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The Wage Effects of Foreign Acquisition of Chinese Privately-Owned Enterprises

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ABSTRACT

This paper focuses on magnitude of the short-run effect of foreign takeover of Chinese privately-owned enterprises in the manufacturing industry and assesses its effect on the average wage based on the firm-level data in the period 2005-07. Using a combination of propensity score matching and difference-in-difference framework, we quantify the causal effect of foreign takeover on average wage level by pairwise matching the acquired firms with domestic firms along similar characteristics (size, debt, location, age, etc.). Our findings suggest no evidence of a wage increase in the acquired firms during the first two years after the foreign takeover. Rather, the wage differential observed in the literature may stem from inherent better performance that makes the firms more attractive to foreign acquisition.

Keywords: *Foreign Direct Investment, Firm Productivity, Spillovers, Emerging countries*

1. INTRODUCTION

Since adopting the "open door" policy and joining the World Trade Organization (WTO), China has become a leading recipient of foreign direct investment (FDI) which contributed to the high GDP growth rate in China during the 2000s. Having recognized the foreign direct investment as an important engine of productivity growth and technological development, the Chinese government introduced a series of liberalization programs, including tax incentive to attract foreign investors. According to the Report of Foreign Direct Investment in China (2013) [19], there were 1272 foreign mergers and acquisition cases worth $1.42 billion in 2006 and 724 of them happened in the manufacturing industry, amounting to 44% of the total transaction value. Besides its impact on total productivity, foreign participation creates more job opportunities for domestic Chinese workers, resulting in structural change in the local labor market [3].

Policymakers are interested in the wage effect of foreign investment can help bring up the overall level of productivity and total GDP growth. However, most previous studies have focused on the productivity change resulting from FDI in China rather than on the wage gain. Motivated by the foreign wage premium found in a couple of industrialized countries, this paper investigates the relationship between FDI and average wage in China.

In this paper, we examine the short-run wage effect of foreign takeover of Chinese firms by comparing the average wage in firms that experienced foreign takeover in 2006 and firms that remained in domestic hands between 2005-07 An estimation based on the direct comparison will suffer from substantial endogeneity since foreign takeovers may "cherry-pick" the better-performing firms. We reduce the selection bias by combining the propensity score matching method with the difference-in-difference (DiD) framework.

This paper augments the literature by focusing on a detailed firm-level panel data. Previous literature has made great attempts to capture the industry effect in Howenstine and Zeile (1992) [13] and Davis and Haltiwanger (1992) [5] or the fixed firm-level effects in Frydman et al. (2000) [8]. We augment the propensity score matching method and the DiD model introduced by Girma [11] that incorporates the time-invariant unobservable characteristics in acquisition decision in order to identify the effect of a foreign takeover on wages the potential endogeneity of the acquisition decision that could only be observed indirectly in the change of firm ownership. We improve the model by isolating the isolate the contemporaneous wage growth to get more precise estimation of the foreign wage differential in private firms.

Our results indicate that there is potential selection bias in foreign acquisitions that makes the observed wage of effect of foreign acquisition highly significant since the concentration of foreign companies in an industry in a particular region not only brings higher productivity but also raises the wage in all plants, including foreign-owned and domestic-owned.

2. LITERATURE REVIEW

A wealth of literature has compared foreign-owned and domestic firms. Using firm-level data, most papers control for the heterogeneity across firms to investigate the average effect of foreign participation on wages.

Accounting for industry effects, Howenstine and Zeile (1992) shows that foreign-owned plants in the US pay higher wages (around 30%) than domestic firms because on average they tend to be more capital intensive and have a higher proportion of skilled labor [13]. Arguing that there might be potential plant-level heterogeneity within the same industry, Davis and Haltiwanger (1992) evaluate the problem using sub-industry data and the resulting difference they find is much smaller than the one presented in the previous study [5]. Doms and Jensen (1998) use a detailed dataset of newly available plant-level data for all US manufacturing firms and find a relatively small wage differential (around 3%) after controlling for idiosyncratic firm characteristics [17]. Using a simple instrumental variable estimation based on a short panel of UK firms, Conyon et al. (2002) find that wages are only 3.4% higher in companies that have been acquired by foreign owners compared to those that have remained domestic [4]. By controlling for firm type, Martins (2004) reveals a much smaller average wage premium than in previous literature for Portugal. In the same country, however, the observed foreign wage differential is argued to be entirely attributable to the foreign investors' cherry-picking of acquisition targets [1].

The acquisition selection problem has not received much investigation in existing empirical studies. Frydman et al. (2000) for the Czech Republic, Hungary and Poland uses fixed effects (FE) to compare the post-acquisition changes in firms in the Czech Republic [8], Hungary and Poland, the paper tries to capture the effect of "treatment" of performance growth, (i.e. change in ownership) by dividing the entire sample into control group (firms that stay in domestic hands) and treatment group (firms acquired by foreign investors).

However, given the limitation of the FE model, researchers have proposed a DiD matching approach at the pretreatment period to be able to identify the effect of a foreign takeover on wages. Given a large set of panel data on individual firms and workers, Sjoholm and Tingvall (2007) [21] control for the worker heterogeneity as well as selection bias using the matched employee-employer data on the entire Swedish private sector. The results suggest that the foreign wage premium is small and almost disappears once the unit of observation on wages is changed into the individual-level Acknowledging the potential endogeneity of the acquisition decision that could only be observed indirectly in the change of firm ownership, Girma combines propensity score matching method with the difference-in-differences technique to analyze the causal effect of the foreign take over on wages [11]. Based on the assumption that the acquired indicator is not correlated with any contemporaneous shock, a control group is selected based on the result of propensity score matching to construct a valid counterfactual for the average wage comparison. Estimating the wage effect they find relatively small foreign a wage premium (3% for skilled workers, 6% for unskilled workers) significant only for US owners.

In the case of China, most studies focus on the effects of foreign takeover on the productivity of domestic firms while the empirical evidence on wage inequality remains unexplored. Wei and Liu (2006) find that foreign participation generates higher productivity within-industry and between industries [16]. However, in the long run, there is no evidence of systematic positive productivity and wage effects within industry (Hale and Long, 2007) [12].

Based on the existing literature, we adopt the difference-in-differences propensity score matching mechanism to control for firm heterogeneity and selection bias in our analysis of the foreign wage differential. The difference-in-differences model based on the matched sample is arguably more appropriate since no strong exogenous assumptions and exclusion restrictions are needed for the implementation. We extend and improve upon the proposed estimation model by using a regression framework that allows for contemporaneous shocks with the acquisitions and details of the estimation approach are described in the following section.

3. DATA DESCRIPTION

We use the firm-level panel data spanning the period 2005-07 from the Chinese industrial enterprise database collected by the National Bureau of Statistics of China. The dataset contains firm identification, operational and financial reporting information for all state-owned enterprises and privately-owned enterprises with an annual turnover higher than 5 million yuan. Firms in the manufacturing industry are 90% of observations in the dataset. We narrow our focus to manufacturing firms. Firms in the dataset are classified into four types: state-owned enterprises, collective-owned enterprises, privately-owned enterprises, and foreign-owned enterprises. We focus on privately-owned which are 38.8% of all firms in the dataset. Privately-owned enterprises outperform state-owned enterprises in profitability since their operating and monitoring systems are more efficient [9]. Furthermore, there are more policy restrictions in place when foreign owners attempt to acquire a state-owned or collectively owned firm than a privately-owned outfit. The dataset includes identification information variables for each firm such as location, industry affiliation, registration type and establishment year. Operational information and financial information variables include the number of employees, gross output, asset, equity, export, total wage and so on.

Since we are interested in the effect of ownership change on wage, we need at least one-year post-

acquisition information to examine the short-run wage effect. We examine the wage change in firms being acquired by foreign capital in 2006. Using the registration type to trace the ownership change, we identify the foreign acquisitions by finding firms that switched from the privately-owned category in 2005 to foreign owned in 2006. We drop firms that experienced foreign takeover in 2006 and reported another ownership change in 2007. To obtain a balanced panel data, we drop firms that appear for less than three years. Thus, our sample consists of 82 firms domestically owned that underwent foreign acquisition in 2006, and 38,485 firms held domestically for all three years.

Table 1 summarizes average wage and financial information for private firms being acquired by foreign capital and private firms remaining privately-owned in 2006. In 2005, the firms experiencing foreign takeover offered higher average wage than the firms remaining domestically owned. Moreover, the differences increase after 2006 when the takeover happened. Importantly, the standard deviations of the average wage and financial variables are relatively large in the dataset. To reduce the variance, we use log transformation for most of the variables in this analysis. According to the summary statistics in 2005, firms experiencing foreign takeover generally had higher industrial add-on value, assets, equity and hired more workers. It implies that foreign investors are more interested in firms with larger size and higher productivity. Interestingly, the average firm being acquired has existed for few years, which shows that foreign investors are more attracted to younger firms. Labor productivity is approximated by industrial add-on value per employee, and the capital-labor ratio is the net total fixed asset per employee. Intangible assets were not reported in 2007.

Table 1: Sample statistics

	2005		2006		2007	
	non-acquisition	acquisition	non-acquisition	acquisition	non-acquisition	acquisition
average wage	15.11	19.07	17.09	21.82	20.25	28.33
	(18.37)	(14.64)	(16.41)	(17.10)	(19.07)	(22.52)
industrial add on	36217.8	49797.4	42763.8	79036.8	51387.0	83529.4
	(289107.7)	(147456.0)	(345198.8)	(190908.5)	(414167.7)	(215271.3)
employment	345.4	492.9	351.8	655.5	354.5	603.2
	(1169.7)	(1028.8)	(1267.4)	(1288.1)	(1381.7)	(944.3)
equity	48694.2	59318.0	55453.6	112039.3	64791.6	100386.6
	(465850.2)	(150843.7)	(550014.4)	(281566.1)	(663238.3)	(295181.5)
plant age	11.29	9.039	12.18	9.942	13.11	11.27
	(10.89)	(6.125)	(10.80)	(6.821)	(10.72)	(6.029)
total asset	117067.8	153153.2	132002.7	235367.6	152619.5	243659.4
	(924765.7)	(511872.3)	(1080157.5)	(580740.8)	(1324149.5)	(704845.7)
net fixed asset	42229.7	49617.9	46369.3	79935.8	50668.6	78892.4
	(436814.1)	(166483.8)	(514507.4)	(246211.6)	(568697.4)	(356233.2)
intangible asset	3660.0	5123.1	4123.4	10343.0	0	0
	(32559.7)	(26909.2)	(43229.2)	(54271.6)	(0)	(0)
debt	68373.7	93835.3	76629.2	123328.3	87827.9	143272.8
	(524139.0)	(383226.8)	(610291.4)	(322087.1)	(748395.1)	(448420.1)
labour productivity	108.4	115.3	126.9	138.3	150.8	170.0
	(272.4)	(200.3)	(304.5)	(175.7)	(572.3)	(310.8)
capital labour ratio	97.13	107.1	102.5	140.3	113.2	125.4
	(611.0)	(187.2)	(597.7)	(190.1)	(719.1)	(203.5)

Note: standard deviations are in the parentheses

4. EMPIRICAL METHODOLOGY

Considering the problem of nonrandom treatment in evaluating the causal effect of foreign acquisition on wages, we employ a combination of matching and difference-in-differences analysis suggested by Blundell and Costa Dias (2000) [2]. Somewhat different from the standard DiD or propensity score matching (PSM) framework, our approach loosens the exogenous restrictions in the standard models and is preferable given the same set of firm characteristics that could affect both the treatment and average wages. Based on the result of propensity score matching, a difference-in-differences estimator is obtained that captures the effects of foreign acquisition on average wages in the firms.

Let $A_{it} \in \{0,1\}$ denote an acquisition indicator equal to 1 if establishment *i* is acquired at time *t* and 0 otherwise. And let $w^1_{i,t+s}$, $s \geq 0$ be the wage at time *t*+*s* following the acquisition and $w^0_{i,t+s}$ be the wage of the firm had it not been acquired. The wage effect of foreign ownership would is $w^1_{i,t+s} - w^0_{i,t+s}$. However, $w^0_{i,t+s}$ is unobservable for firms that have been acquired so there is a fundamental problem of unobservable situation in this causal-effect evaluation. Hence we estimate the average acquisition effect on treated firms, a measure widely used in non-experimental studies to capture the causal effect (Dehejia and Wahba, 2002). Based on the conditional independence assumption $(w^0, w^1) \perp A|X$, the average treatment effect on the treated (ATT) would be identified as

$$E\{w^1_{i,t+s} - w^0_{i,t+s}|A_{it} = 1\} = E\{w^1_{i,t+s}|A_{it} = 1\} - E\{w^0_{i,t+s}|A_{it} = 1\} \qquad (1)$$

where the last term in the equation, the average wage of the acquired firm had they not received the treatment, is estimated using the average wage of the counterfactual domestic firms in the control group, $E\{w^0_{i,t+s}|A_{it} = 0\}$.

To obtain a valid approximation of the foreign wage differential, we follow the PSM procedure suggested by Rosenbaum and Rubin [20]. We construct a sample of acquired and control group firms conditional on a number of observable firm characteristics in the pre-acquisition period. As discussed in Gerfin and Lechner (2002), the accuracy of the matching depends on the richness of the available information on the observations [10]. Given a detailed dataset of firm-level characteristics, we perform the matching based on the propensity score which is the probability of being acquired using the probit model:

$$P(A_{it} = 1) = F(X_{it-1}, D_{it}) \qquad (2)$$

where *D* is the full set of location and industry dummies, and the vector *X* consists of firm size (proxied by the log of total assets), debts, intangible

assets, labor productivity, plant age, capital intensity, the level and the growth of the average wage during the pre-acquisition period. Among the matched sample, being acquired by foreign capital conditional on the covariates *X* is random since firms have very similar pre-treatment characteristics. Thus, the conditional independence assumption should be satisfied.

Influenced by existing evidence presented in the empirical literature on foreign acquisitions, we choose these observable pre-treatment characteristics to control for the probability of foreign acquisitions for each firm. We expect that foreign investors would "cherry pick" larger firms with higher labor productivity and with lower debt level prior to an acquisition. Also, the level and the growth of the wage before the acquisition are both included to account for the fact that foreign firms may target high or low wage firms in Sjoholm and Lipsey (2006) [22]. The capital intensity, estimated by the capital-labor ratio, is another important determinant of foreign acquisition when investors are evaluating the production efficiency of a particular firm [17]. As a determining factor in foreign acquisition, the value of intangible assets (goodwill, brand recognition, and intellectual property) is also included as an important factor for foreign takeover decision.

To use as many as comparison units available as possible, we employ the 'caliper' matching method where for each acquired private firm *i*, the nearest domestic firms whose propensity score falls within a particular radius are selected as the control group. Let P_i be the predicted probability of being acquired for firm *i* in the treatment group and P_j be the probability for firm *j* in the control group, the caliper matching algorithm could be expressed as:

$$\delta > P_i - P_j = \min_{k\in\{D=0\}}\{|P_i - P_k|\} \qquad (3)$$

where δ is the matching radius set to 0.0001 given the total number of firms in the sample. Additionally, we implement the common support condition suggested by Dehejia and Wahba [6] which allows us to drop private firms in the treated group whose propensity score is lower than the minimum or higher than the maximum propensity score in the control group. The overlap condition $0 < P(D = 1|X) < 1$ ensures that private firms in China with the same *X* values have a positive probability for being acquired and not acquired. Based on the propensity score distribution in the common support region, the standard matching estimator could be estimated the difference in average wage between the acquired firms in the treated group N and the weighted comparison group C as:

$$\frac{1}{|N|}\sum_{i\in N}\left(w_{it} - \sum_{j\in C} g(P_i, P_j) w_{jt}\right) \qquad (4)$$

where $g(P_i, P_j)$ is the weight assigned to each domestic firm in the control group as a function of P_i and P_j. And in the following analysis, we use the subsample of matched firms with on support as the sample of observations.

Given a panel data of firms, we adopt a DiD methodology on the matched sample instead of directly estimating the level of foreign wage differential on average wages. The difference-in-differences estimator, based on the PSM result, would enable us to examine the dynamic wage effects of foreign ownership on Chinese private firms and improve the overall quality of our evaluation results. Furthermore, the DiD matching estimator used in this paper could eliminate unobserved firm-level fixed effects between the treated firms and their selected counterfactuals (that the standard matching method fails to capture [23] .

Adopting the standard differences-in-differences methodology for the matched firms, the impact of the foreign takeover on average wages could be estimated using the equation:

$$\ln w_{ijt} = \alpha_t + \beta_1 A_{ijt} + \beta_2 T_{ijt} + \beta_3 A_{ijt} * T_{ijt} + \gamma X_{ijt} + \varepsilon_{ijt} \qquad (5)$$

where A_{ijt} is a dummy equal to one for the periods after the foreign takeover and zero otherwise. T_{ijt} represents the group effect which equals to one if the firm is in the treatment group and 0 if it's in the control group and α_t is the aggregate time effects that are common between the two groups. A set of *X* covariates are also included to control for current firm characteristics. Noted the coefficient β_3 on the coefficient interaction term of A_{ijt} and T_{ijt} captures the Diff-in-Diff effect of foreign ownership in the private firms while the parameter β_2 estimates the differences in average levels between acquired and non-acquired firms in the pre-treatment period.

However, the estimated result may be a biased estimator given the fact that the impact of foreign ownership on average wages may be affected by other factors which are contemporaneous with the acquisition. To ameliorate this, we add another set of dummies capturing the exogenous shocks that are contemporaneous with the acquisition effect to obtain an unbiased estimator for the foreign wage differential. The extended regression model could be expressed as:

$$\ln w_{ijt} = \alpha_t + \theta_1 C_{ijt} + \theta_2 P_{ijt} + \theta_3 T_{ijt} + \theta_4 C_{ijt} * T_{ijt} + \theta_5 P_{ijt} * T_{ijt} + \gamma X_{ijt} + \varepsilon_{ijt} \qquad (6)$$

where C_{ijt} is a contemporaneous dummy, which equals to 1 if t = 2006 and 0 otherwise, and P_{ijt} is for the period one year after the foreign takeover. $C_{ijt} * T_{ijt}$ captures the contemporaneous DiD effect, and $P_{ijt} * T_{ijt}$ captures the Diff-in-Diff effect one year after the ownership change. The treatment indicator T_{ijt} and covariates X_{ijt} are the same as those in the previous model.

5. EMPIRICAL RESULTS

5.1. Propensity score matching

Following the methodology described in Section 4, we implement the propensity score matching with 'caliper' method. We use log wage, labor productivity, log intangible asset, log debt, wage growth, capital-labor ratio and plant age in the pre-treatment period and a full set of location and industry dummies as covariates to estimate the propensity score of being acquired by foreign investors. Based on the propensity score, we identify a control group of firms in a matched sample.

Table 2: Summary statistics of matched and unmatched sample

table II: Matched sample and Unmatch sample statistics

	Unmatched Untreated		Matched untreated		Matched treated	
	Before	After	Before	After	Before	After
log average wage	9.454	9.591	9.468	9.606	9.570	9.694
	(0.344)	(0.328)	(0.333)	(0.318)	(0.399)	(0.318)
labor productivity	80.44	93.24	86.30	104.9	114.8	155.1
	(133.2)	(179.5)	(109.1)	(143.3)	(214.2)	(230.1)
log intangible assets	6.799	6.973	6.728	7.083	7.270	7.674
	(1.776)	(1.739)	(1.812)	(1.581)	(2.245)	(2.149)
log debt	9.636	9.820	9.831	9.951	10.20	10.56
	(1.167)	(1.168)	(1.100)	(1.107)	(1.222)	(1.329)
wage growth	0.120	0.216	0.116	0.221	0.374	0.205
	(0.531)	(0.599)	(0.388)	(0.590)	(0.740)	(0.301)
capital labour ratio	80.18	87.41	75.87	86.65	76.41	84.43
	(116.8)	(116.8)	(102.5)	(121.0)	(79.72)	(100.1)
plant age	10.35	11.35	9.549	10.59	9.391	10.67
	(9.160)	(9.104)	(7.868)	(7.853)	(9.438)	(9.749)
log total asset	10.13	10.31	10.28	10.45	10.77	11.14
	(1.084)	(1.106)	(1.042)	(1.068)	(1.118)	(1.052)

Note: standard errors are in the parentheses

Table 2 presents the summary statistics for the unmatched control group and the matched sample in 2005 (pre-treatment period) and after 2006 (post-treatment period). In the propensity score matching procedure, only 43 treated firms and 3960 control firms are considered since firms with missing values in pre-treatment characteristics are omitted in the propensity score calculation. Moreover, 23 out of 43 treated firms that could be matched with a counterfactual based on the propensity score are identified as "on support" while the other 20 firms with extremely high propensity scores are excluded since it's hard to find a corresponding counterfactual in the untreated group (Fig.1). Based on the propensity score, 375 among 3960 domestic firms are matched to the treatment firms. Therefore, the matched sample consists of 23 treatment firms and 375 control firms. In general, the matched control group share more pre-treatment firm characteristics with the treatment firms compared to the unmatched control group. Additionally, the control firms being matched offer higher wage and have higher productivity than the control firms that are not matched.

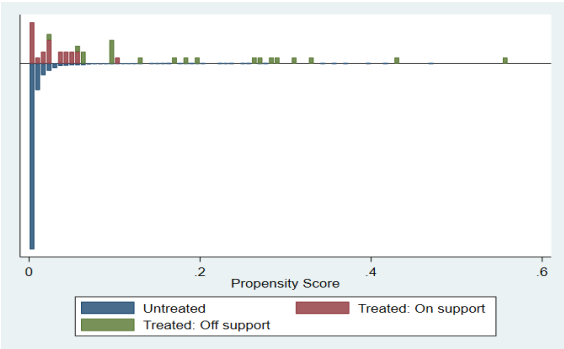
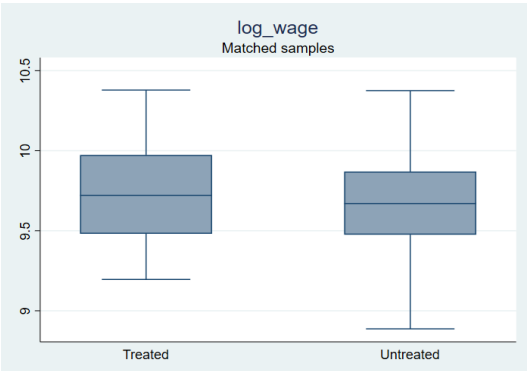


Figure 1. Propensity score distribution and common support area

More importantly, the matching estimator has successfully reduced the selection bias that seems to overestimate the dynamic wage effect of foreign ownership in the unmatched sample. Fig.2 shows that in the unmatched sample, pre-treatment trend seems to be unparalleled between the treatment group and control group while the trend tends to be paralleled between the target firms and its selected counterparts. As shown the boxplot of the log wage in 2006 between the treatment and control group in the matched sample, the average wage in treated firms falls between 25 percentile and 75 percentile of the wage in control firms which indicates that the wage increase observed after the foreign takeover comes from the heterogeneity of firms characteristics rather than the change in ownership. In the matched sample, there is only small wage change in the year when a takeover happened, while the wage change in the year after takeover is moderate. Taking only on-support firms in the matching procedure as the subsample, the wage trend seems to be similar between the treatment and control group before and after the foreign acquisition while on average, firms experiencing foreign takeover offer a higher wage than firms remaining domestically-owned.



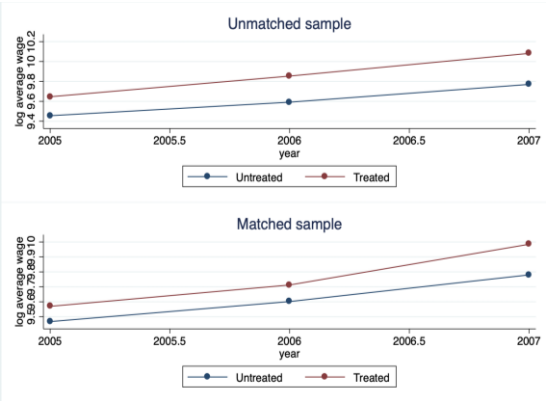


Figure 2. Wage in the matched and unmatched sample

In the late 1990s, privatization of state-owned enterprises in China established a completely new external labor market, reallocating workers to the private sector and linking income to productivity. Due to the well implemented one-child policy and the low fertility rate of newborn babies, China already experienced a labor shortage in early 2008, especially in coastal areas. Moreover, workers from rural area were able to find a job closer to home as factories and firms were moving from coastal regions to inland provinces for lower labor cost. And this structural change raised the wage in both coastal regions and inland regions. Thus, Li et al (2012) argue that Chinese workers experience large wage increase across groups of workers, industries, and regions since the late 1990s [14]. Therefore, under the universal shock in labor demand, the treated firms and control firms with similar pre-acquisition performance characteristics experienced similar wage growth. More importantly, the matching results, satisfying the parallel trend assumption, further ensures the internal ability of the DiD model to capture the causal relationship between foreign ownership and average wage over time.

5.2. Test for Balancing

As emphasized by Rosenbaum and Rubin [20], the so-called balancing condition of the propensity score must be satisfied with the data. Given the propensity score p(X), it must be true that $A \perp X|\ p(X)$, i.e, on average, the treatment and control observations with the same propensity score should have the same distribution of characteristics. we use the first balancing test described in Smith and Todd (2005) [23] to examine the standardized bias for all the covariates X used in the propensity score estimation. The standardized bias for a variable *x* based on |N| acquired firms could be expressed as:

$$\mathrm{SDBIAS}(x) = \frac{100 * \frac{1}{|N|}\sum_{i\in N}\left[x_i - \sum_{j\in C} g(P_i, P_j) x_j\right]}{\sqrt{\frac{\mathrm{Var}_{i\in A}(X) + \mathrm{Var}_{j\in C}(X)}{2}}} \qquad (6)$$

where the difference in the mean value of *x* between the treatment group *N* and control group *C* are scaled by the corresponding average variances in each group. The test results for the matching for year 2006 are reported in Table 3.

Table 3. Balancing tests for matching for 2006

Variable	Unmatched / Matched	Mean Treated	Mean Control	%bias	%reduct |bias|	t-test t	t-test p>|t|	V(T)/V(C)
lag_log_wage	U	9.6459	9.4554	50.4		3.61	0.000	1.43
	M	9.5696	9.5673	0.6	98.8	0.02	0.985	0.91
lag_labor_productivity	U	111.78	80.998	20.3		1.53	0.127	1.67
	M	114.82	97.335	11.5	43.2	0.35	0.730	3.69*
lag_log_intangible_assets	U	7.5674	6.7924	39.1		2.83	0.005	1.48
	M	7.2701	7.2187	2.6	93.4	0.08	0.936	1.14
lag_log_debt	U	10.863	9.6548	97.8		6.77	0.000	1.26
	M	10.276	10.466	-15.3	84.3	-0.52	0.608	0.93
lag_wage_growth	U	.27742	.11917	27.7		1.98	0.047	1.43
	M	.37447	.25353	21.1	23.6	0.63	0.529	1.90
lag_capital_labour_ratio	U	101.83	79.77	19.7		1.25	0.213	0.88
	M	76.414	90.216	-12.3	37.4	-0.57	0.570	0.91
lag_plant_age	U	8.3953	10.278	-22.8		-1.36	0.174	0.66
	M	9.3913	9.0892	3.7	84.0	0.13	0.901	2.03
lag_log_total_asset	U	11.341	10.148	103.2		7.19	0.000	1.28
	M	10.77	10.873	-8.9	91.4	-0.30	0.763	0.90

Sample	Ps R2	LR chi2	p>chi2	MeanBias	MedBias	B	R	%Var
Unmatched	0.116	55.21	0.000	47.6	33.4	115.3*	1.24	0
Matched	0.032	2.03	0.980	9.5	10.2	40.9*	1.15	13

For each lagged variable used in calculating the propensity score, the table presents the estimated percentage bias separately for the unmatched and matched sample of firms in the year 2005. In general, we observe a relatively low standardized bias (smaller than 25% suggested by Rosenbaum and Rubin [20] for the matched sample which indicates that on average the treatment and comparison groups are balanced in terms of the covariates. To test the null hypothesis that the two values of each covariate *x* are equal in treatment and control group, the formal paired t-test reports a large p-value (52.9% to 98.5%) which indicates that there's no significant evidence for unbalancing after matching. More importantly, the propensity matching procedure has substantially reduced the observable bias in the original sample according to the estimation in the table and the distribution presented in Fig.3.

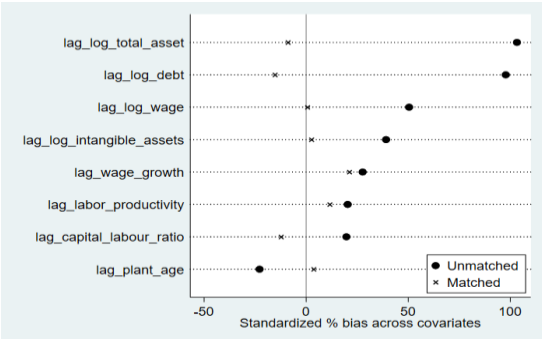


Figure 3. Standardized Bias across covariates for matched and unmatched sample

5.3. Difference-in-Difference estimation

As discussed in Section 4, we implement the DiD methodology with contemporaneous dummies following the propensity score matching technique. We also present

the results of the standard DiD model in column 2 of Table 4 to compare with the estimation in previous literature. Grouping by firms, we use the clustered standard error in an OLS regression to account for possible serial correlation. Since information on intangible assets is not available for 2007, we only include labor productivity, capital-labor ratio, debt, total asset and plant age as our control variables.

In the standard DiD model, the variable *treatment*year* after 2006 captures the effect of foreign ownership on wage. The estimated coefficient is 0.0602 but the effect is not statistically significant The DiD estimations in our paper are close to those presented in existing literature. For example, Girma find the wage premium to be 6% and 3% respectively for unskilled and skilled workers in the food and electronics industries [11].

Using the model with contemporaneous variables, we first consider the impact of foreign ownership on the full sample, which includes 43 treatment firms and 3960 control firms. The variable *Foreign acquisition contemporaneous* captures the DiD effect in the year when foreign takeover happened while *Foreign acquisition posterior* represents the wage difference in the year after the foreign takeover. Table 4 shows that the positive coefficients on the post-acquisition dummies have larger coefficients than the contemporaneous ones in all four OLS regressions. Observing the same pattern in Fig.2, we infer that it takes time for firm productivity and wages to adjust after foreign acquisition. Standard DiD model aggregates both the contemporaneous effect and lagged effect resulting in a smaller

Table 4: OLS regressions with DiD coefficient in matched and full sample

	full sample	matched sample	matched sample	matched sample	matched sample
Foreign acquisition	0.101	0.131	0.102	0.0698	0.134
	(1.76)	(1.72)	(1.22)	(0.79)	(1.76)
year 2006	0.125***		0.134***	0.116***	0.115***
	(23.68)		(7.01)	(5.96)	(5.83)
year 2007	0.294***		0.313***	0.278***	0.280***
	(44.99)		(14.96)	(13.05)	(13.05)
Foreign acquisition contemporaneous	0.0621		0.00896	0.00587	0.00995
	(0.99)		(0.17)	(0.12)	(0.19)
Foreign acquisition post	0.116		0.103	0.106	0.110
	(1.93)		(1.16)	(1.21)	(1.23)
labour productivity	0.0000357	0.000287*		0.000277*	0.000263*
	(0.98)	(2.52)		(2.26)	(2.39)
capital labour ratio	0.000201***	0.000297		0.000164	0.000302
	(4.99)	(1.85)		(1.04)	(1.94)
log debt	-0.0581***	-0.0639**		-0.0569*	-0.0688**
	(-5.75)	(-2.76)		(-2.31)	(-3.04)
log total asset	0.117***	0.0785**		0.101***	0.0789**
	(10.52)	(2.98)		(3.60)	(3.03)
plant age	-0.000487	0.00395**		0.00136	0.00357*
	(-0.95)	(2.60)		(0.98)	(2.38)
after year 2006		0.196***			
		(10.88)			
treatment*year after 2006		0.0602			
		(0.96)			
constant	8.746***	9.270***	9.468***	8.939***	9.320***
	(113.59)	(42.69)	(549.60)	(58.48)	(43.75)
City dummies	Yes	Yes	No	No	Yes
Industry dummies	Yes	Yes	No	No	Yes

Note: t statistics are in the parentheses (robust standard error clustered by firm)
* p<0.05, ** p<0.01, *** p<0.001

Fig.2 shows that propensity score matching helps reduce this bias originating in firm heterogeneity and the selection problem. Coefficients of the contemporaneous effect and posterior effect are both positive across the three regressions in the matched sample though they are statistically insignificant. The estimated coefficients, examining the post-acquisition wage effect, are similar in magnitude, around 10%, across three specifications in the matched sample. Adding control variables and a full set of city and industry dummies in the regression model, do not result in significant changes in the estimated foreign wage premium indicating that the paired samples have relatively low between-group variation in firm-level characteristics.

In the matched sample with the full set of location and industry dummies, the contemporaneous effect estimation is 0.01 while the posterior effect is estimated at 0.11. The estimated post-acquisition effect indicates that on average the acquired firms offer wages that are 11% higher in the year after foreign takeover than control firms. Even if we control for firm characteristics, the t-statistics on the estimated causal effect is not still significant at 5% significance level and the results may be caused by other factors. First, we have shown that the contemporaneous effect is smaller than the posterior effect by a significant amount. After the buyout, the foreign owner needs some time to negotiate new salary contracts in the firm and at the same time, it takes time for firm-specific assets to be transferred to the acquired firm. hence a significant wage change in acquired firms may not be observed in the first two years after the foreign takeover.

Secondly, we see a clear upward trend in the overall wage level in the manufacturing industry. However, the observed wage increase in the whole industry may be driven by the foreign spillover that is likely to affect the productivity in domestic firms and reduce the gap between the foreign and domestic-owned firms. Using DiD technique to capture the wage effect, we may underestimate the wage effect of a foreign takeover. Furthermore, even though we control for sub-industries in our regression model, there may still be product heterogeneity across firms in the same industry that requires firms to offer different salary contracts based on the specific processing and skill requirements. Finally, the results we find may be explained by the binding contracts on production and employment between the Chinese local government and the foreign owners. Different business cultures may constrain foreign investors in communicating with the local government authorities and sometimes feels constrained by the local rules on use of labor.

Examining the results on firm performance characteristics, we find that the estimated coefficients on labor productivity and total assets both have the expected positive sign and are statistically significant at the 95% confidence level. The results suggest that larger firms with higher productivity usually pay a higher wage relative to total revenue. We also find a negative relationship between the average wage and the debt level. In column 5 of Table 4, the coefficient

on log debt is -0.07 which indicates that the average wage will be 7% lower for every additional 10% increase in debt, ceteris paribus. Having experienced some amount of operating loss, firms cut its input cost and take in additional debt that will further decrease total productivity as well as total profits.

6. CONCLUSION

In this paper, we use firm-level panel data between in the period 2005-07 to examine the effect of a foreign takeover on the average wage of Chinese firms in the manufacturing industry. Given the panel data structure, we combine the propensity score matching technique with the DiD econometric model to identify the causal relationship between foreign takeover and wage in firms. Fully utilizing the panel data of firm performing metrics (including log wage, labor productivity, log intangible asset, log debt, wage growth, capital-labor ratio and plant age), we adopt the "caliper" method that matches each acquired firm with a set of domestic firms in the control group whose propensity score fall within a range (0.0001) of the propensity score of the acquired firm. In addition to the standard DiD econometric (DiD) framework, we also capture any contemporaneous shock caused by the foreign takeover.

Our results arein line with those in Sjoholm, and Tingvall (2007) [21], suggesting that the post-acquisition wage effect has been exaggerated in previous studies since they fail to control for the potential selection bias in foreign acquisitions. One possible explanation for the result is that the concentration of foreign companies in an industry in a particular region not only brings higher productivity but also raises the wage in all plants, including foreign-owned and domestic-owned. and Sjöholm and Lipsey [22] argue that the higher wage level in foreign companies combined with positive wage effect in domestic firms lead to an increase in overall average wage in an industry. It may result from the change of the labor market after an influx of foreign capital. This is supported by the fact that the DiD model produces an estimator of the causal effect that is not statistically significant.

Furthermore, we believe a more detailed investigation of the wage dynamics following the foreign takeover would be necessary given more available data. In addition to the firm-level characteristics, the impact of foreign ownership may account for heterogeneity in worker types that we could control for if detailed information on individual workers were available. Foreign investors, targeting domestic firms to expand their market in China, often prefer skilled to unskilled workers that could quickly adapt to new technology and more sophisticated production methods. However, the positive effect of labor demand for skilled labor could be offset by the negative wage effect for unskilled workers, making the coefficient on average wage insignificant. In order to make firmer conclusions on the causal relationship between foreign acquisition and wage level, further research on labor demand is necessary to examine the wage effect on different types of workers over a longer time horizon.

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