

# Is Cracking Down on Corruption Really Good for the Economy? Firm-Level Evidence from a Natural Experiment in China\*†

by

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## ABSTRACT

This paper investigates the negative consequences of anti-corruption measures on economic outcomes. By exploring an unexpected corruption crackdown in Northeast China in 2004, we are able to use a high-quality survey of large-scale manufacturing firms that is available around early 2000s. We find that the crackdown significantly lowers firm productivity and reduces firm entry in affected regions after the event. The negative impacts on labor productivity and entry are mainly borne by private and foreign firms instead of state-owned firms. We attribute these negative impacts to the breaking up of firms' political connections and the removal of the "grease of the wheels" that helps firm perform in weak market institutions. We also find that the corruption crackdown leads to an increase in the perceived corruption levels among employees in both private and public sectors, which suggests that the crackdown may have revealed corruption levels that are beyond the general expectation.

Keywords: anti-corruption, economic development, productivity, entry

JEL: D73, L25, M13, O12

## I. Introduction

Practitioners, NGOs, and political and economic leaders all around the world take serious measures to crack down on corruption. On December 9, 2003, 140 countries signed the United Nations Convention Against Corruption (UNCAC). States across the world are obligated to take anti-corruption efforts in both the public and private sectors. Despite all the zealous efforts to crack down on corruption, the impact of anti-corruption efforts on economic development is not well understood.

Conventional wisdom on corruption holds that corruption harms economic growth because corruption causes misallocation of resources through secret deals (Shleifer and Vishny, 1993) and revenues are collected by corrupt officials instead of the treasury (Goulder et al., 1997). Besides, corrupt politicians may put market distortions in place precisely because of corruption potentials (Shleifer and Vishny, 1993; Djankov et al., 2002). Thus, anti-corruption measures, especially those target corrupt politicians, may remove market distortions and lead to better economic outcomes. Other scholars argue, however, that corruption can “grease the wheels of the economy” because it speeds up bureaucratic procedures (Lui, 1985) and introduces competitions for (scarce) government resources (Leff 1964; Beck and Maher, 1986). According to this view, eliminating corruption may lead to inefficiencies and thus worsen economic outcomes. Furthermore, the literature on the value of political connections (Fisman, 2001) suggests that firms’ tie to corrupt officials prioritizes their access to loans and bailed outs (Charumilind et al., 2006; Faccio et al., 2006), lowers their leverage ratio (Fan et al., 2008), and increases their returns to capital (Acemoglu et al., 2016). Thus, cutting the connections, as anti-corruption measures often do, may hurt the connected firms.

In this paper, we provide empirical evidence on the negative impact of anti-corruption efforts on firm productivity and entry. Our empirical strategy takes advantage of an unexpected corruption crackdown that was triggered by a prostitution investigation and abruptly removed about one hundred high-ranking government officials in Heilongjiang Province (a province in Northeast China that is adjacent to

Russia) in 2004. This strategy allows us to utilize a rich dataset on large-scale manufacturing firms in China from 1999 to 2007. Unlike recent anti-corruption studies that use public-listed firms' stock market returns as measures of firm performance, we examine concrete measures of firm performances such as productivity, entry, and exit from this high-quality firm survey that is available from 1999 to 2007. In addition, our empirical strategy and data allow us to examine firm productivity and firm entry and exit dynamics at the same time, which is not possible when using public-listed firms.

By comparing firms in Heilongjiang to firms in other 19 inland provinces in China, we find that Heilongjiang firms' labor productivity – measured as log value added per employee – decreases substantially after the crackdown in both existing firms and newly entering firms, by 16% and 11% respectively.<sup>1</sup> When we break up our sample by firms' ownership types, we find that the negative impacts of the corruption crackdown are mainly borne by private and foreign firms, whereas state-owned firms remain mostly intact. We argue that this difference between private and state-owned firms is likely due to the breaking up or the weakening of political connections in non-state firms after the crackdown, as government ownership can substitute for personal ties as a source of political connection for SOEs (Calomiris, et al., 2010). By default, the private and foreign firms have weaker ties to the government compared to the state-owned firms and thus suffer from greater losses after a corruption crackdown.

We then show that the corruption crackdown reduces firm entry. We find that there are on average 3% fewer entries in Heilongjiang relative to the other provinces after the crackdown, but the reduction is only observed for private and foreign firms, with 7% and 4% decreases in industry-wide entry rates respectively. The state-owned firms, on the other hand, enjoy a 2% increase in entry rates after the crackdown despite that the entry barriers for all firms (including state-owned firms) increased

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<sup>1</sup> China's coastal regions are very different from the inland areas and the northeastern regions. We thus exclude all coastal provinces and the four municipalities (i.e., Beijing, Shanghai, Tianjin, and Chongqing). In Figure A1, we graphed value-added, sales, assets, and employment against time between Heilongjiang, the Inland China, and the Rest of China. There is no common trend between Heilongjiang and the Rest of China if the coastal areas are included.

substantially.<sup>2</sup> These opposite trends on entry between state and non-state firms further support the political connection argument that state-owned firms enter regardless of entry barriers because their ties to the governments are less vulnerable during a crackdown.

Putting the above evidence together, we find that anti-corruption efforts (in the form of a corruption crackdown) in a corrupt economy have a substantial negative impact on economic development. It lowers firm productivity and reduces firm entry, probably by weakening firms' political connections since only private and foreign firms are affected. It also raises entry barriers for all types of firms, suggesting that corruption crackdown removes the "grease of the wheels" that helps firms in weak market institutions. Our findings address an overlooked fact that, although corruption might be a second-best equilibrium to a corruption-free equilibrium (Fisman and Svensson 2007), cracking down on corruption may lead to even worse economic consequences due to institutional inertia, at least in the short run.

We further find that the crackdown increases the perceived corruption levels among individuals working in both the private and public sectors, which suggests that the crackdown has revealed corruption levels that are beyond the general expectation. This finding provides a possible explanation for fewer entries since firms make entry decisions based on updated beliefs on local corruption levels.

The above results are robust to different definitions of productivity and various model specifications and sample selections. We consistently observe a substantial negative impact of the corruption crackdown on private firms' productivity and entry but not on the state-owned firms'. Falsification tests find no evidence of pre-trends in labor productivity and entry rates among the Heilongjiang firms.

Our study directly contributes to a vast literature on the effect of corruption on economic development. Early studies on this topic rely on cross-country data and corruption index and find a negative correlation between corruption and economic growth (see Mauro, 1995, for instance). More recent studies provide firm-level evidence

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<sup>2</sup> We measure entry barriers using log sales, value-added, total fixed assets, and total employment.

that either finds support for the “grabbing hand” theory of corruption (Fisman and Svensson, 2007) or the “grease of the wheels” effect (Vial and Hanoteau, 2010). On the extensive margin, studies on corruption and firm entry mainly rely on country-level measures of entry barriers (see Djankov et al., 2002; Klapper et al., 2006 for example). In particular, Klapper et al. (2006) find that regulatory entry barriers have no adverse effect on firm entry in high-corruption countries but in low-corruption countries, which is in line with the “grease of the wheel” argument.<sup>3</sup> Our paper differs from the above studies in three important ways. First, while most of the above studies focus on the role of corruption in economic development, we focus on the effect of an anti-corruption effort on economic outcomes. We find that cracking down on corruption does not restore the economy to the first-best non-corruption equilibrium but leads to even worse outcomes. Second, we provide causal evidence from a natural experiment at sub-national levels on how anti-corruption efforts affect economic activities on both the intensive margin (i.e., firm productivity) and the extensive margin (i.e., firm entry and exit). Third, we address the negative impact of anti-corruption efforts by highlighting the role of political connections, which adds to the classic debate between the grabbing hand and the grease-of-wheel effects of corruption.

Our paper also contributes to a growing literature on the consequences of anti-corruption campaigns in China. While some researchers find negative impacts of anti-corruption campaigns on luxury goods imports (Qian and Wen, 2015), financial performances (Kong et al., 2017), and provincial-level GDP growth (Wang, 2016), Lin et al. (2016) and Ding et al. (2017) find positive impacts of anti-corruption campaigns on firms’ market values. Lin et al. (2016) also find heterogeneous impacts of anti-corruption campaigns on stock market valuations by firm types. Specifically, the state-owned enterprises gain in their valuation in all provinces after the announcement of an anti-corruption campaign, but the non-state-owned enterprises only gain in more

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<sup>3</sup> Similar studies that examine the relationship between entry regulation and entry include Desai et al. (2003), Scarpetta et al. (2002), Ciccone and Papaioannou (2007), Ovaska and Sobel (2005), Bjornskov and Foss (2008), Freytag and Thurik (2007), Dreher and Gassebner (2013) among others. Most studies along this line find a negative relationship between entry regulations and entry. Dreher and Gassebner (2013) also find that corruption reduces the negative impact of entry regulation on entry.

liberalized provinces but decline in valuation in provinces with weak market institutions. These findings are consistent with our finding that private firms in Heilongjiang suffer most from the crackdown as Heilongjiang is considered to have less developed market institutions measured by the marketization index published by China's National Economic Research Institute (Fan et al., 2003).<sup>4</sup> Our study differs from these studies in two important ways. First of all, most studies on anticorruption focus on the effect of government-launched anti-corruption campaigns. In contrast, our empirical strategy exploits an unexpected large-scale corruption crackdown caused by a prostitution investigation, which is free of political motivations such as political purge and appealing to the public for political supports that may also affect economic growth.<sup>5</sup> Second, our empirical strategy allows us to use a rich dataset on manufacturing firms to look at a fuller picture of the consequences of anti-corruption cases. Rather than using stock market returns that reflect the market's *expectations* about anti-corruption campaigns as the recent literature does, we use *direct* measures of firm productivity to exam the real impact on firms' performance. More importantly, using this dataset we are able to address firms' entry and exit dynamics. This is important since the results on existing public-listed firms might be biased if entry and exits are not considered. Therefore, our study has general implications on anti-corruption efforts and their consequences.

Our study also contributes to the study of political connections by identifying new consequences of breaking up the connections: decreasing firm productivity and reducing firm entry. Starting with Fisman's (2001) seminal work on connected firms' stock market value during negative rumors about Suharto's health, numerous researches have examined the importance of political connections. For example, Fisman and Wang (2015) have identified the social cost of political connection and find that the connected coal-mining firms in China have much higher death rates. Political connections also

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<sup>4</sup> For more details about the NERI's publications, see <http://www.neri.org.cn/English.html>.

<sup>5</sup> A few studies examine corruption crackdowns rather than anti-corruption campaigns with different focuses. Fan et al. (2008) examines the effect of cracking down economic corruptions on public listed firms' financial performances. Di Tella and Schargrodsky (2003) studies the wage adjusting process during a corruption crackdown in the City of Buenos Aires.

affect financial sector development in various aspects such as lending (Charumilind et al., 2006; Khawaja and Mian, 2005, Claessens et al., 2008), bailed outs (Faccio et al., 2006), and abnormal returns (Acemoglu et al., 2016). In a cross-country analysis of political connections, Faccio (2006) find that connections are particularly common in countries with higher levels of corruption. Political connections are of particular importance in weak institutions, because businesses need the connections to shield away from bureaucratic harassments and to know whom to bribe (Malesky and Samphantharak, 2008).<sup>6</sup> We add to the literature by linking corruption crackdowns to the break-up of political connections and find consistent evidence with the previous research.

Some previous work has examined the effect of government ownership on firm performance (Wang, 2005; Sun and Tong, 2003; Cull and Xu, 2005; Allen et al., 2005; Calomiris et al., 2010). Our study contributes to this literature by finding that state ownership can shield firms away from the negative impact of corruption crackdowns.

A growing body of literature in Political Science finds adverse effects of anti-corruption campaigns on political transparency (Malesky et al., 2012; Hollyer et al., 2015). Wang and Dickson (2018) find that China's ongoing anti-corruption campaigns lower regime support. Our findings are in line with this literature by providing evidence of the negative impact of a corruption crackdown on economic development.<sup>7</sup>

The outline of the paper is as follows. Section II introduces the institutional background on the corruption crackdown in Heilongjiang Province, the data, and our empirical strategy. We present our main findings in section III and discuss the main mechanism in section IV. Section V discusses alternative mechanisms. Section VI concludes.

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<sup>6</sup> Acemoglu et al. (2016) find that political connections have no importance in normal times in democratic institutions like the US but have a significant impact on firm performance during the financial crisis.

<sup>7</sup> Two other studies in the political science literature examine the effect of exogenous replacements of governors on firms' investment behaviors (Malesky and Samphantharak, 2008) and the effect of supporting politicians coming into power on firms' productivity during the Orange Revolution in Ukraine (Earle and Gehlbach, 2015). While those two studies have some similarities to ours, our study differs in identification strategies, institutional backgrounds, and firm outcomes.



## **II. Institutional Background and Identification**

### **A. Heilongjiang Province and the Han Guizhi Crackdown**

Heilongjiang Province locates in the northeastern part of China that is bordered by Russia to the east (Figure 1). It has a population of more than 38 million and is the 15<sup>th</sup> most populous province in China. Heilongjiang and the adjacent Jilin and Liaoning Provinces are collectively called the “Three Northeastern Provinces.” The Northeast is China’s Rust Belt as it was one of the earliest regions to industrialize in China. It specializes in heavy machinery manufacturing and oil extractions even today.<sup>8</sup>

On February 20, 2004, the Chairwomen of the People’s Political Consultative Conference (CPPCC) in Heilongjiang, Han Guizhi, was arrested for corruption investigations. Unlike the later famous anti-corruption campaigns launched by the Chinese president, Xi Jinping, Han’s crackdown was not subject to political purge as it was triggered by an earlier investigation on prostitution at the local level. The prostitution investigation eventually unveiled the most notorious office-selling chain in China’s recent history that Han is at the center of (Zhu, 2008).

In the evening of April 5, 2000, after receiving a 110 call (China’s emergency line), four police officers in Harbin (the provincial capital of Heilongjiang) arrived at the East Sea Dragon Palace Bath House (the Bath) to investigate a possible prostitution case. The Bath’s manager refused to cooperate, assaulted the police with his securities, and took one of the police guns. This police-assault case quickly evolved into a series of corruption investigations into the government officials behind this Bath House, the highest-ranked one being the then party secretary of Suihua City, Ma De. From 2002 to 2003, more than a hundred of government officials in Suihua were investigated. Up to then, the corruption investigations and charges were still at the local level until the uncovering of Han Guizhi in 2004.

On February 20, 2004, Han Guizhi was arrested for corruption investigations. During Han’s investigation, she confessed that she received bribes amounts to more than 9.5 million RMB ( $\approx$  1.5 million USD) from more than 67 officials in exchange for

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<sup>8</sup> For more details about this region, see [https://en.wikipedia.org/wiki/Northeast\\_China](https://en.wikipedia.org/wiki/Northeast_China).

government job positions. Her confession led to the biggest "earthquake" in the Heilongjiang officialdom. The follow-up investigations in the later 2004 involved about 100 more officials from all over Heilongjiang. More than 50 officials who were above the city-level and at least 30 above the county-level were charged for corruption and misconducts. Ten out of Heilongjiang's (then) thirteen prefectural-level top leaders (mayors or party secretaries) were removed due to this large-scale corruption investigation.

We consider the corruption crackdown in Heilongjiang in 2004 as exogenous to the local economy for several reasons. First, the uncovering of the large-scale office-selling chain was accidental. The law enforcement had no intention of investigating corruption when they opened a case for prostitution. This rules out the concern that the anti-corruption measure was due to poor economic performances or other political motives that are correlated with the economy. Second, the escalation of the corruption investigation (from the local level to the provincial level) was mainly due to Han's personality. Had she not told on so many other officials (or had she not been related to so many), there would not be such a large-scale case. Moreover, unlike firm-related corruption cases, office selling should not directly relate to firms' performances. That is, economic concerns did not trigger the crackdown. This further reassures us to treat this event as exogenous to firms' economic performances.

We choose 2004 as the cut-off time as Han was arrested in early 2004 after which the massive crackdown started. Note that although the investigations in 2002 to 2003 involved a large number of officials, the impact remained at the local level in Suihua City. We thus expect this event to have little impact on province-wide firm behaviors.

We expect the impacts of a political turmoil on firms' performances because the Chinese economy depends heavily on business-government relations (Vial and Hanoteau, 2009). According to the World Bank Enterprise Survey in China (as shown in Table 1), firms need to bribe their way out in their business operation, such as getting basic infrastructure installed, obtaining a construction permit, getting a loan, getting a

tax inspection, and avoiding an audit, etc. Among firms that have applied for some basic infrastructure services (e.g., electricity, water, or phone) in the past two years, 89% of them have to pay bribes to get things done. Among firms that have applied for a government contract, 98% of them have to make an informal payment. Not just in China, in developing countries with weak institutions such as Indonesia (Fisman, 2001), Uganda (Fisman and Svensson, 2007), and Cambodia (Malesky and Samphantharak, 2008), corruption and political connections are essential to business operations. Consulting firms in Indonesia provide a survival kit for foreign investors to get connected with the Suharto family (Fisman, 2001). In China, firms get away with safety inspections, pollution fines, etc. if they have an executive in the C-suit who have once worked as high-level government officials (Fisman and Wang, 2015). Therefore, an earthquake in the officialdom (resulting from Han's crackdown) is very likely to affect firm performances.

## **B. Data and Empirical Strategy**

We obtain a panel of firms from the Chinese Industrial Enterprise Database on large-scale enterprises in China that cover 432,174 firms in manufacturing, mining, and utilities from the years 1999 to 2007.<sup>9</sup> This database is constructed by the China National Bureau of Statistics and includes all the state-owned enterprises and non-state-owned enterprises with annual sales above five million RMB.<sup>10</sup> In our analysis, we focus on the manufacturing sectors since approximately 90% of the firms in our database are manufacturing firms. We also exclude firms with missing values, firms that have changed provinces across years, and firms that only exist in the year 2004.<sup>11</sup> We end up with 388,546 firms and 1,556,564 firm-year observations.

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<sup>9</sup> This database is proprietary and can be accessed through HuaMei Commercial Information Consulting Corporation (<http://www.allmyinfo.com/eng/services/index1-1.asp>), a large consulting firm in China.

<sup>10</sup> See the *Standard of the Chinese National Statistical Bureau*, 1996 - 2007.

<sup>11</sup> Note that firms' migration across provinces might affect our results. However, Only 61 firms or 311 firm-year observations (<0.02%) have changed provinces across the years. We thus do not think migration would be a big concern and delete those firms for a cleaner interpretation of our results.

Heilongjiang is one of the largest industry bases in China. The industrial value added in Heilongjiang is 47% of the total value added across all sectors, which outweighs the industry share of 41% in China (Table A1). The large-scale manufacturing firms contribute 20 to 35% of the total GDP in China from 2002 to 2006 (Figure 2). In Heilongjiang and the inland provinces, the share of the large-scale firms' output in the province's GDP is on average between 8 to 13%.

Besides heavy in manufacturing and industry, Heilongjiang's economy is relatively closed. From Panel A in Table 2, only 4% of Heilongjiang manufacturing firms are foreign firms, while 14% of Chinese manufacturing firms are foreign. Also, fewer than 9% of all the Heilongjiang firms are export-oriented while more than 32% of all Chinese firms are export-oriented. On the other hand, there is a large public sector in Heilongjiang where 42% of the firms are state-owned compared to 23% of the China average. Besides, Heilongjiang has slightly lower entry rate and higher exit rate compared to the China average. As shown in Panel B, Heilongjiang firms have lower labor productivity compared to other inland firms and the China average. Heilongjiang firms also have lower value-added and sales and larger employment and fixed assets.

Table 2 shows that Heilongjiang province and Heilongjiang firms are similar to the other inland provinces but are very different from the rest of China if coastal areas are included in the sample. Therefore, we use 19 inland provinces as the control group in our main analysis. Our estimation strategy relies on difference-in-difference comparisons of firms in Heilongjiang and other inland provinces before and after the crackdown.<sup>12</sup> We cluster standard errors at the province level, but our results are robust to clusters at the firm level.<sup>13</sup>

### **III. The Effect of the Corruption Crackdown on Firm Behaviors**

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<sup>12</sup> We also perform the difference-in-difference estimation on a matched sample for the analysis on labor productivity. Using the nearest-neighbor matching algorithm in Abadie et al. (2004), for each Heilongjiang firm in 2006, we draw five matches from the inland provinces based on industry, assets, employees, and sales. The results are qualitatively unchanged. See Table A2 for details. Other studies that use this method include Matsa and Miller (2013).

<sup>13</sup> The results are upon request.

To estimate the effect of the crackdown on firm productivity and entry. We consider the following specification:

$$(1) \quad Y_{it} = \beta_1 Hei_i \times Post2004_t + \beta_2 Post2004_t + \beta_4 X_{it} \\ + \alpha_i + \tau_t + \lambda_i + \epsilon_{it},$$

where  $Y_{it}$  is firm  $i$ 's outcome in year  $t$ .  $Hei_i$  is an indicator variable that equals to one if a firm is in Heilongjiang Province.  $Post2004_t$  is an indicator that equals to one if the year is after 2004;  $X_{it}$  is a vector of controls including the firm's ownership type and log total sales in year  $t$ ;  $\alpha_i$  are time-invariant firm characteristics;  $\tau_t$  is a time trend;  $\lambda_i$  are industry dummies.

#### *A. Labor Productivity*

We define labor productivity as the log of value added per employee. We estimate equation (1) using labor productivity as the dependent variable and the results are reported in Table 3.<sup>14</sup>

We start with the effect of the corruption crackdown on all firms in columns 1 and 2. From column 1, labor productivity declined by a substantial 16.8% among Heilongjiang firms after 2004 relative to changes in productivity in firms in other inland provinces during the same period ( $p < 0.01$ ). In column 2, after adding controls for firms' ownership type and size, the estimate barely changes and is statistically significant at one percent level.

Columns 3 and 4 look at the impact of the crackdown on existing firms. We define existing firms as those who enter before 2004 and exit after 2004 so that the firms are in the sample for at least three years. Again, we find a substantial adverse effect of the crackdown on the existing firms' productivity. To be specific, column 4 shows that firms in Heilongjiang after the crackdown have on average a 15.6% lower

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<sup>14</sup> As this measure of labor productivity may pick up changes in capital investment, we also use two other control function approaches to compute total factor productivity: the OP method (Olley and Pakes, 1996) (at 10% and 5% depreciation) and the LP method (Levinsohn and Petrin, 2003). The results are qualitatively unchanged. We thus adopt this most straightforward measure of productivity. See Table A3 for detail. Appendix B provides more details on the two estimation methods. Other studies that use this productivity measure include Bernard et al. (2003) and Klapper et al. (2006).

productivity compared to firms in other provinces. This effect is significant at one percent level.

In estimating the impact of the crackdown on firms' productivity in their entering years, we estimate an equation that is slightly different from equation (1) as we do not have panel data structure for newly entering firms. To be specific, we estimate the following specification:

$$(2) \quad Y_{it} = \beta_1 Hei_i \times Post2004_t + \beta_2 Hei_i + \beta_3 Post2004_t + \beta_4 X_{it} + \tau_t + \lambda_j + \epsilon_{it},$$

The results are reported in columns 5 and 6 of Table 3. We find that newly entering firms in Heilongjiang after the crackdown had a 10.6% lower productivity compared to the productivity changes in other provinces.

We next examine whether the corruption crackdown affects all firms uniformly. Marketization in China and the privatization of state-owned enterprises make it challenging to define firms' ownership types. To complicate things even further, private firms, on the other hand, may seek government umbrella due to economic stringencies especially during corruption crackdowns. We thus use the classification adopted by Guariglia et al. (2011) that based on the majority share of paid-in-capital to define ownership types.<sup>15</sup> In our sample, 75,585 firms have one or more ownership type changes during the sampling period, which accounts to 7% of the firm-year observations. We thus exclude firms with ownership changes from our sample in analyses pertinent to ownership types.<sup>16</sup>

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<sup>15</sup> There are six categories of ownership structure: state-owned, collective investors, state legal persons, private legal persons, foreign-owned, Hong Kong-Macao-Taiwan (HKMT) owned. We further aggregate state-owned and collective investors to define state-owned firms in our study; state or private legal person as private firms; foreign or HKMT owned as foreign firms.

<sup>16</sup> Table A4 reports the effect of the crackdown on firms' ownership changes. After the crackdown, the SOE reforms slowdown in Heilongjiang (column 1). Interestingly, there is an increase in private to state-owned transformation (column 2), which might occur due to firms' responses to the crackdown to seek for shields from political turmoil in the future. Overall, the crackdown increases ownership type changes in Heilongjiang (column 3). However, when we compare means, we do not find any difference in the changing rate between Heilongjiang and the inland provinces before the crackdown.

In Table 4, we re-estimate equations (1) and (2) for private, state-owned (i.e., the SOE), and foreign firms separately. We find that the negative impact of the crackdown was only felt by the private and foreign firms. In particular, the existing private firms in Heilongjiang after the crackdown experienced a decline close to 20% (column 1) in productivity relative to firms in other provinces and the adverse effect on foreign firms amounts to a substantial 28% (column 5) (both estimates are statistically significant at one percent level). In contrast, the crackdown had no impact on the SOEs' productivity. The difference-in-difference estimators for the SOEs are even positive (columns 3 and 4). When we look at firms in their entering years in columns 2, 4, and 6, we again find a strong negative impact of the crackdown on entering private and foreign firms' productivity with a 12.5% lower productivity for private firms and a 31% lower productivity for foreign firms. In contrast, the entering SOEs' productivity in Heilongjiang did not change differently from the SOEs in other provinces.

In summary, we find a substantial negative impact of the corruption crackdown on firms' productivity both among the existing firms and the newly entering firms. However, those negative impacts are mainly born by non-state-owned firms with the most substantial adverse effect felt by foreign firms.

### *B. Entry and Exit*

In the previous subsection, we examined the effect of the crackdown on firms' behavior on the intensive margin. We now turn our focus to firms' entry and exit at the extensive margin as the crackdown may work on firms' production and entry/exit processes quite differently. Following Klapper et al. (2006), we calculate entry and exit rates at four-digit industry levels. There are 754 four-digit industries in our sample.<sup>17</sup>

We estimate equation (2) using province-year-industry-level entry or exit rates as dependent variables, and we control for cell-level average log sales and a time trend. The results are reported in Table 5. Heilongjiang industries experienced a 0.026 lower

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<sup>17</sup> Since the data collection framework changed from a survey to a census in 2004, we observe a spike in the entry rate in the year 2004. We thus exclude data from 2004 for entry analyses.

entry rate compared to industries in other provinces. This number amounts to 17% of the mean entry rate. On the other hand, the crackdown has no impact on exits.

Table 6 examines different impacts of the crackdown on entry by firms' ownership types and shows that only the private and foreign firms experienced lower entry rates at 0.072 and 0.04, respectively. The entry rate in Heilongjiang among the state-owned firms is even higher after the crackdown.<sup>18</sup>

Firms' entry decisions are mainly affected by entry costs and expected returns. We examine the impact of the crackdown on firms' entry costs in Table 7. If the crackdown increases entry costs, only large firms can enter and thus we should see an increase in firm size. From Panel B, we can see that the entry barriers for the SOEs are higher in all measures. To be specific, after the crackdown in Heilongjiang, newly entering firms' value-added and employment increased by 48% and 35%, respectively, while sales and assets increased by a substantial 70% and 85%, respectively. On the other hand, we only observe moderate increases in sales and employment among private firms and assets in foreign firms. This pattern is in sharp contrast with the patterns on entry behaviors. That is, SOEs enter even when entry barriers are high, and non-state-owned firms' entry slows down despite that the entry barriers are not unusually high (relative to those of the SOEs).

We now turn to firms' expected returns that also matter greatly for entry decisions. Firms' expected returns depend heavily on local corruption levels. Although we do not have direct measures of actual corruption levels before and after the crackdown, we provide evidence by examining individuals' perceived corruption levels. We construct a proxy for perceived corruption from the Chinese General Social Survey (CGSS) in 2003 and 2005. The CGSS asks the question: "*in the past ten years, which group of people do you think benefit the most?*" One of the choices is "government officials". We use this choice versus any other choices as a proxy for individuals' perception of corruption. The results are rather interesting. From Table 8, we can see

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<sup>18</sup> See Table A5 for the exit rates by firm types. We find no impact of the crackdown on private firms' exits, positive impact on SOEs' exits, and a negative impact on foreign firms' exits.



that individuals in both the private and public sectors in Heilongjiang feel that corruption is higher after the crackdown relative to individuals in other provinces (i.e., they are more likely to think that government officials benefit most in the past ten years). One possible explanation for this observation is that the crackdown reveals widespread corruption (more than 100 officials were caught) and high corruption levels (the total bribes taken by Han amount to 1.5 million USD) that individuals have not expected before the crackdown. This finding is consistent with a growing literature on the unintended consequences of anti-corruption campaigns (Wang and Dickson, 2017).

### *C. Robustness Checks*

*Pre-existing trend.* Our difference-in-difference estimator relies on the assumption that firms in Heilongjiang and the other inland provinces follow a common trend. To test if there are pre-existing trends, we create placebo treatments in every year from 1999 to 2007 by interacting the indicator for Heilongjiang province with a year dummy. We plot the coefficients with confidence intervals (at 90% and 95% significance levels) in Figure 3 for all firms, the existing firms, and the newly entering firms. Overall, we find no pre-trend before 2004 in labor productivity. This gives us confidence that the difference we observed after 2004 reflects the actual treatment effect.

*Entry measures.* Another potential issue that may bias our results is the definition of entry. Our database contains SOEs of all sizes but only non-SOEs with annual sales higher than five million RMB. Using firms' in-sample entry and exit as measures of firm dynamics can be problematic since the negative impact of the crackdown on private and foreign firms' entry can occur if the crackdown prevents small non-state firms from growing large enough to be included in our sample. That is, the entry dynamics that we observe might reflect firms' size dynamics. We address this issue from several angles. First, given that small-scale firms are not observable, we examine the effect of the crackdown on existing firms' size as measured by sales. Table 9 shows that the crackdown has a negative impact on existing firms' sales. If we assume that the

unobserved small-scale firms follow the same trend, we might observe fewer “newly entering firms” because the small-scale firms were not big enough to be included in our sample. However, we find more SOEs enter even though the crackdown reduces existing SOEs’ size. Second, we apply the same five-million size threshold to all the firms and exclude all SOEs with annual sales of less than 5 million. We find that private firms’ entry rate decreases in Heilongjiang after the crackdown and the SOEs entry rate increases (Table 10), which is consistent with our main findings.<sup>19</sup> Nevertheless, we cannot entirely rule out the possibility that the entry dynamics that we observed result from sample selections. We thus should interpret the results on entry and entry barriers with caution.

#### **IV. Political Connections**

The above evidence on productivity and entry, especially the heterogeneous effects of the crackdown on private, foreign, and the state-owned firms, points to the role that political connections might play in a corrupt economy.

In our analysis, we use firms’ ownership types as proxies for the strength of political connections. The reason is the following. As we discussed earlier, government ownership can serve as a source of political connection that substitutes for personal ties (Calomiris, et al., 2010). . Using firms’ ownership types as proxies for political connections extend the standard measures as it encompasses connections not only to individual officials but also to the local administration in general regardless of who assumes the office. It also allows us to differentiate the strength of the ties. As the SOEs are often the direct source of income and measures of political achievements for the government, their ties to the government are naturally stronger compared to those of the non-SOEs

Given the above discussion, it is very likely that the private and foreign firms have weak ties to governments or government officials compared to SOEs so that we find SOEs are intact after the crackdown while the non-SOEs suffer significantly in

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<sup>19</sup> We present the results on labor productivity from the censored sample in Table A6. The results are consistent with the findings in Table 4 that private and foreign firms in Heilongjiang are affected negatively while SOEs’ labor productivity is unaffected.

labor productivity and entry. In addition, had political connections not playing a role, we would have observed less entry of the SOEs in Heilongjiang given that we find a higher entry barrier but no change in expected productivity for SOEs after the crackdown. In contrast, we find more SOEs enter. This further suggests that the SOEs are well connected or at least they can rebuild their connections more easily so that they enter nevertheless.

### **V. Are the Results about Political Connections or Other Explanations?**

The effect of the corruption crackdown on the actual levels of corruption remains ambiguous. Unfortunately, we do not have accurate measures of corruption after the crackdown. In the short run, if there are no improvements in the institutional environment (such as a better court), the crackdown may lead to more strict monitoring and less supply of corrupt officials, and thus may increase the level of corruption since now only firms that can afford high bribes will pay bribes to get things done. Or, the government officials will only take the risk of being caught if the stake in corruption is high enough. In this case, we would observe an increase in corruption after the crackdown down and a decrease in firms' productivity and entry. On the other hand, the crackdown may eliminate corruption defined as bribing opportunities. However, this may be detrimental to the firms if they cannot find a way around the red-tapes in weak market institutions. Moreover, it is also likely that one corruption crackdown will not change the norm on corruption. Nevertheless, without considering firms' political connections, we cannot explain the different impacts of the crackdown on firms that differ by their ownership types.

The reduction in labor productivity and entry is not due to dysfunction of the local government or political uncertainties in Heilongjiang after the crackdown. If governments were worse functioning, the state-owned firms should have performed worse than the non-state-owned firms since the state-owned firms are heavily handicapped by the government. We find the opposite, however, that the state-owned firms fair better after the crackdown in terms of labor productivity and entry. Also, we

find no evidence that existing firms are facing a higher political uncertainty as they have no change in their capital intensity conditional on the firm's employment. In Table 11, we can see from column 1 that the capital intensity of the existing Heilongjiang firms increases after the crackdown relative to firms' in other provinces. We do, however, find some increase in uncertainty facing new firms (column 2).

There are two other public and political events around the year 2004 in the Northeastern region that might affect our results. The first one is a pilot Value-added Tax Reform initiated by the central government on July 1, 2014. However, the Tax Reform applies to all three Northeastern provinces. We have repeated our analyses using only three Northeastern provinces, and we still find a strong negative impact of the corruption crackdown on Heilongjiang firms' productivity and entry, especially among the private sector.<sup>20</sup> The second event is a series of nuclear tests in North Korea starting in October 2006. North Korea is a close neighbor to the Northeastern regions. These atomic tests might drive out businesses and reduce entry in this region. As North Korea is adjacent to Jilin and Liaoning, we should observe a stronger negative impact on Ji-Liao regions relatively to Heilongjiang, but we found the opposite in our three-province analysis. Furthermore, the beginning of these nuclear tests is towards the end of our sampling period. We thus do not find this event particularly concerning.

## VI. Conclusion

This paper studies an unexpected large-scale corruption crackdown in Heilongjiang province in China around 2004. This unexpected event allows us to identify the causal impact of a corruption crackdown on firms' productivity and entry behaviors at sub-national levels. Using a comprehensive database on Chinese manufacturing firms, we compare Heilongjiang firms' performances before and after the crackdown to firms in other provinces. To the surprise of the researchers, we find that the crackdown has a substantial negative impact on Heilongjiang firms' labor productivity and entry. Interestingly, these negative impacts are mainly felt by private

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<sup>20</sup> The results are upon request.

and foreign firms with the SOEs intact. We attribute these different impacts across firm types to political connections. The corruption crackdown also increases entry barriers for all types of firms, suggesting that it removes the “grease of the wheels” that helps firms in weak market institutions. We test our argument against alternative mechanisms. We find that the decrease in productivity and entry cannot be attributed to dysfunction of the government, political uncertainty, or other reforms and events around our treatment period. We thus conclude that cracking down on corruption in a corrupt region has a substantial adverse effect on the economy, at least in the short-run.

Although our data is limited to make inference about long-term outcomes of anti-corruption measures, we find strong negative impacts of an anticorruption effort on economic outcomes at least in the short-run (a three year period).<sup>21</sup> We contend that an abrupt and short-lived corruption crackdown is less likely to change social norms towards corruption because there are no institutional improvements to contain corrupt behaviors. Nevertheless, future work is needed to examine some long-term consequences of anticorruption on firm performances. Besides, we use firms’ ownership types as a crude measure of the strength of political connections due to data limitations. Future work using more detailed measures of the strength of political connections before and after the crackdown would be valuable.

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<sup>21</sup> There might be a difference between the anti-corruption measure that we focus on in this paper and the large-scale and long-term anti-corruption campaign launched by the Chinese president Xi Jinping. Xi’s anti-corruption campaign might be able to change the social norm toward corruption.. This may be why previous studies on the Xi’s anti-corruption campaign find positive responses from the stock market (e.g., Ding et al., 2017).

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Fig. 1 Heilongjiang Province and Other Inland Regions in China

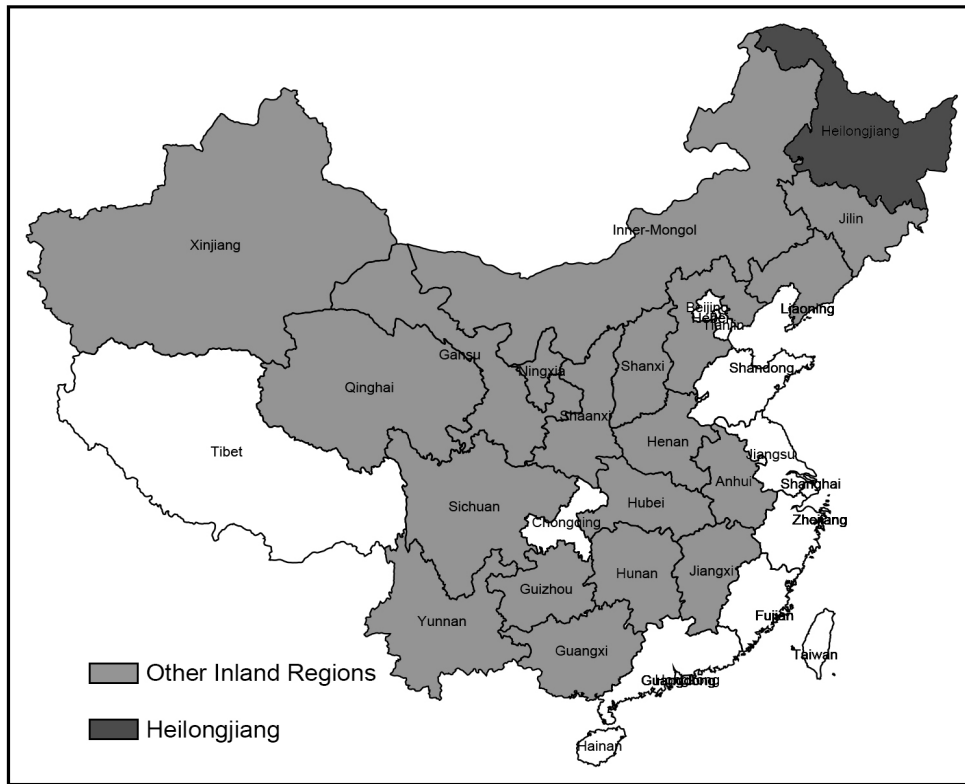


Fig. 2 Total industry output as percent of GDP for large-scale manufacturing firms by year, 2002 - 2006

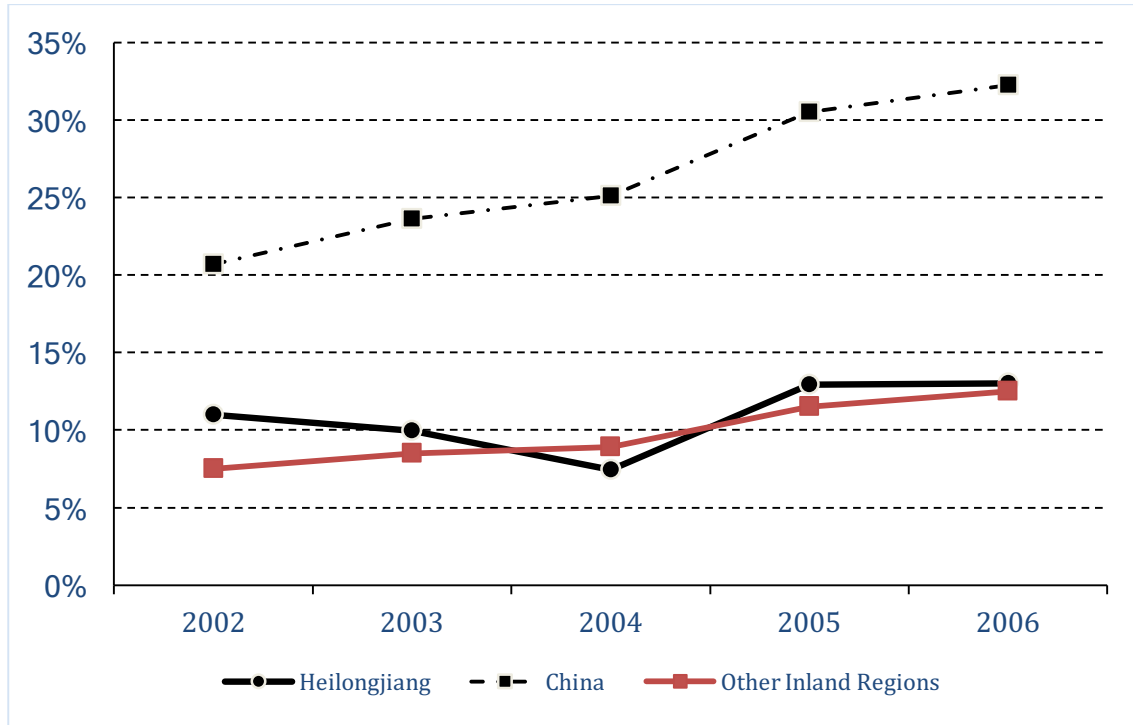
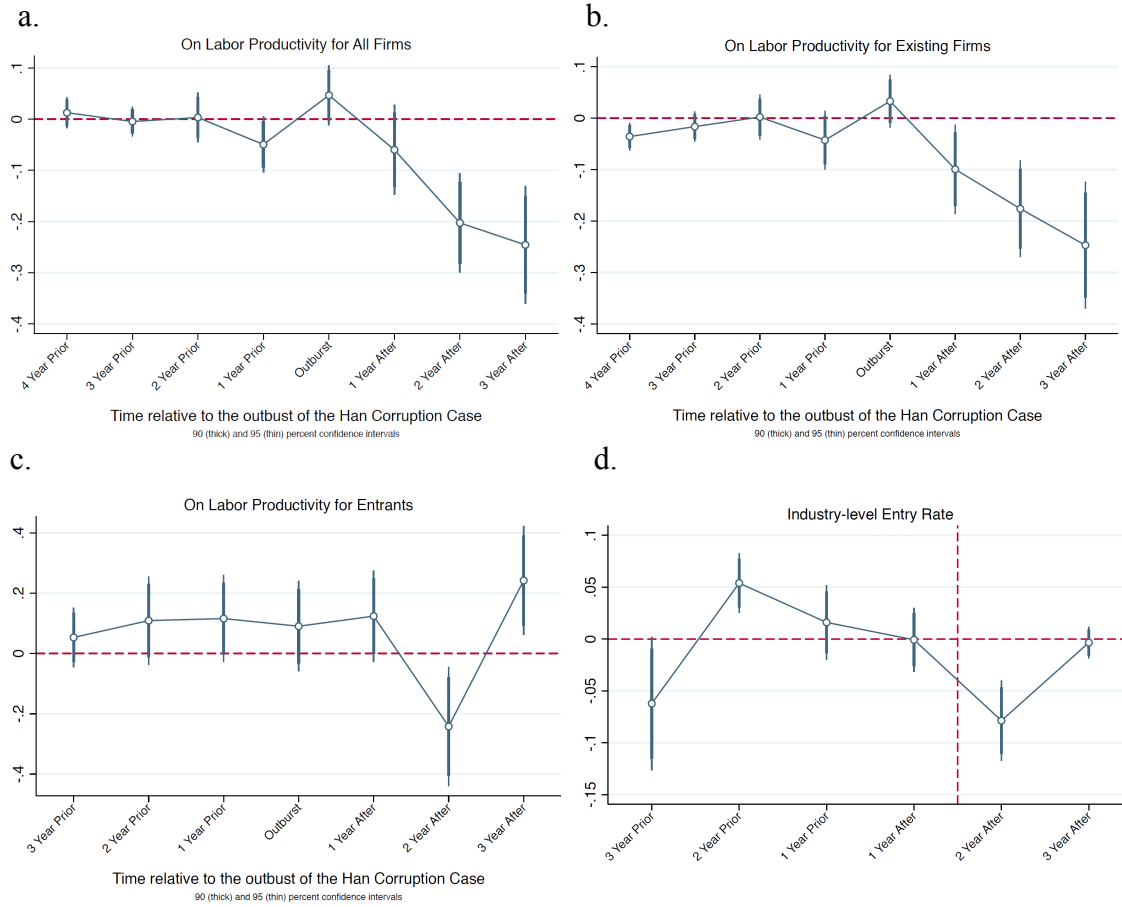


Fig 3. Pre-existing trend analysis.



Note: Each graph represents coefficient from a regression of outcome variables on Heilongjiang and year dummies where 2004 is the outburst year. All estimates are benchmarked to effects in 1999.

Table 1. Business operations and informal payment in China

		% bribed if applied
services	% firm applied	
electricity, water, phone	26%	89%
construction permit	8%	33%
tax inspection	67%	20%
import license	5%	26%
operation license	5%	22%
government contract	15%	98%
as % annual sales		Total in RMB
Total informal payment	4.8%	¥ 188,758.60
conditional on paid	(0.060)	(324523.00)
Degree		Percent
To what degree corruption is an obstacle to business	No Obstacle	73.7%
	Minor	19.9%
	Moderate	3.6%
	Severe	0.7%
	Very severe	0.3%
	do not apply	1.9%

Source: The 2012 World Bank Enterprise Survey. Information is based on respondents' recall of events over the past two years. The survey covers 2,700 firms in 25 cities and 10 provinces (Anhui, Hebei, Henan, Hubei, Liaoning, Sichuan, Guangdong, Jiangsu, Zhejiang, and Shandong) and 2 municipalities (Beijing and Shanghai).

Table 2. Summary Statistics

	Heilongjiang	Other Inland Regions	China
<u>A. Provincial-level Characteristics</u>			
Total Number of Manuf. Firms	4,272	129,797	388,546
% Agricultural product	15.4%	10.0%	6.3%
% Heavy machinery	23.9%	25.3%	31.6%
%Private firms	54.6%	62.1%	63.4%
%State-owned Enterprises	41.5%	33.4%	22.8%
%Foreign firms	3.9%	4.5%	13.8%
%Export-oriented firms	8.6%	19.5%	32.2%
Entry Rate	18.8%	20.4%	20.0%
Exit Rate	15.4%	14.8%	14.0%
<u>B. Firm-level Characteristics</u>			
Labor Productivity (log)	3.42	3.64	3.83
Employment	373.75	315.98	257.17
Sales (in 1,000RMB )	67,591.19	66,072.07	74,346.04
Fixed assets (in 1,000RMB)	32,538.16	27,638.29	21,382.14
Value added (in 1,000RMB)	17,377.73	20,455.61	19,689.24

Note: Other inland regions include the following 19 provinces: Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Anhui, Jiangxi, Henan, Hubei, Hunan, Guangxi, Sichuan, Guizhou, Yunnan, Shannxi, Gansu, Qinghai, Ningxia, Xinjiang. Entry rates are averaged over the years 2000 to 2007. Exit rates are averaged over the years 1999 to 2006. Units are in 1000 RMB. Provincial FDI are from the Wind database (<http://www.wind.com.cn/en/>). Data on population are from China Statistical Yearbook from 2002 to 2007. All monetary values are deflated to 1999 RMB.

Table 3. The effect of a corruption crackdown on firm's Labor Productivity

	All firms		Existing firms		New firms	
	(1)	(2)	(3)	(4)	(5)	(6)
Heilongjiang X After2004	-0.168*** (0.035)	-0.167*** (0.034)	-0.157*** (0.033)	-0.157*** (0.033)	-0.096** (0.043)	-0.106** (0.046)
Firm Fixed Effect	X	X	X	X		
Year Fixed Effect	X	X	X	X	X	X
Industry Fixed Effect		X		X		X
Firm characteristics		X		X		X
Observations	489,775	489,775	222,213	222,213	88,834	88,834
Number of firms	133,307	133,307	36,639	36,639	88,834	88,834
R <sup>2</sup>	0.168	0.170	0.203	0.206	0.077	0.148

Notes: Firms in Heilongjiang province are affected by the anticorruption campaign outbursts in 2004. Control regions include the following 19 inland provinces: Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Anhui, Jiangxi, Henan, Hubei, Hunan, Guangxi, Sichuan, Guizhou, Yunnan, Shannxi, Gansu, Qinghai, Ningxia, Xinjiang. Standard errors are clustered at province level. Firm characteristics include firm's ownership type (i.e., private, state, or foreign owned) and total sales (log) in columns (2), (4), and (6). The samples in columns (1) and (2) include all large-scale manufacturing firms from years 1999 to 2007. The samples in columns (3) and (4) include firms that enter before 2004 and exit after 2004. The sample in columns (5) and (6) include firms in their entering year after 1999.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 4. The effect of a corruption crackdown on firm's labor productivity by firm's ownership type

	Private		State		Foreign	
	Incumb	New firms	Incumb	New firms	Incumb	New firms
	(1)	(2)	(3)	(4)	(5)	(6)
Heilongjiang X After2004	- 0.197*** (0.032)	-0.125** (0.045)	0.028 (0.043)	0.097 (0.083)	- 0.280*** (0.045)	-0.310*** (0.037)
Firm Fixed Effect	X		X		X	
Year Fixed Effect	X	X	X	X	X	X
Industry Fixed Effect	X	X	X	X	X	X
Firm characteristics	X	X	X	X	X	X
Observations	96,725	63,019	30,645	9,302	9,263	3,118
Number of firms	17,283	63,019	4,815	9,303	1,507	3,119
R <sup>2</sup>	0.241	0.112	0.139	0.163	0.109	0.146

Notes: Firms in Heilongjiang province are affected by the anticorruption campaign outbursts in 2004. Control regions include the following 19 inland provinces: Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Anhui, Jiangxi, Henan, Hubei, Hunan, Guangxi, Sichuan, Guizhou, Yunnan, Shanxi, Gansu, Qinghai, Ningxia, Xinjiang. Standard errors are clustered at province level. Firm characteristics include total sales (log). Samples restricted to firms with no ownership changes during their sampling periods. The samples in columns (1),(3), and (5) include firms enter before 2004 and exit after 2004. The samples in columns (2), (4), and (5) include firms in their entering year after 1999.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 5. The effect of a corruption crackdown on firm entry and exit

	Entry		Exit	
	(1)	(2)	(3)	(4)
Heilongjiang X After2004	-0.029*** (0.009)	-0.026** (0.009)	-0.002 (0.012)	-0.000 (0.011)
Mean of dependent var.	0.174		0.159	
Firm characteristics		X		X
Year Fixed effect	X	X	X	X
Observations	41,669	41,669	41,679	41,679
R <sup>2</sup>	0.065	0.080	0.064	0.070

Notes: Firms in Heilongjiang province are affected by the anticorruption campaign outbursts in 2004. Control regions include the following 19 inland provinces: Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Anhui, Jiangxi, Henan, Hubei, Hunan, Guangxi, Sichuan, Guizhou, Yunnan, Shannxi, Gansu, Qinghai, Ningxia, Xinjiang. Standard errors are clustered at province level. Entry and exit rates are calculated for each year-province-industry (four-digit)-ownership type cell. Columns (2) and (4) control for cell-level average log sales. Entry year is defined as the first year in sample after the year 1999. Exit year is defined as the last year in sample before the year 2007. Data in 2004 are excluded.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1



Table 6. The effect of a corruption crackdown on entry by firm's ownership type

	Private	State	Foreign
	(1)	(2)	(3)
Heilongjiang X After2004	-0.072*** (0.013)	0.018** (0.009)	-0.040*** (0.012)
Mean of dependent variable	0.261	0.110	0.192
Firm characteristics	X	X	X
Year Fixed effect	X	X	X
Observations	29,540	22,393	7,348
R <sup>2</sup>	0.142	0.033	0.074

Notes: Firms in Heilongjiang province are affected by the anticorruption campaign outbursts in 2004. Control regions include the following 19 inland provinces: Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Anhui, Jiangxi, Henan, Hubei, Hunan, Guangxi, Sichuan, Guizhou, Yunnan, Shannxi, Gansu, Qinghai, Ningxia, Xinjiang. Standard errors are clustered at province level. Entry and exit rates are calculated for each year-province-industry (four-digit)-ownership type cell. Columns (2) and (4) control for cell-level average log sales. Entry year is defined as the first year in sample after the year 1999. Data in 2004 are excluded. Sample restricted to firms with no ownership changes during their sampling years.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 7. The effect of a corruption crackdown on new firms' size by firm's ownership type

	Log(sale) (1)	Log(vad) (2)	Log (asset) (3)	Log(labor) (4)
<b>Panel A: Private firms</b>				
Heilongjiang X After2004	0.158*** (0.053)	0.014 (0.054)	0.016 (0.047)	0.138*** (0.045)
Observations	65,384	63,019	65,384	65,384
R <sup>2</sup>	0.066	0.047	0.035	0.090
<b>Panel B: State Firms</b>				
Heilongjiang X After2004	0.698*** (0.141)	0.484*** (0.143)	0.851*** (0.195)	0.351** (0.165)
Observations	9,815	9,302	9,815	9,815
R <sup>2</sup>	0.180	0.147	0.057	0.077
<b>Panel C: Foreign Firms</b>				
Heilongjiang X After2004	0.123 (0.085)	-0.138 (0.085)	0.663*** (0.124)	0.130 (0.081)
Observations	3,318	3,118	3,318	3,318
R <sup>2</sup>	0.068	0.065	0.116	0.104

Notes: Firms in Heilongjiang province are affected by the anticorruption campaign outbursts in 2004. Control regions include the following 19 inland provinces: Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Anhui, Jiangxi, Henan, Hubei, Hunan, Guangxi, Sichuan, Guizhou, Yunnan, Shannxi, Gansu, Qinghai, Ningxia, Xinjiang. Standard errors are clustered at province level. Each regression includes a time trend and industry fixed effect. Sample includes firms in their entering year after 1999 with no ownership changes in their sampling years.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 8. The effect of a corruption crackdown on individuals' perceptions on corruption, the CGSS 2003 and 2005

	DD: All individuals	DD: State Employees	DD: Non-state Employees
	(1)	(2)	(3)
Heilongjiang X After2004	0.168*** (0.030)	0.199*** (0.040)	0.122*** (0.034)
Individual characteristics	X	X	X
Observations	7,380	4,047	3,333
R <sup>2</sup>	0.034	0.022	0.065

Notes: Firms in Heilongjiang province are affected by the anticorruption campaign outbursts in 2004. Control regions include the following 17 inland provinces where the CGSS is covering: Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Anhui, Jiangxi, Henan, Hubei, Hunan, Guangxi, Sichuan, Guizhou, Yunnan, Shannxi, Gansu, Xinjiang. Standard errors are clustered at province level. Individual controls include gender, employment status (e.g., full-time or not), marital status, age, education attainment, income, and CCP affiliation. State employees are those who reported to work for the Central government or the state-owned agencies or enterprises.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 9. The effect of a corruption crackdown on existing firms' sales

	Private	State	Foreign
	(1)	(2)	(3)
Heilongjiang X After2004	-0.134*** (0.032)	-0.068* (0.034)	-0.109*** (0.034)
Firm Fixed Effect	X	X	X
Year Fixed Effect	X	X	X
Industry Fixed Effect	X	X	X
Firm characteristics	X	X	X
Observations	99,200	32,393	9,563
Number of firms	17,286	4,819	1,507
R <sup>2</sup>	0.358	0.105	0.268

Notes: Firms in Heilongjiang province are affected by the anticorruption campaign outbursts in 2004. Control regions include the following 19 inland provinces: Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Anhui, Jiangxi, Henan, Hubei, Hunan, Guangxi, Sichuan, Guizhou, Yunnan, Shannxi, Gansu, Qinghai, Ningxia, Xinjiang. Standard errors are clustered at province level. Each regression includes a time trend, industry fixed effect, and firm fixed effect. Sample includes firms enter before 2004 and exit after 2004 with no ownership changes in their sampling years.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 10. The effect of a corruption crackdown on entry by firm's ownership type, sales larger than 5m

	Private	State	Foreign
	(1)	(2)	(3)
Heilongjiang X After2004	-0.061*** (0.013)	0.022** (0.009)	-0.001 (0.012)
Mean of dependent variable	0.219	0.121	0.178
Firm characteristics	X	X	X
Year Fixed effect	X	X	X
Observations	27,210	16,022	6,783
R <sup>2</sup>	0.147	0.033	0.075

Notes: Firms in Heilongjiang province are affected by the anticorruption campaign outbursts in 2004. Control regions include the following 19 inland provinces: Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Anhui, Jiangxi, Henan, Hubei, Hunan, Guangxi, Sichuan, Guizhou, Yunnan, Shanxi, Gansu, Qinghai, Ningxia, Xinjiang. Standard errors are clustered at province level. Entry and exit rates are calculated for each year-province-industry (four-digit)-ownership type cell. Columns (2) and (4) control for cell-level average log sales. Entry year is defined as the first year in sample after the year 1999. Data in 2004 are excluded. Samples restricted to firms with annual sales greater than 5 million and with no ownership changes in their sampling periods.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 11. The effect of a corruption crackdown on firms' capital intensity

	Existing firms	New firms
	(1)	(2)
Heilongjiang X After2004	0.033** (0.015)	-0.079*** (0.027)
Firm Fixed Effect	X	
Year Fixed Effect	X	X
Industry Fixed Effect	X	X
Firm characteristics	X	X
Observations	228,161	91,496
Number of firms	36,643	91,497
R <sup>2</sup>	0.086	0.072

Notes: Firms in Heilongjiang province are affected by the anticorruption campaign outbursts in 2004. Control regions include the following 19 inland provinces: Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Anhui, Jiangxi, Henan, Hubei, Hunan, Guangxi, Sichuan, Guizhou, Yunnan, Shannxi, Gansu, Qinghai, Ningxia, Xinjiang. Standard errors are clustered at province level. The sample in column 1 includes firms enter before 2004 and exit after 2004. The sample in column 2 includes firms in their entering year after 1999.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## APPENDIX A

Fig A1. Common Trend on Control Variables

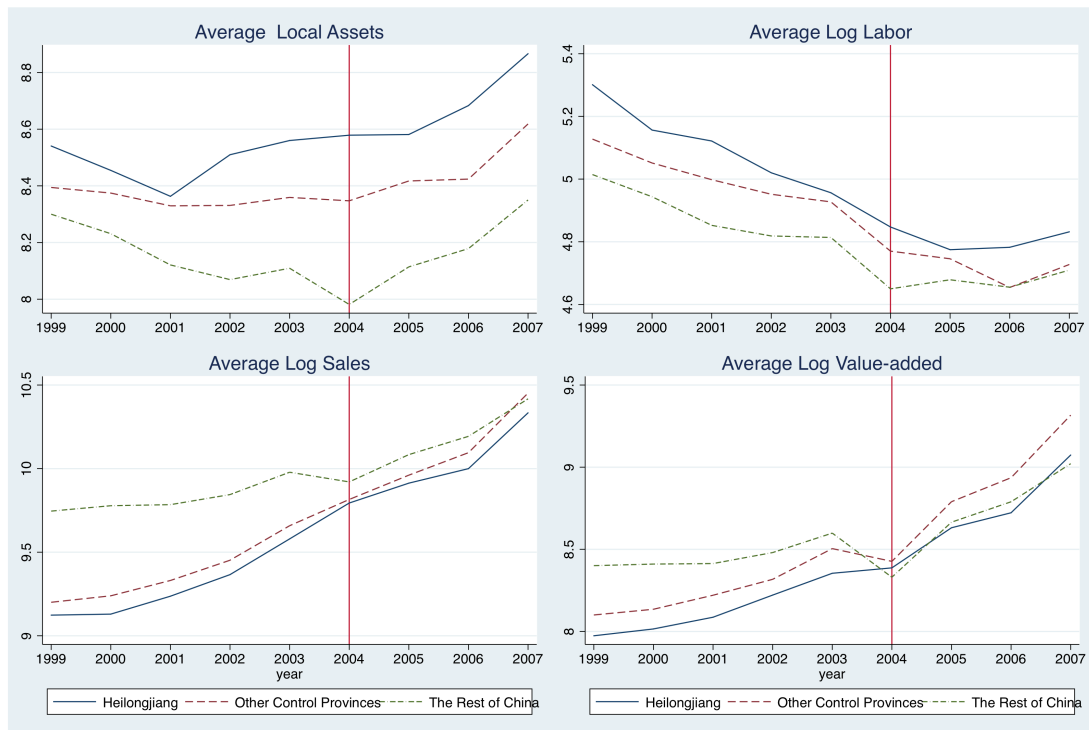


Table A1. Value Added by Industry in Treated and Control Regions (in 100 million RMB), 2002-2006 average

Sectors	Heilongjiang		Other Inland Regions		China	
	Value-Added	% of total	Value-Added	% of total	Value-Added	% of total
Agriculture, forestry and fishing	60.39	12.4%	1271.80	16.1%	2035.59	12.3%
Industry	230.27	47.2%	2977.76	37.7%	6782.32	41.0%
Construction	24.78	5.1%	520.06	6.6%	911.28	5.5%
Wholesale and retail trade	40.31	8.3%	680.19	8.6%	1282.31	7.7%
Transportation, storage, and postal services	32.36	6.6%	584.51	7.4%	951.41	5.7%
Accommodation and food service activities	10.71	2.2%	212.79	2.7%	370.08	2.2%
Financial and insurance activities	4.10	0.8%	209.03	2.6%	711.79	4.3%
Real estate activities	14.83	3.0%	261.77	3.3%	751.60	4.5%
Other industries	69.95	14.3%	1180.03	14.9%	2758.36	16.7%
		100.0			16554.7	100.0
Total	487.70	%	7897.93	100.0%	5	%

Notes: Other inland regions include the following 19 provinces: Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Anhui, Jiangxi, Henan, Hubei, Hunan, Guangxi, Sichuan, Guizhou, Yunnan, Shanxi, Gansu, Qinghai, Ningxia, Xinjiang. Value-added are in nominal terms. Due to missing data, data and statistics for the sector of accommodation and food service activities are between 2004 and 2006. Data source: China National Bureau of Statistics: <http://data.stats.gov.cn>.



Table A2. The effect of a corruption crackdown on firm's Labor Productivity, matched sample

	Labor Productivity	TFP-OP Method 10%	TFP-OP Method 5%	TFP-LP Method
	(1)	(2)	(3)	(4)
Heilongjiang X After2004	-0.181*** (0.035)	-0.245*** (0.026)	-0.245*** (0.026)	-0.259*** (0.027)
Firm Fixed Effect	X	X	X	X
Year Fixed Effect	X	X	X	X
Industry Fixed Effect	X	X	X	X
Firm characteristics	X	X	X	X
Observations	46,118	20,915	20,915	20,915
Number of firms	9,066	3,537	3,537	3,537
R <sup>2</sup>	0.191	0.166	0.167	0.145

Notes: Firms in Heilongjiang province are affected by the anticorruption campaign outbursts in 2004. Control regions include the following 19 inland provinces: Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Anhui, Jiangxi, Henan, Hubei, Hunan, Guangxi, Sichuan, Guizhou, Yunnan, Shannxi, Gansu, Qinghai, Ningxia, Xinjiang. Standard errors are clustered at firm level. Firm characteristics include firm's ownership type (i.e., private, state, or foreign owned) and total sales (log). The sample include firms in Heilongjiang in 2004 with their five closest matched firms drawn from the 19 control provinces.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table A3. The effect of a corruption crackdown on firm's Total Factor Product

	All firms		Existing firms		New firms	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A. Productivity Measure: TFP OP Method, 10% depreciation</i>						
Heilongjiang X						
After2004	-0.221*** (0.026)	-0.235*** (0.028)	-0.218*** (0.026)	-0.230*** (0.028)	0.057 (0.054)	0.106** (0.051)
Observations	216,058	216,058	122,028	122,028	21,566	21,566
Number of firms	52,118	52,118	18,943	18,943	21,566	21,566
R <sup>2</sup>	0.102	0.158	0.148	0.198	0.070	0.216
<i>Panel B. Productivity Measure: TFP OP Method, 5% depreciation</i>						
Heilongjiang X						
After2004	-0.221*** (0.026)	-0.235*** (0.028)	-0.218*** (0.026)	-0.230*** (0.028)	0.056 (0.055)	0.106** (0.051)
Observations	216,058	216,058	122,028	122,028	21,566	21,566
Number of firms	52,118	52,118	18,943	18,943	21,566	21,566
R <sup>2</sup>	0.102	0.159	0.147	0.200	0.070	0.219
<i>Panel C. Productivity Measure: TFP LP Estimation</i>						
Heilongjiang X						
After2004	-0.256*** (0.032)	-0.253*** (0.030)	-0.251*** (0.031)	-0.247*** (0.030)	0.156** (0.070)	0.146** (0.055)
Firm Fixed Effect	X	X	X	X		
Year Fixed Effect	X	X	X	X	X	X
Industry Fixed Effect		X		X		X
Firm characteristics		X		X		X
Observations	216,058	216,058	122,028	122,028	21,566	21,566
Number of firms	52,118	52,118	18,943	18,943	21,566	21,566
R <sup>2</sup>	0.121	0.123	0.172	0.176	0.038	0.212

Notes: Firms in Heilongjiang province are affected by the anticorruption campaign outbursts in 2004. Control regions include the following 19 inland provinces: Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Anhui, Jiangxi, Henan, Hubei, Hunan, Guangxi, Sichuan, Guizhou, Yunnan, Shannxi, Gansu, Qinghai, Ningxia, Xinjiang. Standard errors are clustered at province level. Firm characteristics include firm's ownership type (i.e., private, state, or foreign owned) and total sales (log) in columns (2), (4), and (6). The samples in columns (1) and (2) include all large-scale manufacturing firms from years 1999 to 2007. The samples in columns (3) and (4) include firms that enter before 2004 and exit after 2004. The sample in columns (5) and (6) include firms in their entering year after 1999.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table A4. The effect of a corruption crackdown on firm's ownership type change

	SOE to POE	POE to SOE	All Change
	(1)	(2)	(3)
Heilongjiang X After2004	-0.006** (0.002)	0.018*** (0.002)	0.011** (0.005)
Firm Fixed effect	X	X	X
Year Fixed effect	X	X	X
Industry Fixed effect	X	X	X
Observations	506,335	506,335	506,335
Number of firms	134,069	134,069	134,069
R <sup>2</sup>	0.014	0.006	0.024

Notes: Firms in Heilongjiang province are affected by the anticorruption campaign outbursts in 2004. Control regions include other 19 inland provinces: Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Anhui, Jiangxi, Henan, Hubei, Hunan, Guangxi, Sichuan, Guizhou, Yunnan, Shannxi, Gansu, Qinghai, Ningxia, Xinjiang. Standard errors are clustered at province level. Firm characteristics include firm's total sales (log). SOE stands for State-owned Enterprises. POE stands for private firms. FOE stands for foreign firms.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table A5. The effect of a corruption crackdown on exit by firm's ownership type

	Private	State	Foreign
	(1)	(2)	(3)
Heilongjiang X After2004	0.002 (0.011)	0.047** (0.018)	-0.062*** (0.016)
Mean of dependent variable	0.140	0.263	0.107
Firm characteristics	X	X	X
Year Fixed effect	X	X	X
Observations	27,101	24,896	6,629
R <sup>2</sup>	0.056	0.095	0.030

Notes: Firms in Heilongjiang province are affected by the anticorruption campaign outbursts in 2004. Control regions include the following 19 inland provinces: Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Anhui, Jiangxi, Henan, Hubei, Hunan, Guangxi, Sichuan, Guizhou, Yunnan, Shannxi, Gansu, Qinghai, Ningxia, Xinjiang. Standard errors are clustered at province level. Entry and exit rates are calculated for each year-province-industry (four-digit)-ownership type cell. Columns (2) and (4) control for cell-level average log sales. Exit year is defined as the last year in sample before the year 2007. Data in 2004 are excluded. Sample restricted to firms with no ownership changes during their sampling years.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table A6. The effect of a corruption crackdown on firm's labor productivity by firm's ownership type: sales larger than 5m

	Private		State		Foreign	
	Incumb (1)	New firms (2)	Incumb (3)	New firms (4)	Incumb (5)	New firms (6)
Heilongjiang X After2004	-0.184*** (0.033)	-0.148*** (0.042)	0.022 (0.036)	-0.085 (0.073)	-0.273*** (0.050)	-0.340*** (0.059)
Firm Fixed Effect	X		X		X	
Year Fixed Effect	X	X	X	X	X	X
Industry Fixed Effect	X	X	X	X	X	X
Firm characteristics	X	X	X	X	X	X
Observations	82,868	56,535	19,804	5,781	8,545	2,873
Number of firms	14,711		2,999		1,374	
R <sup>2</sup>	0.247	0.108	0.172	0.150	0.111	0.146

Notes: Firms in Heilongjiang province are affected by the anticorruption campaign outbursts in 2004. Control regions include the following 19 inland provinces: Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Anhui, Jiangxi, Henan, Hubei, Hunan, Guangxi, Sichuan, Guizhou, Yunnan, Shanxi, Gansu, Qinghai, Ningxia, Xinjiang. Standard errors are clustered at province level. Firm characteristics include total sales (log). Samples restricted to firms with annual sales greater than 5 million and with no ownership changes in their sampling periods. The samples in columns (1),(3), and (5) include firms enter before 2004 and exit after 2004. The samples in columns (2), (4), and (5) include firms in their entering year after 1999.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## APPENDIX B Notes on Productivity Estimation

### B.1 Setup

We assume that the firm has following Cobb-Douglas production technology:

$$y_{it} = \exp(\omega_{it}) k_{it}^{\alpha} l_{it}^{\beta} \quad (B1)$$

where  $i$  represents firm and  $t$  represents the time.  $y_{it}$  is the firm's value added,  $k_{it}$  is the capital stock,  $l_{it}$  is the labor input, and  $\exp(\omega_{it})$  is the total factor productivity. The productivity is known by the firm while unobservable to the econometrician.

### B.2 Productivity Measures

#### B.2.1 labor productivity

A commonly used measure for the firm's production efficiency is the labor productivity, which is defined as follow

$$lp_{it} = \frac{y_{it}}{l_{it}} \quad (B2)$$

According to this definition, productivity is the value added per worker. Though it is not the actual total factor productivity, this measurement is used in the literature on international trade (e.g., Bernard et al., 2003). If we assume that the production function is as in (B1), then it is obvious that the labor productivity measure contains information of the production efficiency  $\exp(\omega_{it})$  as well as the firm's capital intensity (capital stock per unit of labor). In particular, when  $\alpha + \beta = 1$ , i.e., the production technology is of constant return to scale, labor productivity can be expressed as follows:

$$lp_{it} = \exp(\omega_{it}) \left( \frac{k_{it}}{l_{it}} \right)^{\alpha} \quad (B3)$$

Next we briefly explain the estimation method we implemented to obtain the total factor productivity.

### B.3 Control function approach to estimate $\omega_{it}$

In industrial organization literature,  $\omega_{it}$  can be backed out using control function approaches. The two most popular approaches are OP (Olley and Pakes, 1996) method and LP (Levinsohn and Petrin, 2003) methodology. We introduce them briefly as below.

#### B.3.1 OP method

The problem facing the econometrician is the identification of  $\alpha$  and  $\beta$ . Because firms make capital and labor choices by their own productivities, the OLS estimators for  $\alpha$  and  $\beta$  are potentially biased because the productivity would be contained in the error term if not being controlled. More specifically, the bias will be upward because more productive firms will invest more in capital and employ more workers. Olley and Pakes (1996) propose to use the firm's capital investment to control for the firm's productivity. Under some mild assumptions, the firm's capital investment can be written as:

$$i_{it} = i(\omega_{it}, k_{it-1}, a_{it}) \quad (B4)$$

where  $i_{it}$  represents the firm's capital investment and  $a_{it}$  is the firm's age. Moreover, the capital investment is increasing in the firm's productivity conditional on firm's previous capital stock and age. Therefore we can write the firm's productivity as

$$\omega_{it} = i^{-1}(i_{it}, k_{it-1}, a_{it}) \quad (B5)$$

OP use a two-step procedure to estimate the productivity. In the first step, the firm's productivity is controlled using a polynomial function of  $i_{it}$ ,  $k_{it-1}$ , and  $a_{it}$ . The first-

step estimation uses the logged form of the production and can identify the labor coefficient  $\beta$ . The productivity process is assumed to be following a first-order Markov process:

$$\omega_{it+1} = \rho\omega_{it} + \xi_{it+1} \quad (\text{B6})$$

where  $\xi_{it+1}$  is the i.i.d error term. From the first-stage estimation, the productivity can be expressed as a function of the data and the remaining parameters to be identified. The moment conditions used to identify this parameter is thus given by:

$$E \left( \xi_{it+1} \otimes \begin{pmatrix} 1 \\ l_{it} \\ k_{it} \end{pmatrix} \right) = 0 \quad (\text{B7})$$

### B.3.2 LP approach

OP method requires the investment to be positive. In application, this can cause the loss of a large portion of the sample. Levinsohn and Petrin (2003) suggest using the material input to control for the productivity. LP approach follows the logic of OP closely. The only difference is that in the first-stage estimation, the control function of productivity is based on the firm's static choice of materials. Specifically, the firm's first-order condition is of the material is:

$$m_{it} = m(\omega_{it}, k_{it}, a_{it}) \quad (\text{B8})$$

Using an estimation procedure similar to OP, the productivity can be backed out. The advantage of LP method is that the data on intermediates are usually available and are usually positive.