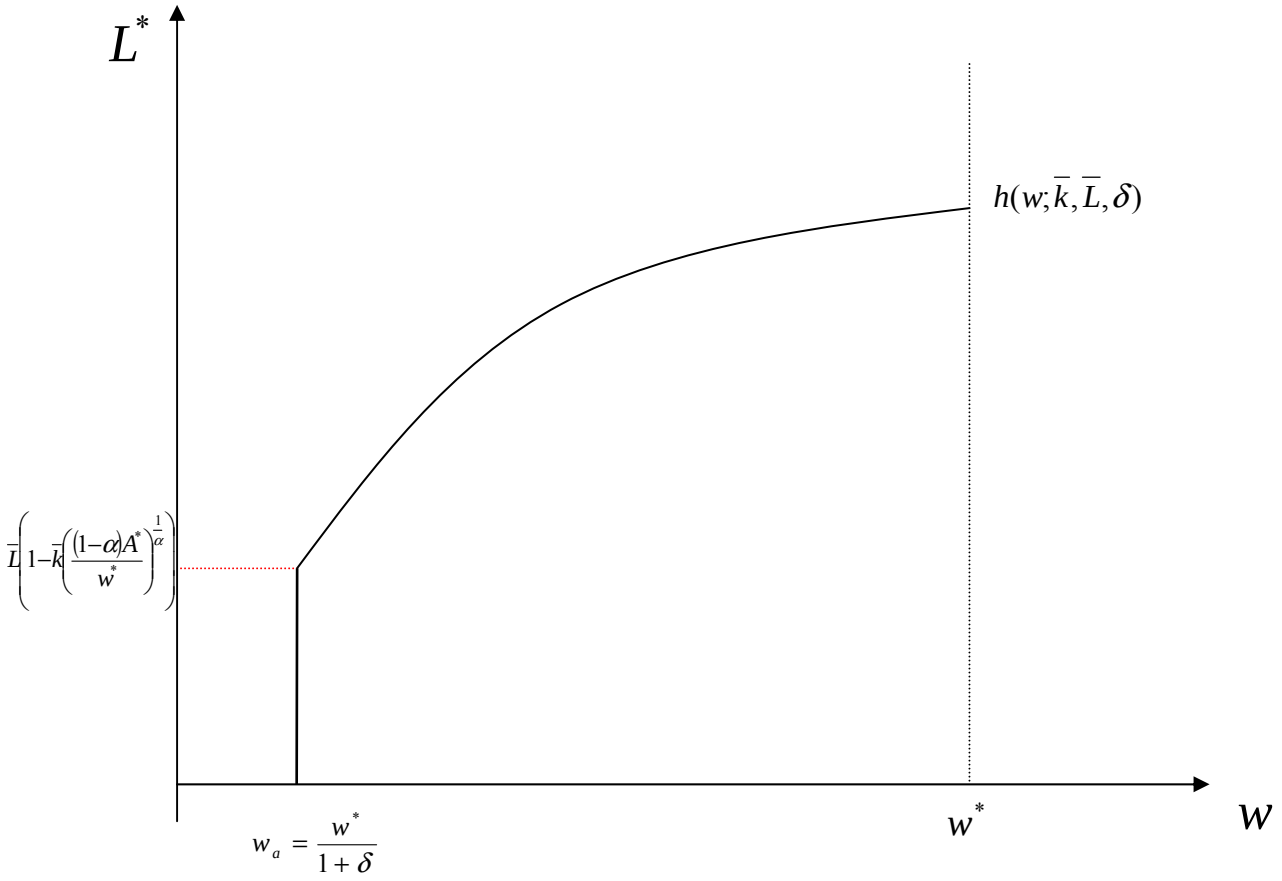
---

10 If the domestic labour supply is totally elastic at $w = \overline{w}$, there is a unique level of foreign firms' production and employment consistent with the zero-profit condition

with $h'(w) > 0$ and $h''(w) < 0$. A higher domestic wage rate, and hence a higher w/r, encourages the use of capital in domestic firms in sector x. Given $\overline{K}$, employment of domestic firms falls and hence domestic labour available for foreign producers increases. The second derivative reveals that the rate at which employment is released from domestic firms in sector x decreases as w rises.

For $w = w_a$, domestic production is viable in both sectors. Capital market clearing is consistent with different employment levels by domestic producers as in the traditional Rybczynski parallelogram. Therefore, employment available for foreign firms is bounded between zero (pre-FDI liberalization equilibrium) and the employment level consistent with specialization in the capital-intensive good x, which is $h(w_a)$. Figure 7 depicts $h(w)$. The amount of labour available for foreign producers at any level of w increases with $\overline{L}$ and it decreases with relative capital-abundance $\overline{k}$. The intuition in both cases is the same: The larger or the more labour-abundant the domestic country is, the higher the residual level of employment consistent with capital market equilibrium at any w. Also, $h(w)$ increases with δ. For any w, the greater the δ the lower the domestic return to capital faced by domestic producers, which implies a higher wage-rental ratio and a more capital-intensive production technique of domestic producers in the capital-intensive industry. Consequently, more labour is available for foreign production.

Figure 7
Residual domestic labour supply for foreign firms consistent with domestic capital market equilibrium



Equilibrium

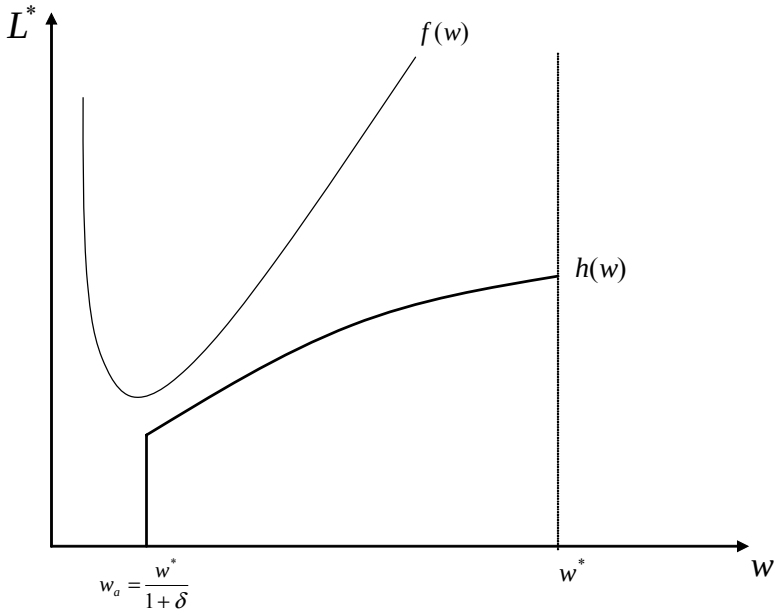
An equilibrium with FDI is reached when the residual labour supply is equal to the minimum labour requirement of foreign producers. There are two possible solutions, depending on whether the conditions for positive FDI are satisfied or not. Consider first that $h(w)$ and $f(w)$ do not intersect each other, as in panel (A) in Figure 8. In such case, there is no equilibrium with FDI and the domestic wage rate is w_a. Conceptually, the foreign producer cannot attain the scale that compensates for the fixed cost of production. At any wage rate, the minimum employment level that a foreign producer requires to compensate the fixed cost is higher than the residual labour supply consistent with domestic capital market clearing condition. The likelihood of this equilibrium is higher (i) if the fixed cost of foreign investment is high enough, (ii) if the domestic economy is small and/or too capital abundant (low $\bar{L}$ and high $\bar{k}$), and (iii) if the technology disadvantage of the domestic country is small (low δ). The lack of FDI inflows into China before 1990 can be either the result of a prohibition for foreign investment or a high-enough fixed cost for foreign enterprises to install production facilities in China.

Otherwise, when $h(w)$ and $f(w)$ intersect each other, there are three possible equilibriums. The autarky equilibrium is still valid, as the return to capital in foreign firms is r^*, which is equal to the capital return in the source economy. There are two additional equilibriums with FDI: a low-wage low-FDI and high-wage high-FDI equilibrium. In the high-wage equilibrium—labelled B in panel (B)—the domestic economy specializes completely in the production of the capital-intensive good, i.e., all domestic capital is employed in sector x, in response to the rise in w/r. The low-wage low-FDI equilibrium, labelled A, might or might not have a wage rate higher than the pre-liberalization level. As depicted in panel (B), the wage rate increases and there is full domestic specialization in the capital-intensive good. The scale of foreign firm's production is relatively small. In panel (C), FDI takes place in equilibrium without an increase in the domestic wage rate, and domestic firms continue producing both goods. The scale of foreign firms' production is lower than in panel (B).

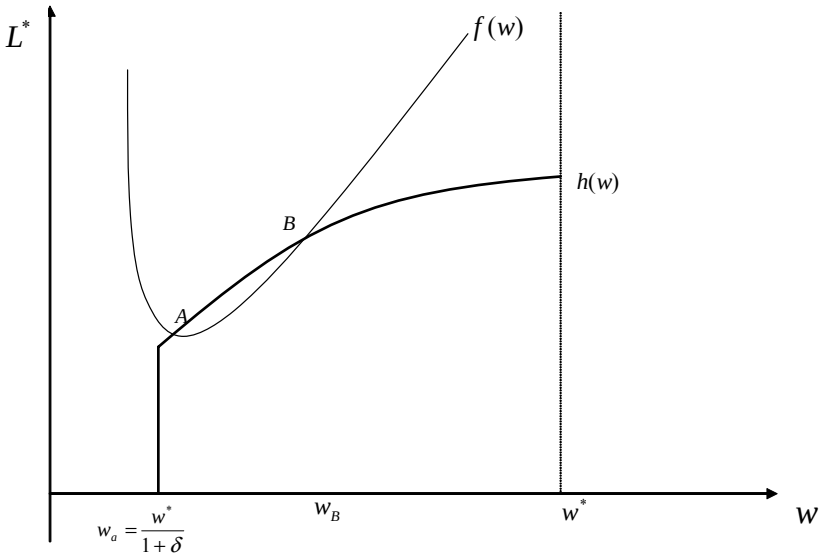
The low-wage low-FDI equilibrium is unstable. A marginal increase in w above w_A generates excess demand for labour, as foreign producers are willing to expand infinitely, driving domestic wages to w_B. Likewise, a fall in w from w_A generates excess supply of labour, as the residual supply for foreign producers is smaller than the minimum foreign employment scale, bringing the economy towards its autarky equilibrium. In contrast, both the autarky and the high-wage high-FDI equilibriums are stable.[11] If the conditions for an equilibrium with FDI hold, we cannot predict whether the autarky equilibrium will persist or whether the economy will move towards the high-wage high-FDI equilibrium. In this paper, however, we assume that the stable FDI equilibrium takes place. The evidence of high FDI penetration in China suggests that this is a reasonable assumption. Besides, at least from a theoretical perspective, China is likely to satisfy the condition for an equilibrium with FDI to exist: large labour-abundant and productivity backward country. Two features of this equilibrium are relevant for our analysis. First, FDI inflows shift domestic production towards the

[11] The condition for stability is that $f'(w) > h'(w)$.

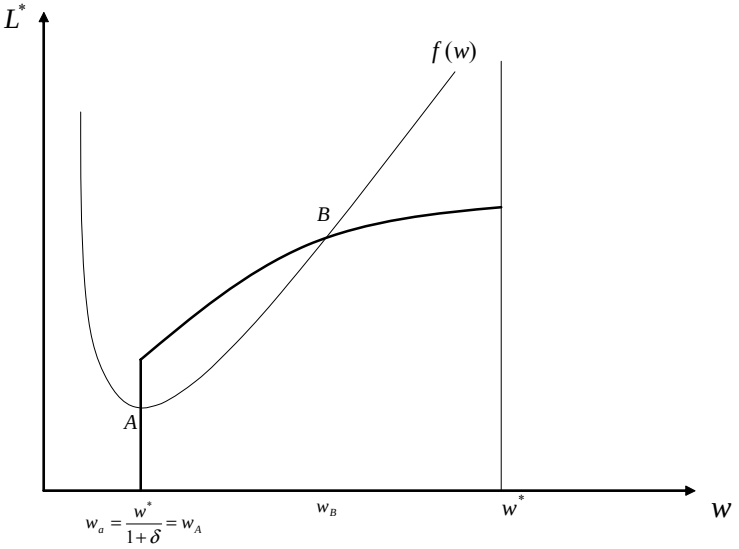
Figure 8
Domestic labour market equilibrium after FDI liberalization



Panel (A): No FDI



Panel (B)



Panel (C)

capital-intensive sector. The rise in the relative price of labour for domestic producers renders domestic production uncompetitive in the labour-intensive industry, shifting the pattern of domestic production towards the capital-intensive sector. Interestingly, this effect is more likely and stronger in countries with a (pre-FDI liberalization) comparative advantage in the labour-intensive good. This is consistent with the evidence that the access of productivity advanced foreign firms have pushed domestic firms towards the capital-intensive sectors.

4 Implications for trade

In this section we compare the trade pattern of the domestic economy with and without FDI integration. For simplicity, we assume that preferences are such that a share γ of national income is spent in the labour-intensive good z and a share $1-\gamma$ is spent in the capital intensive good x. Therefore, net trade of both goods as a share of income is given by;

$$t_x = \frac{T_x}{I} = \frac{x}{I} - (1-\gamma) \text{ and}$$

$$t_z = \frac{T_z}{I} = \frac{p^* z}{I} - \gamma$$

where I is national income expressed in terms of good x ($w\bar{L} + r\bar{K}$), and x and $p^* z$ are the real value of output of both products. Without FDI integration, net trade of the labour-intensive good is:

$$t_z^a = p^* \cdot A^* \cdot \left(\frac{\beta}{1-\beta}\right)^{\beta} \cdot \left(\frac{w^*}{r^*}\right)^{\beta} \cdot \left(1 - \frac{(1-\alpha)(1-\beta)}{(\alpha-\beta)} \cdot \left(\frac{r^*}{w^*}\bar{k} - \frac{\beta}{1-\beta}\right)\right) \cdot \frac{1}{w^* + r^*\bar{k}} - \gamma$$

where t_z^a is net export of good z in autarky (FDI isolation). As expected, t_z^a is decreasing on $\bar{k}$, which means that labour-abundant countries export the labour-intensive good. In this case, we assume that $\bar{k}$ is such that $t_z^a > 0$. By definition, $t_x^a = 1 - t_z^a$.

With FDI integration, net trade of the labour-intensive good becomes:

$$t_z^i = p^* \cdot A^* \cdot \left(\frac{\beta}{1-\beta}\right)^{\beta} \cdot \left(\frac{w^*}{r^*}\right)^{\beta} \cdot \frac{1}{w} \cdot \frac{\left(1 - \bar{k}\left(\frac{w^*}{w(1+\delta)}\right)^{1/\alpha}\left(\frac{A^*(1-\alpha)}{w^*}\right)^{1/\alpha}\right)}{\left(1 + \frac{\alpha}{1-\alpha}\bar{k}\left(\frac{w^*}{w(1+\delta)}\right)^{1/\alpha}\left(\frac{A^*(1-\alpha)}{w^*}\right)^{1/\alpha}\right)} - \gamma$$

where w is the equilibrium wage rate with FDI integration. Notice that net trade of the labour-intensive good not only depends upon $\bar{k}$ but it also depends upon the technology gap δ as well as on the post-integration wage rate, which also depends on $\bar{k}$ and δ as well as $\bar{L}$ and F_z. This expression assumes that the condition for an equilibrium with positive FDI exists, and that the equilibrium wage rate is such that the domestic economy specializes in the capital-intensive good.

The necessary condition for FDI integration to enhance net exports of the labour-intensive good (as a share of national income), i.e., $t_z^i > t_z^a$, is

$$G(\bar{k},\delta,\omega) = \frac{\alpha-\beta}{\alpha(1-\beta)} \cdot \omega^{1-\beta} \cdot J(\bar{k},\delta,\omega) - 1 > 0 \tag{9}$$

where $\omega = w^* / w$, and $J(\bar{k},\delta,\omega) > 1$.[12] It turns out that unless $\alpha \approx \beta$, that is, unless the factor intensity of both sectors is very similar, $G(\bar{k},\delta,\omega) > 0$. International wage data from ILO reveal that the ratio of China's average wages to average wages in the rest of the world have evolved from around 4 to 10 per cent between 1990 and 2000 if we consider all countries in the world, and it has grown from 3 to 5 per cent when we only consider countries that are the main sources of FDI into China. This means that $\omega = w^* / w$ is between 30 and 10 depending upon the sample considered. Therefore, for reasonable values of α and β, expression (9) shows that the conditions for FDI liberalization to increase net exports of labour-intensive products (as a share of national income) in China hold.

To get an intuition on the determinants of the bias in the trade structure introduced by FDI inflows, we analyse how $G(\omega,\bar{k},\delta)$ varies with $\bar{L}$, F_z, $\bar{k}$ and δ. Changes in $\bar{L}$ and F_z affect comparative advantage directly through their impact on the equilibrium the international/domestic wage ratio $\omega = w^* / w$, while changes in $\bar{k}$ and δ have both direct and indirect effects on the bias in comparative advantage. Accordingly:

i) $\dfrac{\partial G}{\partial F_z} = \dfrac{\partial G}{\partial \omega} \cdot \dfrac{\partial \omega}{\partial F_Z}$

ii) $\dfrac{\partial G}{\partial \bar{L}} = \dfrac{\partial G}{\partial \omega} \cdot \dfrac{\partial \omega}{\partial \bar{L}}$

iii) $\dfrac{\partial G}{\partial \bar{k}} = \left.\dfrac{\partial G}{\partial \bar{k}}\right|_{\omega=\bar{\omega}} + \dfrac{\partial G}{\partial \omega} \cdot \dfrac{\partial \omega}{\partial \bar{k}}$, and

---

12 $J(\bar{k},\delta,\omega) = \left[\left(1-\dfrac{\bar{k}}{k_x^a}\cdot\left(\dfrac{\omega}{1+\delta}\right)^{1/\alpha}\right)\cdot\left(1+\dfrac{\alpha}{1-\alpha}\cdot\dfrac{\bar{k}}{k_x^a}\right)\right] \Big/ \left[\left(1-\dfrac{\bar{k}}{k_x^a}\right)\cdot\left(1+\dfrac{\alpha}{1-\alpha}\cdot\dfrac{\bar{k}}{k_x^a}\cdot\left(\dfrac{\omega}{1+\delta}\right)^{1/\alpha}\right)\right]$ and k_x^a is the capital-labour ratio in the capital-intensive sector before FDI integration.

iv) $$\frac{\partial G}{\partial(1+\delta)} = \left.\frac{\partial G}{\partial(1+\delta)}\right|_{\omega=\bar{\omega}} + \frac{\partial G}{\partial \omega}\cdot\frac{\partial \omega}{\partial(1+\delta)}$$

We know from section 3 that ω decreases as F_z falls ($\partial\omega/\partial F_z > 0$) and that ω decreases as the labour force increases ($\partial\omega/\partial\bar{L} < 0$). Also, ω increases as the domestic economy becomes more capital abundant ($\partial\omega/\partial\bar{k} < 0$), and ω increases as the productivity gap δ falls ($\partial\omega/\partial(1+\delta) < 0$). The sign of $\partial G/\partial\omega$ depends upon the size of $(\bar{k}/k_x^a)\cdot(\omega/(1+\delta))^{1/\alpha} \in (0,1)$. For small enough values of $(\bar{k}/k_x^a)\cdot(\omega/(1+\delta))^{1/\alpha}$, i.e., if the domestic economy is very labour abundant or if FDI inflows have a relatively high impact on domestic wages, $\partial G/\partial\omega > 0$ meaning that a marginal increase in domestic wages shifts comparative advantage towards the capital-intensive product. The opposite happens if $(\bar{k}/k_x^a)\cdot(\omega/(1+\delta))^{1/\alpha}$ is relatively high.

We do not observe $(\bar{k}/k_x^a)\cdot(\omega/(1+\delta))^{1/\alpha}$, but according to Equation (8), in equilibrium this expression is equal to $1-L^*/\bar{L}$, which is the share of domestic firms in total employment. For example, in 2004 foreign firms' employment represented 25 per cent of total manufacturing employment (*China Markets Yearbook* 2005), which assures that $\partial G/\partial\omega < 0$. Therefore, $\partial G/\partial F_z < 0$, meaning that policies that lower the fixed cost of foreign investment not only encourage FDI inflows in the labour-intensive sector, but they also increase net exports of the labour-intensive good as a share of national income relative to a scenario of FDI isolation. A lower F_z increases FDI in the labour-intensive sector, pressuring wages up and lowering domestic capital-intensive production. The net effect is an increase in exports of the labour-intensive product as share of national income. Notice, however, that if the decrease in the fixed cost of foreign production is higher in capital-intensive sectors, FDI might shift completely to the capital-intensive production. Because the domestic wage/rental ratio is still higher than the pre-integration equilibrium, the domestic sector also specializes in the capital-intensive good and labour-abundant economy becomes a net exporter of the capital-intensive product. Even a small inflow of foreign capital into the capital-intensive sector can generate this result, meaning that from an aggregate perspective, the link between capital/labour endowment and trade patterns is broken down.

A similar results follows from an increase in labour-supply ($\partial G/\partial\bar{L} > 0$), which can be interpreted as a policy that relaxes rural-urban migration restrictions. In a scenario without FDI liberalization, the increase in $\bar{L}$ raises both exports and output of the labour-intensive good, without affecting the export-income ratio. With FDI liberalization, the rise in $\bar{L}$ encourages the arrival of foreign firms and lowers domestic employment in the capital-intensive sector, enhancing the export/income ratio of the labour-intensive good.

Domestic capital accumulation has two competing effects on comparative advantage. On the one hand, capital accumulation encourages the production of capital-intensive goods, meaning that comparative advantage shifts away from the labour-intensive industry. However, this Rybczynski effect is stronger under FDI isolation because the capital-labour ratio in the domestic economy is lower. Analytically, $\left.\partial G/\partial\bar{k}\right|_{\omega=\bar{\omega}} < 0$. On the other hand, a higher $\bar{k}$ discourages the arrival of foreign-invested firms because of

the lower attainable scale of production, decreasing the comparative in the labour-intensive good. The net effect depends upon the relative strength of both effects.

Domestic firms' technological progress unambiguously weakens comparative advantage in the labour-intensive good relative to an equilibrium without FDI integration. Two mechanisms generate this result. First, a higher domestic productivity discourages FDI, enhancing the production of domestic firms in the capital-intensive sector. Second, even without factor mobility from foreign to domestic firms, the higher domestic productivity raises output in the capital-intensive industry and raises national income, meaning that net exports of the labour-intensive commodity as a share of national income fall ($\partial G / \partial (1+\delta)\big|_{\omega=\bar{\omega}} > 0$). Overall, $\partial G / \partial (1+\delta) > 0$.

A final implication follows from analysing the role of capital market segmentation in China. The model assumes that the domestic capital market remains segmented from foreign firms' access, meaning that the return to domestic capital is endogenously determined, and in equilibrium it is lower than the international level due to the lower productivity of domestic firms. The removal of capital market distortions render unproductive domestic firms uncompetitive in all industries, because firms cannot offer capital a return equal to its opportunity cost. In other words, there is no room for productivity-backward firms in a context where productivity-advanced firms have access to all domestic factors. Therefore, only foreign firms produce in equilibrium, and the sectoral composition of output will depend on sectoral differences in the relative cost of foreign investment. Unless the fixed cost of FDI is significantly lower in capital-intensive sectors, the economy specializes in the labour-intensive industry, meaning that net exports of the labour-intensive product would increase. In terms of Figure 8, capital market integration implies that $h(w)$ becomes horizontal at $L^* = \bar{L}$, and the fixed cost of foreign investment only affects the domestic wage rate.

5 Conclusions

Although China is undoubtedly a labour-abundant economy, the extent of its penetration into world markets in the last 20 years in labour-intensive commodities has surprised even the most optimistic analysts. The evidence that China's export boom has coincided with a huge penetration of foreign-invested firms into labour-intensive sectors suggests that elements beyond traditional endowment-based considerations explain the export performance of China. This paper argues that FDI liberalization has introduced a Ricardian component in the determination of comparative advantage in China that has enhanced net exports in labour-intensive products. We show that FDI liberalization enhances the arrival of productivity-advanced foreign firms to the labour-intensive industry, where the benefits from low domestic wages are larger, and domestic capital market segmentation supports the production of productivity-backward domestic firms in the capital-intensive sector. Under certain conditions, that are likely to hold for China, the former effect dominates and FDI liberalization shifts comparative advantage towards the labour-intensive product. In other words, China's high export share of labour-intensive products reflects both its labour-abundance as well as a higher relative productivity in labour-intensive sectors as consequence of foreign firms' penetration. These Ricardian determinants of comparative advantage arise endogenously in response to international factor price differences and FDI liberalization.

This simple mechanism is capable of explaining many features of China's economy, like the sectoral bias of FIEs' market share, the high share of foreign firms in total exports, and the low return to capital in productivity-backward domestic firms. Although the model is built upon the idea of homogeneous products, the high sophistication of China's exports may also reflect the predominance of productivity-advanced foreign firms in China's labour-intensive exports.

We conclude showing that capital market liberalization not only leads to the disappearance of the low-productivity domestic sector but also further enhances the comparative advantage in labour-intensive products. The opposite happens if policies to promote FDI in capital-intensive sectors lower significantly the cost of FDI in those industries. If the benefits for foreign investment of capital-intensive firms dominate the labour-cost benefit favouring labour-intensive foreign firms, the Ricardian advantage in capital-intensive sectors dominates the factor-endowment advantage in the labour-intensive sector.

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