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Did Foreign Direct Investment Put an Upward Pressure on Wages in China?

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This paper studies the extent to which foreign direct investment (FDI) could have contributed to recent increase in wages in China. Using a World Bank survey data set of 1,500 Chinese enterprises conducted in 2001, the paper finds that the presence of FDI in the same industry and region has an indirect effect on wages of skilled workers in private firms, while it does not appear to affect wages of ordinary workers or of any workers in state-owned enterprises (SOEs). It further finds that observed quality of engineers in both SOEs and domestic private firms declines in the presence of FDI in the same industry and region, while quality of managers improves in domestic private firms. The paper

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discusses potential reasons for such discrepancy in the FDI effects on private and state firms' labor practices. These findings highlight the relevance of labor market institutions in determining FDI spillovers. [JEL L33, F23, O17]
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Both researchers and policymakers have long touted foreign direct investment (FDI) as an important factor in promoting developing countries' economic growth. However, despite the rapid growth in international capital flows in recent decades, there is no consensus regarding the impact of FDI inflows on domestic firms.[1] As this impact is not internalized by foreign investors, it may give rise to exteralities that may call for policy intervention. Thus, it is important to investigate such spillovers from FDI to decide whether the appropriate government policy is to promote FDI inflows, to restrict them, or to adopt a laissez-faire stance toward them. It is, therefore, not surprising that this issue has caught the attention of the literature and the media in the context of China's record-setting growth and FDI inflows.[2]

One of the reasons that have been cited to explain the failure in finding positive FDI spillovers is the competition effects on domestic firms. Aitken and Harrison (1999), for example, document competition effects in the output market: by competing away market share from domestic firms, foreign firms are believed to impose negative effects on indigenous firms in the host country, which may offset the positive technological spillovers transferred from foreign firms to domestic firms. In this paper, we focus instead on competition effects in the input markets. In particular, foreign firms may compete for labor inputs with indigenous firms on the domestic labor market and drive up the wage bill.

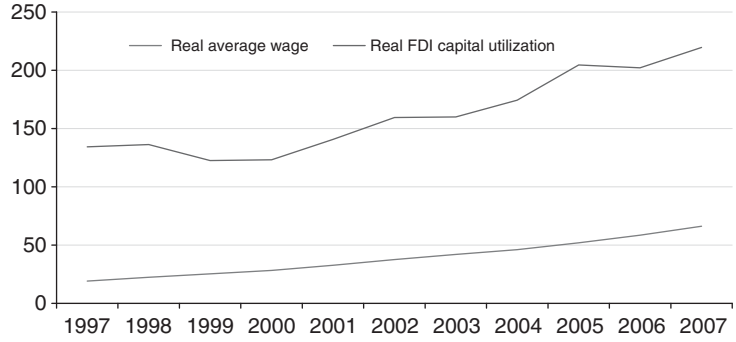
As shown in Figure 1, in China both real FDI capital utilization and real average wage showed an upward trend in the last decade. Of course, the patterns shown in the figure could be due to a multiplicity of changes that have simultaneously occurred in China during the same time period. A more rigorous study showing the competition effects of FDI on domestic labor market requires more disaggregated data. To date, there has been little direct evidence supporting competition effects from FDI on labor markets: Although there has been mixed evidence about the *direct* effects of FDI on wages, that is tests of whether foreign invested firms pay higher wages,[3] to

[1]For a critical evaluation of studies that find no or negative FDI spillovers, see Moran (2006).

[2]For a review of previous studies on FDI spillovers in China, see Hale and Long (2011a).

[3]Literature on wages in foreign invested enterprises includes Aitken, Harrison, and Lipsey (1996) study that finds that higher FDI is associated with higher wages in foreign invested firms; Almeida (2007) and Heyman, Sjöholm, and Tingvall (2007) studies that find no effects for Sweden and Portugal, respectively; Conyon and others (2002) and Girma and Görg (2007) studies that find some positive effects for unskilled wages in the U.K.; and Lipsey and Sjöholm

Figure 1. FDI capital utilization and average wages in China



Source: Statistical Yearbook, various issues (Chinese National Bureau of Statistics).

our knowledge there has been little analysis of *indirect* effects of FDI on wages in *domestic* firms.[4] We also found no studies of FDI effects on quality of labor either in firms that receive foreign capital or in domestic firms in the same location and industry.

To fill this gap, in this paper we study the indirect effects of FDI presence on labor market outcomes in China using the World Bank firm survey data. We analyze the pressure that FDI put on wages and quality composition of labor by examining differences between foreign invested and domestic firms and by studying the indirect effects of FDI presence in the same city and industry on wages and quality of labor in domestic firms. To control for potential omitted variable bias and thus help interpret our spillover effects as causal, we use instrumental variables approach.

There are two aspects of Chinese labor market that we need to take into account when analyzing our data and interpreting the results. First, although China, until recently, had a rich endowment of unskilled labor, the shortage of skilled labor is well documented. For example, according to the *Report on Chinese Entrepreneurs* issued by the Survey System for Chinese Entrepreneurs in 2003, 80 percent of the entrepreneurs surveyed report a shortage of technical personnel, over 50 percent report a shortage of managerial personnel, and 74 percent report a shortage of sales personnel. Second, personnel practices in state-owned enterprises (SOEs) in China are

(2004) study for Indonesia that finds positive effects of FDI on wages. Most recently, Harrison and Scorse (2009) find significantly higher wages for skilled labor in foreign invested firms in Indonesia but no such effects for unskilled labor, once education and gender are controlled for. In a related paper, Braconier, Norback, and Urban (2005) study the role of low labor costs in attracting FDI.

[4]Exceptions are Aitken, Harrison, and Lipsey (1996) study of U.S., Mexican, and Venezuelan firms that find no evidence of wage spillovers, Feenstra and Hanson (1997) study of Mexican regions that find positive spillovers of FDI on skilled wages, and Barry, Görg, and Strobl (2005) study of large Irish firms that find differential effects on exporting and non-exporting firms.

likely to differ dramatically from those in private firms. To account for these two aspects, we study effects on wages and quality of skilled and unskilled labor separately. We also allow for FDI presence to have different effects on wages and quality of labor in domestic SOEs and private firms.

Broadly speaking, we find that some of the increase in wages in China could indeed be attributed to FDI presence. However, the competitive pressure from FDI does not affect all types of labor in the same way. In addition, FDI presence affects wages and quality of labor differently in domestically owned private firms and in SOEs.

In particular, we do not find spillover effects of FDI on the market for unskilled labor—FDI presence does not seem to have any impact on wages and quality of unskilled workers in domestic firms. This is not very surprising given that we also find that foreign invested firms do not pay higher wages to ordinary workers than domestic firms, which are in line with the findings in Harrison and Scorse (2009). We also find that foreign invested firms hire ordinary workers of the same observed quality, and are therefore less likely to put pressure on this segment of the labor market, given the elastic supply of unskilled labor in China up to this point in time (year 2000).

In contrast, we find that foreign invested firms pay higher wages to their skilled workers and that the observed quality of skilled workers is higher in foreign invested firms, compared with domestic firms. We also find that larger presence of FDI leads to higher wages of skilled workers in private firms and to lower quality of skilled workers in SOEs, especially relative to private firms. These results are more consistent with labor market competition effects of FDI than with skill-biased technology transfer, a finding similar to that of Zhao (2001).

Our work contributes to the literature in several ways. First, we use a unique firm-level data set to study the effects of FDI in China. Second, the contrasting outcomes we find for SOEs and for private firms add evidence to the advantages of private ownership over state ownership documented in previous studies.[5] Third, our empirical findings suggest that the inability of SOEs to benefit from FDI technological spillovers may be due to the rigid compensation structure that forbids them from hiring high-quality skilled labor. To the extent that labor market institutions are restrictive in many developing countries, our findings suggest an explanation for the fact that positive FDI spillovers are more difficult to find in developing countries. Finally, because skilled labor enjoys higher wages and we find positive spillover effects of FDI on wages of skilled workers, our findings speak to the literature on FDI and wage inequality.[6]

[5]See Megginson and Netter (2001) for a summary of empirical evidence showing superior performance of private firms over SOEs.

[6]Two closely related papers in this respect are Blonigen and Slaughter (2001) which, in contrast to our findings, find no increase in demand for skilled labor due to inward FDI into the United States, and Feenstra and Hanson (1997) that do find an increase in demand for skilled labor due to FDI inflows into Mexico.

The structure of the paper is as follows: Section I provides institutional background on FDI and wage policies in China and outlines the implications of wage restrictions on SOEs when they compete with other types of firms in the labor market. Section II describes the data and the methodology, Section III presents the empirical findings and the related discussion, while Section IV concludes.

I. Institutional Background and Implications

In this section we describe the institutional environment in China that is relevant to our analysis—FDI-related policies and trends as well as differences between private firms' and SOEs' wage and personnel policies.

FDI and FDI Policies in China

China's FDI policies developed from being restrictive before 1978 to being permissive in the early 1980s, then to being encouraging in the mid-1980s to the mid-1990s, and finally matured in the mid-1990s to link FDI to domestic development priorities. With the country's accession into the World Trade Organization (WTO) in 2001, substantial changes were made to its FDI policies largely to unify the treatment of domestic and foreign firms.[7]

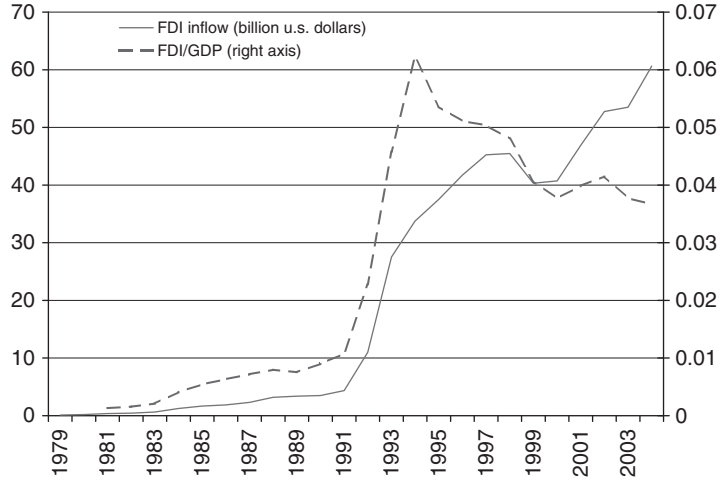
Since the beginning of the reform era in the early 1980s, when FDI was allowed only in a limited number of Special Economic Zones, the geographic scope was gradually expanded to cover more coastal cities and regions, and then finally to cover the whole country by the mid-1990s. Along with the expansion of geographic areas open to FDI, government policies toward FDI also evolved from permitting it to encouraging it through favorable treatment in taxes, tariffs, foreign exchange regulations, and licensing requirements. These early measures, largely embodied in the *Provisions of the State Council of the People's Republic of China for the Encouragement of Foreign Investment* (1986), prompted the rapid growth in FDI inflow into China, especially between the mid-1980s and the mid-1990s. Illustrating the breathtaking speed of FDI growth in China, the annual FDI inflow was \$100 million in 1979, \$1 billion in 1984, and then reached close to \$40 billion in 1995. As shown in Figure 2, the annual FDI inflow has remained above \$40 billion since 1995, while the FDI/GDP ratio has surpassed 3 percent since 1992. Between 1994 and 1997, the ratio exceeded 5 percent.[8]

Owing to the limited geographic regions open to foreign capital and favorable tax policies in the early stages of China's opening up, FDI was largely concentrated in coastal areas and labor intensive industries. Since the mid-1990s, in addition to further expanding the geographic regions open

[7]See Fung, Iizaka, and Tong (2004) for a detailed review of the trend, policy, and impact of FDI in China.

[8]Dollar, Hallward-Driemeier, and Mengistae (2006) show that the investment climate in China is superior to that of South Asian or Latin American countries and that this advantage helps explain large FDI inflows into China.

Figure 2. FDI inflows into China



Source: Statistical Yearbook, various issues (Chinese National Bureau of Statistics).

to foreign investment and maintaining a favorable investment environment, government policies began to focus more on linking FDI to domestic development priorities. For instance, the *Provisional Guidelines for Foreign Investment Projects*, which took effect in 1995, classified all FDI projects to one of four categories: encouraged, restricted, prohibited, and permitted. Priority was given to FDI in agriculture, energy, transportation, telecommunications, basic raw materials, and high-technology industries. FDI projects that could take advantage of the rich natural resources and relatively low labor costs in the central and northwest regions were also vigorously encouraged.[9] As a result, investment from large multinational corporations has increased rapidly and FDI started to shift toward capital- and technology-intensive industries since the mid-1990s. While the coastal areas continue to attract the most FDI inflows, certain inland regions have also become more popular among foreign investors.

In spite of China's great success in attracting FDI, the effects of FDI on domestic firms are far from clear. For instance, Huang (2005) argues that the large FDI inflow into China is accompanied by the repressive policies toward domestic private firms, implying that foreign firms have captured resources, markets, and policy preferences from domestic firms. From the viewpoint of the government, the goal in encouraging FDI has been clearly stated from the very beginning to be obtaining advanced technology as well as

[9]The new *Guiding Catalogue of Foreign Investment Projects* published in 2002 further combined the categories into three: encouraged, prohibited, and permitted.

management skills from foreign partners. But the government's early reluctance to allow solely foreign-owned firms (till the passage in 1986 of the *Law of the People's Republic of China on Enterprises Operated Exclusively with Foreign Capital*) suggests that it had doubts about FDI spillover effects on domestic firms. In addition, restrictions on domestic sales of foreign-invested firms that existed during much of the pre-WTO period seem to reflect the government's concern that foreign firms might crowd out domestic firms in their competition for domestic market share.

In addition to the potential competition effects on the output market, FDI inflows may also pose competitions to domestic firms on the input markets, especially on the labor markets. The latter competition effects probably did not enter the decision-makers' minds at the time. But our results to be presented below suggest that such competition effects are quite important and thus deserve more consideration.

Firm Ownership and Personnel Practices in China

A firm's ownership type has important effects on employee salaries in China. Liu, Long, and Jing (2007) show that on average, salaries are higher in SOEs than in domestic private firms even after controlling for firm characteristics (such as firm size, age, capital intensity, existence of union, sector, and region) as well as employee characteristics (such as education, age, gender, labor productivity, technical level, and working experience). However, the high level executives are paid substantially more in private firms than in SOEs (Kato and Long, 2006). Combined, these patterns imply greater salary dispersion in domestic private firms than in SOEs. In other words, the pay schedule is probably more compressed in SOEs.[10]

There are at least two potential explanations for such differences, both legacies of the planned economy till 1978: (1) SOEs face constraints in their wage structures, that is they cannot pay their skilled employees more due to constraints imposed through government policies and guidelines; and (2) SOEs have multiple social objectives and thus are not willing to structure their wage scales to achieve more efficiency at the cost of egalitarianism.

Before economic reforms began in the late 1970s, employee compensation in China followed a rigid grid system based on factors that reflected neither firm performance nor individual contributions. The bulk of the industrial labor force was employed in SOEs and their compensation was determined by the region, industry, level of supervising government agency, and the size of the enterprise, as well as the job title, occupation, and seniority of the individual.

In the post-reform era, compensation mechanisms in SOEs oftentimes are still subject to government guidelines that restrict wage differentials among employees and that often set a limit on the maximum salary for executives. For example, both the central government and several provincial governments in

[10]Our World Bank data set shows the same patterns, that is greater salary dispersion in private firms than in SOEs.

China have set or have considered setting limits on the ratio between CEO salary and unskilled worker compensation. The limit being contemplated by the central government in 2005 was 15, while provinces such as Jiangxi adopted 10 as the ratio limit in 2006.[11]

As a comparison, the 1996–1997 Tower Perrin Compensation Survey gives the range of CEO-worker compensation ratio of 11 for Germany and 24 for the United States, and such ratios have seen dramatic increases in past decade and a half. To the extent that these numbers reflect the efficient outcomes of labor market competition in those countries and that China most likely is in greater need for managerial talents, these limits may impose artificial restrictions on SOEs' ability to hire and retain talent.

Consequently, although both incentives to offer higher salaries and schemes to circumvent salary caps abound, big salaries for top executives are generally frowned upon by both the government and other employees in the state owned firms. In addition, state-owned firms have multiple social objectives to achieve, some of which (such as social stability) are more congruent with more equal pay schemes.

In contrast, private firms in China have always enjoyed more freedom in setting their own compensation policies and they show great flexibility in adopting more effective incentive systems. One telling example is the different pace at which different firms adopt the "yearly salary system" for executive compensation. Consisting of a fixed component (the base salary) and a variable component (the risk salary) that relates the executive's salary to firm performance, this new system resembles the typical cash compensation package in Western firms. The mechanism was initially conceived by the central government as a way to improve SOE performance. In reality, however, the new compensation system was adopted by private firms at a much faster pace, once it proved to provide an effective incentive mechanism for executives.[12] Even in SOEs that have adopted the new compensation system for executives, there is more emphasis on egalitarian concerns.

These explicit and implicit constraints imply a more compressed wage structure in SOEs. As recently as 1999, the highest ratio between CEO compensation and that of an average unskilled worker was 6 among the 40 largest enterprises owned by the central government.[13] We are not aware of any data on the ratio between CEO salary and unskilled worker compensation for

[11]See the March 25, 2005, Issue of *China Industry and Commerce Times*, and "The Rules for Administrating CEO Compensation in SOEs in Jiangxi Province," government document issued by the Jiangxi State Asset Supervision and Administration Commission (accessed online on July 21, 2006 at http://jiangxi:jxnews.com.cn/system/2006/07/07/002290697.shtml).

[12]See Kato and Long (2006) for a detailed discussion of executive salary policies in Chinese firms.

[13]See the "Research report on Chinese manager incentive mechanisms and policies,"cited in the January 14, 2002, issue of the *Market Daily* (accessed online on July 26, 2006 at http://news.xinhuanet.com/newscenter/2002–01/24/content252489.htm).

private Chinese firms in general. But compensation data for private listed firms in China and worker compensation data from the International Labor Organization suggest that the ratio was close to 15 between 1998 and 2002.

Whether it is the inability or the unwillingness on the part of the SOEs, the discussion above shows that in reality private firms in China tend to have a more dispersed and more flexible wage distribution. And whether the more rigid and compressed wage structure in Chinese SOEs is due to explicit restrictions or implicit limitations, they have similar implications on how these firms compete on the labor market. When faced with firms that are both willing and able to pay higher wages for workers of higher quality, SOEs may experience difficulty in attracting and retaining quality employees. We now explore the empirical validity of these implications.

II. Empirical Evidence

In this section we will present our findings with respect to the effects of FDI on labor market competition in China. We realize that our findings could have multiple interpretations, which we will discuss in the next section. But first, we describe our data and empirical approach.

Data

We use data from the Study of Competitiveness, Technology and Firm Linkages conducted by the World Bank in 2001, as described in more detail in Hale and Long (2011a). The survey collects detailed information on firms and their operation environment, based on two questionnaires, one filled out by the Senior Manager of the firm's main production facility, and the other filled out by the accountant and/or the personnel manager of the firm. For most of the variables, the firms were requested to provide information as of year 2000. However, for many accounting measures, information from up to three previous years was also collected.

In this study, we use a small portion of the survey that gives accounting information on firms' input (including wages and the composition of the labor force), output, and ownership structure. In particular, we rely on the detailed information on the wages for three types of employees: managers, that is persons making management decisions; engineers, that is trained and certified engineers; and ordinary workers, persons whose skills fall below the professional level. The list of variables used in our study is presented in the Appendix.

The methodology of the survey is stratified random sampling with the stratification based on subsectors including accounting and related services, advertising and marketing, apparel and leather goods, business logistics services, communication services, consumer products, electronic equipment and components, information technology (IT), and automobile and auto-parts. A stratified random sample of 300 establishments is drawn from each of five cities in China: Beijing, Chengdu, Guangzhou, Shanghai, and

Table 1. Distribution of Foreign and Domestic Firms

	All	Foreign	Domestic	Private Share[1]
Number of firms	1500	382	1118	1118
By city:				
1. Beijing	300	75	225	0.31
2. Chengdu	300	32	268	0.39
3. Guangzhou	300	84	216	0.46
4. Shanghai	300	122	178	0.16
5. Tianjin	300	69	231	0.39
By industry:				
1. Accounting and related services	104	11	93	0.41
2. Advertising and marketing	89	15	74	0.39
3. Apparel and leather	222	63	159	0.36
4. Business logistics services	110	22	88	0.14
5. Communication services	71	3	68	0.12
6. Consumer products	165	40	125	0.39
7. Electronic components	203	77	126	0.36
8. Electronic equipment	192	65	127	0.37
9. IT services	128	21	107	0.49
10. Vehicles and parts	216	65	151	0.37

[1]For domestic firms only.

Tianjin, giving a total sample size of 1,500. Table 1 gives the city and sector distribution of firms included in the survey.

Based on the information on firms' foreign ownership, we construct the measure of FDI presence as follows: For each domestic firm, we identify the city-sector cell where the firm is located. We then compute the weighted average of the largest foreign partner's share in each firm located in the same city-sector, as of 1999, with firm employment as the weight, because we do not have information on the firms' total foreign direct investment shares. The average foreign share thus obtained is referred to as the "FDI presence" in the city-sector cell. Our focus, therefore, is the effect of FDI presence within the same geographic location and industry. Table 2 gives the average foreign share by city and industry sector.

Table 3 shows summary statistics of the variables used in the analysis. In the table, domestic firms with private ownership of less than 100 percent are listed as SOEs, while others are listed as private. This split is done for the purpose of comparing firms with different ownership types, while when used in the regression analysis that follows, we resort to a continuous measure of the share of private ownership. The table shows that SOEs are quite different from private firms in many aspects: They tend to be larger and have a longer history; their workers tend to be older and less educated, and tend to get lower wages; and their managers tend to have less foreign work experience. These differences are all statistically significant.

Table 2. FDI Presence by City and Industry Sector in 1999

Sector, city	Beijing	Chengdu	Guangzhou	Shanghai	Tianjin	Overall
Accounting and related services	0.186	0.000	0.011	0.000	0.022	0.048
Advertising and marketing	0.036	0.008	0.013	0.095	0.193	0.074
Apparel and leather goods	0.162	0.009	0.212	0.174	0.311	0.172
Business logistics services	0.006	0.000	0.032	0.040	0.044	0.024
Communication services	0.000	0.008	0.000	0.000	0.008	0.003
Consumer products	0.097	0.061	0.108	0.185	0.324	0.161
Electronic components	0.149	0.038	0.207	0.302	0.458	0.231
Electronic equipment	0.253	0.014	0.065	0.353	0.240	0.189
Information technology services	0.052	0.068	0.020	0.154	0.009	0.054
Vehicles and vehicle parts	0.123	0.096	0.125	0.238	0.121	0.139
Overall	0.129	0.036	0.104	0.186	0.209	0.133

Table 3. Summary Statistics

	Domestic			
Variable	Mean (SOE)	Mean(private)	Diff.	Foreign
Log of Wage (prod. worker)	2.07	2.01	0.06	2.37
Log of Wage (engineer)	2.52	2.70	−0.18**	3.09
Log of Wage (manager)	2.54	2.68	−0.14*	3.16
Age (prod. worker)	34.60	30.5	4.0***	29.10
Age (engineer)	37.50	34.2	3.4***	32.80
Age (manager)	39.20	35.9	3.3***	35.10
Education (prod. worker)	9.84	9.56	0.28**	9.78
Education (engineer)	13.10	13.5	−0.32***	13.60
Education (manager)	12.60	12.7	−0.19*	13.10
Engineers with foreign experience	0.004	0.11	−0.006**	0.02
Managers with foreign experience	0.030	0.064	−0.034***	0.15
Skill ratio	0.31	0.36	−0.056***	0.35
Wage spread	0.44	0.58	−0.14**	0.66
Firm age	23.70	9.92	13.8***	8.30
Log of capital stock	9.63	8.21	1.42***	10.00
Log of labor force	5.60	4.76	0.84***	5.40
Observations[1]	326	792		382

[1]Owing to missing values, the number of observations for each variable may be smaller.
Note: SOE is defined as private share <1, private $= not(SOE)$.
*Significant at 10 percent; **significant at 5 percent; ***significant at 1 percent.

Empirical Approach

First, we analyze differences in wages and labor quality between domestic and foreign firms, excluding SOEs from our sample, where SOEs are defined as firms with less than 100 percent of private ownership share. We use the

following specification:

$$Y_{jik} = \alpha_{ik} + \beta_1 FOR_{jik} + Z'_{jik}\Gamma + \varepsilon_{jik}, \quad (1)$$

where Y_{jik} is an outcome variable, such as average unskilled worker education, age, or wage, in the firm j operating in industry i and city k, α_{ik} are city-industry fixed effects, FOR_{jik} is the share of foreign ownership in the same firm, Z_{jik} is a set of firm-level control variables specific to the outcome variable, while ε_{jik} is a random error term. The coefficient β_1 on FOR_{jik} measures the difference between foreign and domestic private firms.

To document differences between SOEs and private firms, we restrict our analysis to firms with no foreign partners, and use a similar specification:

$$Y_{jik} = \alpha_{ik} + \beta_2 PR_{jik} + Z'_{jik}\Gamma + \varepsilon_{jik}, \quad (2)$$

where PR_{jik} is the share of private ownership of the firm j and the other variables are the same as defined above. The coefficient β_2 on PR_{jik} measures the difference between SOEs and private firms.

Finally, to measure spillover effects of FDI on domestic private firms and SOEs, we use the following specification, again limiting our sample to the firms with zero foreign ownership:

$$Y_{jik} = \alpha_i + \alpha_k + \beta_3 FDI_{ik} + \beta_4 PR_{jik} + \beta_5 FDI_{ik} \cdot PR_{jik} + Z'_{jik}\Gamma + \varepsilon_{jik}, \quad (3)$$

where FDI_{ik} is a measure of FDI presence in industry i and city k, while α_i and α_k are city and industry fixed effects. The coefficient β_3 measures the effect of FDI presence on firms with zero private ownership, that is SOEs, while the sum $\beta_3 + \beta_5$ measures the effect of FDI presence on firms with 100 percent private ownership.

Because our measure of FDI presence does not vary within city-industry cell, we cannot include a full set of city-industry fixed effects in Equation (3), but rather include separate city and industry fixed effects. This of course creates a possibility for the omitted variable bias if there are unobserved factors that are correlated with both foreign presence in a city-industry cell and wages or labor quality in that cell. For example, if foreign investment is largely driven by firm productivity factors, we may expect the unobserved component of local productivity potential to lead to both higher foreign presence and higher wages and better labor quality in a city-industry cell. Alternatively, if FDI is largely attracted to low cost regions, the unobserved cost component may lead to higher foreign presence but lower wages and better labor quality in a city-industry cell. Both cases above will result in biased OLS estimates of the FDI effects on wages and labor quality of local domestic firms. To address this potential bias, we also estimate the same relationship using the instrumental variables approach.

The literature on FDI location provides a guide to our search for instruments. Given that FDI presence is defined at the city-industry level and is not firm specific, we need to find instruments defined at the same level. Blonigen (2005) argues that multinational corporations make overseas

investment for several reasons, including securing access to domestic market, and using cheap local resources, such as labor, to produce for other markets.[14] Consistent with these findings, we construct two instruments, which we find to be uncorrelated with cost and quality of labor in domestic firms: the percentage of firms in the industry that exported in year 2000 multiplied by the berth capacity of the city's seaport ($Port \times EX$) and the average transportation cost as a percentage of sales in the industry multiplied by the sum of population of all other provinces weighted by the inverse of the distance between the provincial capital and the city squared ($Dist \times Tr$).[15]

The capacity of the seaport affects the cost of exporting, while the percentage of firms that export serves as a proxy for the importance of exporting in a particular industry. Thus, $Port \times EX$ measures the access to overseas market and the attractiveness to export-oriented FDI of the particular city-industry cell. The sum of population of all other provinces weighted by the square of the inverse of their distance to a city gives a measure of how centrally located the city is, while the average transportation cost as a percentage of sales measures the bulkiness of the industry. $Dist \times Tr$ therefore measures the access to the domestic market and thus the attractiveness to market-seeking FDI of the city-industry.

Because the percentage of firms that exported in the given sector and the average share of transportation costs are defined at the sector level, any potential direct effect they may have on labor cost and quality will be absorbed by the industry fixed effect. Similarly, if there is any direct effect of the city's port capacity or distance to provincial capital on wages and labor quality, it is absorbed by city fixed effects. We thus use the products of share of exporting firms and port capacity and share of transportation costs and distance to provincial capital as instruments for the average share of foreign presence in the city-industry cell.

Specifically, we estimate, using GMM, the following system of equations, limiting the sample to firms with zero foreign share:

$$\begin{cases} FDI_{ik} = \delta_i + \delta_k + \delta_1 \, Port{\times}EX_{ik} + \delta_2 \, Dist{\times}Tr_{ik} + \bar{Z}_{ic}' \, \Phi + \omega_{ik} \\ FDI_{ik} \cdot PR_{jik} = \zeta_i + \zeta_k + (1 + \zeta_0 \, PR_{jik}) \cdot (\zeta_1 \, Port{\times}EX_{ik} + \zeta_2 \, Dist{\times}Tr_{ik}) \\ \qquad\qquad + \bar{Z}_{ic}' \Psi + \varpi_{ik} \\ Y_{jic} = \alpha_i + \alpha_k + \beta_3' FDI_{ik} + \beta_4' PR_{jik} + \beta_5' FDI_{ik} \cdot PR_{jik} + Z_{jik}' \, \Gamma + \varepsilon_{jik}, \end{cases}$$

[14]Empirical studies demonstrating the importance of various factors in attracting FDI include Amiti and Smarzynska Javorcik (2008), Blomstrom and Lipsey (1991), and Kravis and Lipsey (1982) (size and access to domestic markets and suppliers); Bagchi-Sen and Wheeler (1989) (population size, population growth, and per capita sales); Coughlin, Terza, and Arromdee (1991) (tax rate and infrastructure); de Mooij and Ederveen (2003) (tax rate); Ma (2006) (access to international market). Studies on location of FDI specific to China include Cheng and Kwan (2000) and Sun, Tong, and Yu (2002).

[15]See Hale and Long (2011a) for the full description and the values of these variables for each city-industry cell.

where $\bar{Z}_{ic}$ is a matrix of firm characteristics, averaged for each city-industry cell.

III. Empirical Results

In this section we build up the discussion toward our main results of spillover effects of FDI on domestic firms' labor cost and composition by first comparing foreign invested firms with domestic private firms, then discussing differences between domestic private firms and domestic state-owned firms, and finally turning to the question of spillover effects.

Comparison of Domestic and Foreign Invested Private Firms

Table 4 shows results from our study of differences in wages and labor quality between foreign and domestic firms. The reported results exclude all the domestic firms with private ownership share less than 100 percent.[16]

The top panel of Table 4 shows that, whether or not we control for observed quality of labor, firms with higher foreign ownership share tend to pay higher average wages to their engineers and managers. Part of the wage premium is explained by the higher quality of managers, as the coefficient on private share is smaller once we control for observed quality, while the rest may be due to unobserved variation in quality not controlled for by age and education. In terms of magnitudes, our results demonstrate that managers in fully foreign firms would get paid 51 percent more than in fully domestic private firms, with 9 percentage points due to their observable quality advantage. Finally, engineers in fully foreign firms get on average 30 percent higher wages compared with fully domestic private firms. We find that for ordinary workers there is also positive correlation between foreign ownership share and wage, but it is smaller in magnitude and not statistically significant. These results related to wages are similar to those obtained in Harrison and Scorse (2009) for Indonesia.

As shown in the bottom panel of Table 4, we find that firms with higher share of foreign ownership tend to hire younger workers of all types, as well as more educated managers, who are also more likely to have foreign working experience. In particular, our results imply that firms with 100 percent foreign ownership would hire engineers and ordinary workers that are on average 2.3 years younger, and managers that are on average 1.6 years younger, have 8.5 more months of education and are 12 percentage points more likely to have foreign experience, compared with domestic private firms. Taken together, these results show that foreign invested firms tend to hire younger employees (note that we already control for firm age), better qualified managers, and are willing to pay higher wages to their engineers and managers, but not to their ordinary workers.

[16]As a robustness test we instead excluded firms according to their reported legal status and obtained similar results.

Table 4. Differences Between Foreign and Domestic Private Firms

Dependent var.	β (Foreign Share)	Robust SE	Controls	Adj. R^2	N. (Obs.)
Wage					
Log (average wage)					
Ordinary workers	0.16	(0.12)	Log(K/L)	0.06	791
Engineers	0.29**	(0.13)	Log(K/L)	0.12	832
Managers	0.50***	(0.11)	Log(K/L)	0.15	1075
Ordinary workers	0.14	(0.13)	Log(K/L), quality[1]	0.06	776
Engineers	0.24*	(0.13)	Log(K/L), quality[1]	0.12	801
Managers	0.36***	(0.12)	Log(K/L), quality[1]	0.16	1017
Labor quality					
Avg. age					
Ordinary workers	−2.33***	(0.79)	Log(K), firm age	0.33	782
Engineers	−2.32***	(0.76)	Log(K), firm age	0.26	837
Managers	−1.63**	(0.70)	Log(K), firm age	0.22	1071
Avg. education					
Ordinary workers	0.15	(0.19)	Log(K)	0.21	782
Engineers	0.11	(0.17)	Log(K)	0.20	839
Managers	0.73***	(0.15)	Log(K)	0.28	1074
Avg. foreign experience					
Engineers	0.009	(0.007)	Log(K)	0.12	815
Managers	0.12***	(0.033)	Log(K)	0.09	1027

[1]Quality controls include average age, average age squared, and average education of the relevant group, as well as controls for foreign experience for engineers and managers.

*Significant at 10 percent; **significant at 5 percent; ***significant at 1 percent.

Estimated by OLS. City × sector fixed effects included in all regressions.

Sample limited to private firms.

How to explain these patterns? The observed lack of significant difference in ordinary worker wages between foreign invested firms and domestic firms is most likely due to extremely elastic supply of unskilled labor, especially when younger workers are drawn into the labor market. The finding that foreign firms pay higher average wages to skilled labor (managers and engineers) is consistent with the view of better technology used by foreign firms being complementary to skill and making skilled labor more productive. Alternatively, foreign firms seek more productive skilled labor and that age, education, and foreign experience do not fully account for differences in their productivity.

The findings provide support for both the explanations above. On one hand, although foreign firms pay significantly more to their managers and engineers, we find the results to be more pronounced for managers than for engineers. This is consistent with the belief that foreign firms are more likely to have superior managerial practices (than advanced technology, especially when the foreign investment comes from the Greater China Area) and

therefore their managers in particular are more productive. But on the other hand, although foreign firms hire younger managers and engineers, only managers in foreign firms tend to have more education and a higher likelihood of having foreign experience. Thus to the extent that the unobserved component of labor quality is positively correlated with observed quality, the productivity of managers working in foreign firms may be less fully captured in age, education, and foreign experience. This suggests that the larger wage differential may simply correspond to the greater ability differential between foreign and domestic firms for managers than engineers. This is a plausible case because managerial ability is probably harder to evaluate than technical skills. The results from the later sections will also help shed more light on the validity of these alternative explanations.

Differences Between Private and State-Owned Domestic Firms

Before we discuss spillover effects of FDI presence on wages and quality of labor in domestic firms, we document differences in these variables for domestic firms with respect to their ownership structure. Table 5 demonstrates that private firms tend to hire skilled labor of higher quality and pay them higher wages. Specifically, if the share of private ownership is higher, wages paid to engineers and managers, but not those to ordinary workers, are higher. We also find that employees of all types tend to be younger, the share of engineers and managers with foreign experience larger, and the managers more educated, while ordinary workers tend to be less educated, if the private share is higher.

To discuss the magnitude of the above differences, we can compare SOE firms with zero private share with those that have 100 percent private ownership share. The coefficients in the regressions reported in Table 5 indicate that wages of engineers are higher in private firms than in SOEs by about 17 percent, while the wages of managers are higher in private firms by about 20 percent. Note that some wage differences are due to differences in quality—when controlling for age, education, and foreign experience, the coefficients on PR_{jik} in wage regressions for engineers and managers become smaller, with private firms paying wage by 12 and 15 percent higher for engineers and managers, respectively, than SOEs.[17] In addition, private firms hire engineers and managers that are on average 2 and 4 years younger, respectively, when we control for firm age. The differences in education level are modest: private firms hire managers that on average have four additional months of education, compared with SOEs.[18] The average shares of engineers and managers with foreign experience are 1 and 7 percentage points higher, respectively, in private firms than in SOEs.

[17]The remaining average differences reflect the fact that age, education, and foreign experience only measure some of the quality aspects, with many others not observed by an econometrician.

[18]Note that average education of managers in SOEs is 12.6 years—see Table 3.

Table 5. Differences Between Domestic Private Firms and SOEs

Dependent var.	β (Private Share)	Robust SE	Controls	Adj. R^2	N. (Obs.)
Wage					
Log (avg. wage)					
Ordinary workers	0.012	(0.093)	Log(K/L)	0.07	793
Engineers	0.17**	(0.080)	Log(K/L)	0.13	828
Managers	0.18***	(0.070)	Log(K/L)	0.14	1076
Ordinary workers	0.022	(0.10)	Log(K/L), quality[1]	0.07	778
Engineers	0.10	(0.081)	Log(K/L), quality[1]	0.13	790
Managers	0.13*	(0.074)	Log(K/L), quality[1]	0.15	1013
Labor quality					
Avg. age					
Ordinary workers	−5.00***	(0.59)	Log(K), firm age	0.38	784
Engineers	−2.33***	(0.61)	Log(K), firm age	0.27	830
Managers	−3.90***	(0.48)	Log(K), firm age	0.27	1075
Avg. education					
Ordinary workers	−0.28**	(0.13)	Log(K)	0.21	789
Engineers	0.042	(0.12)	Log(K)	0.18	831
Managers	0.29**	(0.11)	Log(K)	0.25	1077
Avg. foreign experience					
Engineers	0.012**	(0.005)	Log(K)	0.18	820
Managers	0.073***	(0.013)	Log(K)	0.11	1050

[1]Quality controls include avg. age, avg. age squared, and avg. education of the relevant group as well as controls for foreign experience for engineers and managers.

*Significant at 10 percent; **significant at 5 percent; ***significant at 1 percent.

Estimated by OLS. City × sector fixed effects included in all regressions.

Sample limited to domestically owned firms.

These findings are consistent with our discussion of hiring practices in China. In particular, we find that ordinary workers are paid roughly the same in the two types of firms, while engineers and managers are paid more in private firms, indicating relatively more compressed wage structure in SOEs. As we discussed previously, this could be due to implicit or explicit wage constraints faced by SOEs when competing with other types of firms or to the inferiority of their skill-complementary factors of production. Our finding that SOEs tend to employ lower quality skilled labor compared with private firms indicates that the wage compression in SOEs is more likely due to implicit or explicit constraints on wages they can pay.

Spillover Effects From Foreign Presence

We now turn to spillover effects of foreign firm presence on domestic firms. Table 7 presents our main results from IV estimations, while Table 6 presents the results from OLS estimation, which are qualitatively similar, for

Table 6. Effect of FDI on Domestic Private Firms and SOEs
(OLS)

	Coefficient on				Adj. R^2	N. (Obs.)
Dependent var.	Private shr.	FDI	FDI*Prv.shr.	Controls		
Wage						
Log (average wage)						
Ordinary workers	−0.079	0.60	0.20	Log(K/L)	0.06	793
Engineers	0.057	1.17*	0.69	Log(K/L)	0.11	828
Managers	−0.016	0.46	1.35**	Log(K/L)	0.12	1076
Ordinary workers	−0.075	0.58	0.25	Log(K/L), quality[1]	0.06	778
Engineers	0.008	1.33*	0.50	Log(K/L), quality[1]	0.11	790
Managers	−0.110	0.47	1.76***	Log(K), quality[1]	0.13	1013
Labor quality						
Avg. age						
Ordinary workers	−4.89***	3.31	−3.62	Log(K), firm age	0.38	784
Engineers	−2.62**	3.22	0.56	Log(K), firm age	0.27	830
Managers	−3.21***	1.40	−7.96	Log(K), firm age	0.27	1075
Avg. education						
Ordinary workers	−0.47*	−0.023	0.56	Log(K)	0.20	789
Engineers	−0.066	−0.324	0.83	Log(K)	0.17	831
Managers	0.046	−0.896	1.95*	Log(K)	0.24	1077
Avg. foreign experience						
Engineers	0.003	−0.027	0.036	Log(K)	0.001	820
Managers	0.049**	−0.001	0.30**	Log(K)	0.08	1050

[1]Quality controls include avg. age, avg. age squared, and avg. education of the relevant group as well as controls for foreign experience for engineers and managers.

*Significant at 10 percent; **significant at 5 percent; ***significant at 1 percent. SE are clustered on city × sector cells

Estimated by OLS. City fixed effects and sector fixed effects included in all regressions.

Sample limited to domestically owned firms.

comparison.[19] The columns of Table 7 give coefficient estimates for private share, FDI presence, and the interaction term between private share and FDI presence, along with an F-test of total effect of FDI on firms with 100 percent private ownership. The rest of the columns report the goodness of fit statistics and specification test results. We can see that the null of weak instruments is always rejected while the null of valid instruments is never rejected.

The top panel of Table 7 shows that private firms pay higher wages to both engineers and managers where there is more FDI. In contrast, FDI presence has no effect on the average wages of ordinary workers. The results

[19]Quantitatively, the magnitudes of the coefficients in the IV regressions are higher than those in OLS regressions, indicating that the omitted variable bias works against us finding positive spillover effects on wages.

Table 7. Effect of FDI on Domestic Private Firms and SOEs

(IV)

	Coefficient on			Prob($>F$)			IV eqn.1	IV eqn.2	J-test
Dependent var.	Private shr.	$\widehat{FDI}$	$\widehat{FDI \cdot PR}$	$\widehat{FDI} + \widehat{FDI \cdot PR} = 0$	Adj.R^2	N. (Obs.)	p-value[1]	p-value[1]	p-value[2]
Wage									
Log(average wage)									
Ordinary workers	−0.19	2.71	0.99	0.17	0.06	793	0.01	0.00	0.60
Engineers	−0.079	1.95	1.60**	0.033**	0.12	828	0.05	0.00	0.69
Managers	−0.17	0.32	2.67**	0.064*	0.13	1076	0.02	0.00	0.61
Ordinary workers	−0.22	1.75	1.29	0.17	0.08	778	0.01	0.00	0.57
Engineers	−0.10	2.60	1.08	0.04**	0.13	790	0.01	0.00	0.60
Managers	−0.27**	−0.11	3.02***	0.06**	0.15	1013	0.00	0.00	0.35
Labor quality									
Avg. age									
Ordinary workers	−4.36**	−7.21	−7.47	0.17	0.36	784	0.01	0.00	0.25
Engineers	−1.86	4.17	−5.14	0.93	0.28	830	0.04	0.00	0.13
Managers	−2.34*	−11.2	−17.1**	0.003***	0.23	1075	0.01	0.00	0.15
Avg. education									
Ordinary workers	−0.12	−2.21	−2.04	0.16	0.19	789	0.01	0.00	0.17
Engineers	0.061	−2.85*	−0.25	0.10*	0.17	831	0.02	0.00	0.95
Managers	−0.51	−3.13	2.83*	0.89	0.24	1077	0.01	0.00	0.56
Avg. foreign experience									
Engineers	−0.003	0.039	0.11	0.27	−0.01	820	0.04	0.00	0.28
Managers	0.0001	0.24	0.67**	0.006***	0.06	1050	0.01	0.00	0.19

[1]Partial F-test for the first stage (H0: weak instruments), Equations 1 and 2.

[2]Hansen J-test for over-identification (H0: valid instruments).

*Significant at 10 percent; **significant at 5 percent; ***significant at 1 percent. SE are clustered on city × sector cells and corrected for small sample. Estimated by GMM. City FEs and sector FEs included in all regressions.

Sample limited to domestically owned firms. Controls are the same as in Table 6.

also show that there are no significant effects of FDI on the wages of skilled or unskilled labor in SOEs.

The bottom panel of Table 7 summarizes the effects of FDI on average labor quality. For ordinary workers, FDI presence has no significant effects on either their average age or their average education. In contrast, the presence of FDI reduces the average quality of engineers, exhibited by their average education level, both in SOEs and in private firms. There is also evidence that the average age of engineers hired by SOEs increases in the presence of FDI, although the effect is not statistically significant.

For managers, their average education in SOEs also tends to decrease in the presence of FDI, although the effect is not significant. Furthermore, such negative effect is not present for private firms, and managers in private firms have significantly more education than their counterparts in SOEs at the presence of FDI. Two additional results on quality of managers are different from those on engineers. With higher FDI presence, the average age of managers tends to decrease for private firms, while the percentage of managers with foreign work experience tends to increase for these firms.

To summarize, FDI presence leads to higher wages for managers and engineers in domestic private firms, but not to higher wages for ordinary workers in private firms, or higher wages for skilled or unskilled labor in SOEs. In terms of labor quality, while the average education level of engineers drop for domestic firms, the average quality of managers for private firms tends to be higher where FDI is present. We discuss the reasons for these differences between engineers and managers in the next section.

To understand the magnitudes of these effects, we compare the effects of an increase in FDI presence from zero to 20 percent in the city-industry cell on fully private and fully state-owned firms. Such an increase in FDI presence would lead to 60–70 percent increase in wages of both engineers and managers in private firms, but not in SOEs. It would also lower average education of engineers in SOEs and private firms by about 7 months, lower the average age of managers in private firms by 5.7 years, and increase the share of managers with foreign experience in private firms by 18 percentage points.

Discussion of Results

We can thus conclude that the empirical findings give an affirmative answer to the question stated in the title of this paper—"Did Foreign Direct Investment Put an Upward Pressure on Wages in China?" While this particular result is quite straightforward, we also find some more subtle and interesting patterns in the way FDI affects China's labor markets. In particular, we find that the upward pressure of FDI on wages is limited to the market for skilled labor, and that while private firms compete with foreign invested firms by paying higher wages to skilled workers, SOEs respond to such competition by hiring skilled workers of lower quality.

In light of our above discussion of reasons for wage compression in SOEs and the cited reports on skilled labor shortages in China, we believe our results from the previous sections can be explained as follows. Because SOEs are faced with many constraints on employment practices, domestic private firms are more able to obtain skilled labor with better quality by paying them higher wages when the supply of skilled labor is inelastic. This is supported by results in Section 'Differences between private and state-owned domestic firms' (Table 5).

For the other results, consider foreign invested firms in China, which use skill-complementary technologies. Such technologies require skill-intensive production processes, thus higher productivity and higher wages for skilled labor. The adoption of such technologies will also imply the hiring of skilled labor of higher quality. This is consistent with the higher wages and quality of engineers and managers observed in Section 'Comparison of domestic and foreign invested private firms' (Table 4).

To explain the results on the labor market spillover effects of FDI (Tables 6 and 7), we need to integrate labor market competition into our discussion. Both because FDI increases demand for all factors of production in the host region and due to its greater reliance on skill-complementary technology, larger foreign presence in the city would lead to a higher demand for skilled labor. Given that in the short and medium run the supply of skilled labor is very inelastic, this would push up the wages of skilled workers in the city and industry with higher FDI presence. The wage results in Table 7 support the above discussion.

Furthermore, with foreign firms attaching greater value to skilled labor (due to their technology with higher skill-complementarity), they will compete away skilled labor with the highest ability, leading to lower quality of skilled labor in domestic firms. This negative impact is especially grave for SOEs, because they might find it difficult to compete on the labor market with both foreign firms and domestic private firms due to explicit or implicit wage constraints. The results on the education level of engineers provide empirical support.

The findings related to manager quality in Table 7, however, call for additional discussion. Instead of suffering a drop in quality as in the case of engineers, we observe both a higher percentage of managers with foreign experience and more educated managers in domestic private firms in the presence of FDI. This suggests that at least one type of positive FDI spillover effects is present: Foreign investment has brought with it an inflow of managerial talents, some of whom are hired by domestic firms. Yet such benefits are only enjoyed by private firms, as SOEs are constrained in how much they can pay their workers.

It is worth highlighting that the spillover effects of FDI are quite different for the two types of skilled labor in China. For the labor market of technical personnel, the presence of FDI has led to higher wages and lower ability for engineers in domestic firms. But for managerial personnel, FDI has led to both higher wages and higher ability for managers working

in domestic private firms. In other words, while the net effect of FDI on domestic firms is clearly negative for the engineer labor market, the managerial labor market story is far from clear. Although domestic firms now have to pay higher wages for their managers, they also have a better chance of hiring someone with more education and foreign experience. Apparently, more managers have come from the outside world to regions with FDI presence. Maybe this is because compared with engineers, managers are more adventurous and thus more willing to move.

There may be other stories potentially consistent with our findings. For example, if foreign firms bring in superior skill-complementary technology and that superior technology is adopted by domestic private firms but not by SOEs, we would observe similar patterns in the spillover effects. While we do not rule out this possibility, we believe that this scenario is less likely because to our knowledge there is no convincing evidence of technological spillovers from FDI in China. In particular, as we document in our related paper (Hale and Long, 2011a), we fail to find persistent positive spillovers using the same data set as used in the current paper. Moreover, without resorting to labor market competition, our finding of a decline in the quality of engineers in SOEs when more FDI is present is hard to explain within this scenario. Nevertheless, the limitations of our data, especially the lack of the time dimension, do not allow us to formally address this and other potential explanations for our findings. Firm-level panel data sets, such as those used in Hale and Long (2011b) would potentially help shed further light on these issues.

Overall our results suggest, consistent with anecdotal evidence, that skilled labor is scarce and unskilled labor is abundant in China (at least till the time when the survey was conducted). As a result, higher competition for skilled labor induced by FDI leads to higher wages of skilled labor both in foreign invested and in domestic private firms that compete with foreign invested firms for skilled labor. SOEs appear to be unable or unwilling to increase the wages they pay to their skilled workers and as a result experience a decline in the quality of their skilled personnel. On the other hand, there is evidence that FDI has brought with it additional managerial talents, which may be a source of positive FDI spillovers worthy of more careful research in the future.

Robustness Tests

One potential concern with the data used here is that the measure of FDI presence is constructed using a small sample of firms. Thus, one may worry that a few large firms with or without foreign presence will substantially affect the average foreign share we calculate for the city-industry cell. We therefore construct the alternative measure, for five manufacturing sectors only, using the Census of Manufacturing Firms in China. We are comforted to find that the new measure is very similar to our original one: for the manufacturing sectors the simple correlation coefficient between the two FDI

measures is 0.54, the adjusted R^2 of the regression of one measure on the other and city and industry fixed effects is 0.84, and the Spearman rank correlation coefficient is 0.64.[20]

Since the new measure seems higher than our original one for three sectors in Guangzhou and one sector in Tianjin, to test whether our results are sensitive to the small differences in the FDI measure, we replace our original measure with the new measure for manufacturing sectors, while keeping the original measure for the service sectors.[21] All our results on labor quality hold both qualitatively and quantitatively. For the wage results, the *p*-values tend to increase because the new measure of FDI presence has higher variance, while qualitatively our results hold. We recover the statistical significance of the results if we use the $log(1 + new\ measure)$ instead, which better matches the mean and the variance of our original measure.

Next, we attempt alternative definitions of the FDI presence based on our original data set. First, we use the same measure of FDI presence as in the main specification, but for 2000 rather than for 1999. Our results are unchanged. Alternatively, we weigh the FDI share in each firm by the number of years since the firm first acquired a foreign partner, thus giving higher weight to FDI that has been around for longer. We find that such modification does not affect our results much. We are thus fairly comfortable with the results reported in our main specification.

We also re-estimate wage regressions controlling for the hiring conditions of the firms, specific to each type of labor, such as minimum age, education, and experience of new hires, as well as the number of job applications per vacancy. While this restricts our sample, our results are largely robust to the inclusion of such controls.

In addition to the wages and other characteristics of engineers and managers, the survey reports similar variables for a joint category of "technical and managerial" personnel. We estimate all of our regressions for this set of variables and find, as one would expect, results that are more or less the average of those for engineers and for managers, with magnitudes of the coefficients being slightly closer to those we find for engineers.

Barry, Görg, and Strobl (2005) show that FDI may have differential effects on wages of exporting and nonexporting firms. We therefore re-estimate our regressions controlling for the share of foreign sales of each firm, and the results are not affected by the inclusion of this additional control variable.

There may be the related concern that the share of exporting firms and the share of foreign firms in an industry are jointly determined and therefore

[20]See Hale and Long (2011a) for additional details and the tabulations of the alternative measure.

[21]We are unable to estimate the model for manufacturing sector only, because a small number of degrees of freedom is left when the sample is cut by half.

the share of exporting firms cannot be treated as an exogenous variable and hence it is not a valid instrument. We attempt an alternative specification, where instead of the share of exporting firms in the industry we use the share of *foreign* exporting firms in the industry. This measure is by construction exogenous to the second stage regression, which is limited to domestic firms. Our results are, in fact, stronger when we use this alternative measure to construct our instruments.

Finally, we re-estimate our instrumental variables regressions using two-stage least squares instead of GMM and obtain very similar results.

IV. Conclusion

In this paper we have found evidence suggesting that the FDI presence in China may be putting an upward pressure on wages of skilled workers through increased competition in the market for skilled labor. Such competition effects are reflected in higher wages that domestic private firms pay to their skilled workers and in a decline in quality of engineers in SOEs that appear to be constrained in what wages they can pay to their employees. We find no such competition effects in the market for unskilled ordinary workers.

These findings suggest that labor market institutions such as wage constraints have important implications on how FDI affects domestic firms. To the extent that many developing countries have rigid labor market conditions, our findings help explain why it is particularly difficult to find positive FDI spillovers in these countries.

As an example, these findings offer one reason for why Hale and Long (2011a) and others fail to find positive productivity spillovers from FDI into China, at least for SOEs. If FDI leads to a lower quality of skilled workers in SOEs, these firms may lack the human capital necessary for absorbing potential technological spillovers. This in turn implies that more privatization may be necessary in order for domestic firms to capture potential positive spillovers from FDI.

Moreover, our findings have important implications for inequality in China. In particular, because FDI presence increases wages of better paid skilled workers, but does not have an effect on wages of ordinary workers, more FDI presence is likely to lead to higher income inequality. This is, in fact, consistent with recent trends of a growing rural-urban income inequality, because unskilled labor in China is largely drawn from the pool of rural population.

APPENDIX

Variables Used in This Study

In this study, we use a small portion of the survey that gives information on firms' input, output, as well as foreign ownership. In particular, we use the following variables directly or constructed from the survey, with all values referring to year 2000 unless indicated otherwise:

Capital input:	Value of fixed assets in year 2000 RMB, used in logs.
Labor input:	Number of employees in the firm, used in logs.
Capital/Labor:	Capital intensity of the firm, measured as the ratio between capital input and labor input.
Firm age:	Firm's age.
Average education:	Average education level of ordinary workers, engineering, and managerial personnel in the firm, in years of schooling.
Average age:	Average age of ordinary workers, engineering, and managerial personnel in the firm, in years.
Average foreign experience:	Average foreign experience of engineering and managerial personnel in the firm, in years.
Transportation cost:	Transportation expenses divided by sales.
Industry:	Industry sector of the firm, a categorical variable $1, 2, \ldots, 10$.
City:	City where the firm is located, a categorical variable $1, 2, \ldots, 5$.
Largest foreign partner share:	The share of the largest foreign partner in firm's ownership in 1999.
Private ownership share:	Total share of private ownership, including portfolio investment in 1999.
Share of foreign sales:	Foreign sales divided by total sales in 1999.
Transportation cost of supplies:	Share of transportation cost in the total cost of supplies purchased in 1999.

We use the following variables from outside of our survey data to construct instruments for FDI presence:

Port berth:	The total number of berths (including both productive and nonproductive) in the port located by the city (valued at 0 if the city has no port), obtained from Chinese Statistical Yearbook 2001, National Bureau of Statistics.
Distance between cities:	The distance between the capital city of each province or autonomous region and the cities in our sample, obtained from the official website of the China National Materials, Storage and Transportation Corporation.[22]
Provincial population:	The population of each province or autonomous region, obtained from Chinese Statistical Yearbook 2001, National Bureau of Statistics.

[22]www.cmst.com.cn/mileage/mileage.asp, last accessed January 29, 2007.

REFERENCES

Aitken, B., and A. Harrison, 1999, "Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela," *American Economic Review*, Vol. 89, No. 3, pp. 605–18.

Aitken, B., A. Harrison, and R.E. Lipsey, 1996, "Wages and Foreign Ownership: A Comparative Study of Mexico, Venezuela, and the United States," *Journal of International Economics*, Vol. 40, No. 3–4, pp. 345–71.

Almeida, R., 2007, "The Labor Market Effects of Foreign Owned Firms," *Journal of International Economics*, Vol. 72, No. 1, pp. 75–96.

Amiti, M., and B. Smarzynska Javorcik, 2008, "Trade Costs and Location of Foreign Firms in China," *Journal of Development Economics*, Vol. 85, No. 1–2, pp. 129–49.

Bagchi-Sen, S., and J. Wheeler, 1989, "A Spatial and Temporal Model of Foreign Direct Investment in the United States," *Economic Geography*, Vol. 65, No. 2, pp. 113–29.

Barry, F., H. Görg, and E. Strobl, 2005, "Foreign Direct Investment and Wages in Domestic Firms in Ireland: Productivity Spillovers versus Labour-Market Crowding Out," *International Journal of the Economics of Business*, Vol. 12, No. 1, pp. 67–84.

Blomström, M., and R. Lipsey, 1991, "Firm Size and Foreign Operations of Multinationals," *Scandinavian Journal of Economics*, Vol. 93, No. 1, pp. 101–7.

Blonigen, B.A., 2005, "A Review of the Empirical Literature on FDI Determinants," NBER Working Paper, 11299.

———, and M.J. Slaughter, 2001, "Foreign-Affiliate Activity and U.S. Skill Upgrading," *Review of Economics and Statistics*, Vol. 83, No. 2, pp. 362–76.

Braconier, H., P.-J. Norback, and D. Urban, (2005), "Multinational Enterprises and Wage Costs: Vertical FDI Revisited," *Journal of International Economics*, Vol. 67, No. 2, pp. 446–70.

Cheng, L.K., and Y.K. Kwan, 2000, "What are the Determinants of the Location of Foreign Direct Investment? The Chinese Experience," *Journal of International Economics*, Vol. 51, pp. 379–400.

Conyon, S., S. Girma, S. Thompson, and P. Wrights, 2002, "The Impact of Foreign Acquisition on Wages and Productivity in the U.K," *Journal of Industrial Economics*, Vol. 50, pp. 85–102.

Coughlin, C., J. Terza, and V. Arromdee, 1991, "State Characteristics and the Location of Foreign Direct Investment Within the United States," *Review of Economics and Statistics*, Vol. 73, No. 4, pp. 675–83.

de Mooij, R.A., and S. Ederveen, 2003, "Taxation and Foreign Direct Investment: A Synthesis of Empirical Research," *International Tax and Public Finance*, Vol. 10, No. 6, pp. 673–93.

Dollar, D., M. Hallward-Driemeier, and T.A. Mengistae, 2006, "Investment Climate and International Integration," *World Development*, Vol. 34, No. 9, pp. 1498–16.

Feenstra, R.C., and G.H. Hanson, 1997, "Foreign Direct Investment and Relative Wages: Evidence from Mexico's Maquiladoras," *Journal of International Economics*, Vol. 42, No. 3–4, pp. 371–93.

Fung, K.C., H. Iizaka, and S.Y. Tong, 2004, "FDI in China: Policy, Recent Trend and Impact," *Global Economic Review*, Vol. 32, No. 2, pp. 99–130.

Girma, S., and H. Görg, 2007, "Evaluating the Foreign Ownership Wage Premium Using a Difference-in-Differences Matching Approach," *Journal of International Economics*, Vol. 72, No. 1, pp. 97–112.

Hale, G., and C. Long, 2011a, "Are there Productivity Spillovers from Foreign Direct Investment in China?" *Pacific Economic Review*, Vol. 16, pp. 135–53.

——— , 2011b, *Foreign Direct Investment in China: Winners and Losers* (Singapore: World Scientific).

Harrison, A., and J. Scorse, 2009, "Do Foreign-owned Firms Pay More? Evidence from the Indonesian Manufacturing Sector," in *Labor Markets and Economic Development*, ed. by R. Kanbur, and J. Svejnar (London and New York, Routledge: Taylor & Francis Group).

Heyman, F., F. Sjöholm, and P.G. Tingvall, 2007, "Is there Really a Foreign Ownership Wage Premium? Evidence from Matched Employer-Employee Data," *Journal of International Economics*, Vol. 73, No. 2, pp. 355–76.

Huang, Y., 2005, *Selling China: Foreign Direct Investment During the Reform Era*, Cambridge Modern China Series (Cambridge; New York and Melbourne: Cambridge University Press).

Kato, T., and C. Long, 2006, "Executive Compensation, Firm Performance, and Corporate Governance in China: Evidence from Firms Listed in the Shanghai and Shenzhen Stock Exchanges," *Economic Development and Cultural Change*, Vol. 54, No. 4, pp. 945–83.

Kravis, I., and R. Lipsey, 1982, "The Location of Overseas Production and Production for Export by U.S. Multinational Firms," *Journal of International Economics*, Vol. 12, No. 3/4, pp. 201–23.

Lipsey, R., and F. Sjöholm, 2004, "Foreign Direct Investment, Education and Wages in Indonesian Manufacturing," *Journal of Development Economics*, Vol. 73, No. 1, pp. 415–22.

Liu, L., C. Long, and R. Jing, 2007, "Effects of Firm Ownership on Employment Compensation," manuscript, School of Economics and Management, University of Electronic Science and Technology of China.

Ma, A., 2006, "Export Spillovers to Chinese Firms: Evidence from Provincial Data," *Journal of Chinese Economic and Business Studies*, Vol. 4, No. 2, pp. 127–49.

Megginson, W.L., and J.M. Netter, 2001, "From State to Market: A Survey of Empirical Studies on Privatization," *Journal of Economic Literature*, Vol. 39, pp. 321–89.

Moran, T.H., 2006, *Harnessing Foreign Direct Investment for Development: Policies for Developed and Developing Countries* (Washington DC: Center for Global Development).

Sun, Q., W. Tong, and Q. Yu, 2002, "Determinants of Foreign Direct Investment Across China," *Journal of International Money and Finance*, Vol. 21, pp. 79–113.

Zhao, Y., 2001, "Foreign Direct Investment and Relative Wages: The Case of China," *China Economic Review*, Vol. 12, No. 1, pp. 40–57.