

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 consequences of anti-corruption measures on economic outcomes. By exploiting 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 from 1999 to 2007. We find that the crackdown significantly lowers firm productivity and reduces firm entry. The negative impacts are mainly borne by private and foreign firms instead of state-owned firms. We argue that these findings are likely due to the breaking up of private and foreign firms' political connections and the removal of the "grease of the wheels" that helps firms perform in weak market institutions. We also find that the corruption crackdown leads to an increase in the perceived corruption levels among individuals 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: L2, M1, O1

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 in order to create 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 worse economic outcomes. Furthermore, the literature on the value of political connections (Fisman, 2001) suggests that firms’ ties to corrupt officials prioritize their access to loans and bailouts (Charumilind et al., 2006; Faccio et al., 2006), lower their leverage ratio (Fan et al., 2008), and increase their returns to capital (Acemoglu et al., 2016). Thus, cutting the connections, as anti-corruption measures often do, may hurt the connected firms. In summary, the theoretical literature does not provide a conclusive answer to the consequences of anti-corruption measures on the economy.

In this paper, we find negative impacts of anti-corruption efforts on firms’ productivity and entry. Our empirical strategy takes advantage of an unexpected corruption crackdown that was triggered by a prostitution investigation in Heilongjiang Province (a province in Northeast China that is adjacent to Russia) in 2004. The

crackdown abruptly removed about one hundred high-ranking government officials in Heilongjiang. This exogenous event allows us to utilize a rich dataset on large-scale manufacturing firms in China. 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 the corruption crackdown substantially decreases firms' labor productivity – measured as log value added per employee – for both existing firms and newly entering firms, by 16% and 10% respectively.¹ 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 the difference between private and state-owned firms is likely due to the breaking up or the weakening of political connections in non-state firms (i.e., the private and the foreign firms). From the political connection literature, there are two ways to form political connections: either through personal ties (Fisman, 2001) or through institutional ties (or both). As Calomiris et al. (2010) point out that institutional ties such as those formed through government ownership can substitute for personal ties as a good source of political connection. The institutional ties to the government, furthermore, are by default less vulnerable than the personal ties during a crackdown that target corrupt officials. Since the non-state firms do not have this additional layer of

¹ 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 plot firms' value-added, sales, assets, and employment against time for Heilongjiang, Inland China, and the Rest of China. There is no common trend between Heilongjiang and the Rest of China if coastal areas are included. We also exclude Tibet as there are only 281 manufacturing firms in Tibet.

connections through government ownership, they are more likely to suffer from the crackdown that breaks their personal ties to the government.

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, in contrast, even enjoy a 2% increase in entry rates after the crackdown despite that the entry barriers for all firms (including state-owned firms) increase substantially.² The opposite trends on entry observed for state and non-state firms further support the political connection argument that state-owned firms enter regardless of entry barriers because institutional ties to 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' personal connections to the government. It also raises entry barriers for all types of firms, suggesting that the corruption crackdown removes the "grease of the wheels" that helps firms in weak market institutions. Furthermore, our findings suggest that large state-owned firms benefit from the crackdown since the crackdown reduces the non-state competitors' productivity and entry. This is supported by the evidence that more large-scale state-owned firms enter the market after the crackdown despite an increase in entry barriers among all firms and a decrease in entry among the non-state firms.

Although we do not directly identify the impact of breaking up political connections as firms' ownerships are only proxies for political connections, the finding that the corruption crackdown negatively affects the economy carries important implications on the consequences of anti-corruption efforts in weak market institutions. It addresses an overlooked fact that, although corruption might be a second-best

² We measure entry barriers using log sales, value-added, total fixed assets, and total employment. See details on entry barriers in Table 6.

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 another plausible explanation for fewer entries after the corruption crackdown since firms make entry decisions based on expected local corruption levels.

The above results are robust to different definitions of productivity and various model specifications, sample selections, and ways of clustering standard errors that correct for a small number of clusters. 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 results are not driven by dysfunction of the government, political uncertainty, or other concurrent events in Heilongjiang and its nearby regions around our treatment period.

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 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.³

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 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

³ 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) find that corruption reduces the negative impact of entry regulation on entry.

institutions measured by the marketization index published by China's National Economic Research Institute (Fan et al., 2003).⁴

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.⁵ 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 efforts. 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 as outcome variables. More importantly, using this dataset, we can 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 paper also contributes to the study of political connections. Starting with Fisman's (2001) seminal work on connected firms' stock market value in light of negative rumors about the Indonesia president 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 affect financial sector development in various aspects such as lending (Charumilind et al., 2006; Khawaja and Mian, 2005, Claessens et al., 2008), bailouts (Faccio et al., 2006), and abnormal returns (Acemoglu et al., 2016). In a cross-country study of political connections, Faccio (2006) find that political connections are particularly

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

⁵ Two other studies examine corruption crackdowns rather than anti-corruption campaigns, but both with different focuses from ours. Fan et al. (2008) examine the effect of cracking down on 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.

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).⁶ Our study adds to the literature by linking corruption crackdowns to the break-up of political connections and identifying its consequences: decreasing firm productivity and reducing firm entry.⁷ More importantly, the heterogeneous effects on state-owned firms versus private firms possibly highlight different strengths of political connections formed through the institutional versus personal ties, which is not well-understood in the literature.

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.⁸

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.

II. Institutional Background and Identification

A. Heilongjiang Province and the Han Guizhi Crackdown

⁶ 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.

⁷ 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 also contributes to this literature by finding that state ownership can shield firms away from the negative impact of corruption crackdowns.

⁸ 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.

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 15th 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.⁹

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 of 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 security force, 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 government officials in Suihua were investigated. Up to then, the corruption investigations 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 government office positions. Her confession led to the biggest “earthquake” in the Heilongjiang officialdom. The follow-up investigations in late 2004 involved about 100

⁹ For more details about this region, see https://en.wikipedia.org/wiki/Northeast_China.

more officials from all over Heilongjiang. More than 50 senior officials including at least 30 officials at prefectural or above levels 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 agency 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 weak 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 impacts of 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 construction permits, getting loans, getting tax inspections, and avoiding audits, etc. Among firms that have applied for some basic infrastructure services (e.g., electricity, water, or phone) in the past two years, 89% have

to pay bribes to get things done. Among firms that have applied for a government contract, 98% 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 firms' 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 2007.¹⁰ 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.¹¹ In our analysis, we focus on the manufacturing sector since approximately 90% of the firms in our database are manufacturing firms. We exclude firms with missing values for key variables, firms that have changed provinces across years, and firms that only exist in the year 2004.¹² We end up with 388,546 firms and 1,556,564 firm-year observations.

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

¹⁰ 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. The unit of observation is at the firm level instead of at the establishment level. If a firm has multiple establishments, we get the firm-level aggregates for all the establishments.

¹¹ See the *Standard of the Chinese National Statistical Bureau*, 1996 - 2007.

¹² Firms' migration across provinces may contaminate the treatment effect. 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. Multiple establishments might also affect the results if a firm has establishments in both the treatment and control regions. However, this is likely causing a downward bias in our estimates.

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. In addition, 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. We address the common trend assumption by directly testing for pre-existing trends in the robustness check section (section III.C) after we present our main findings. We also perform a difference-in-difference estimation on a matched sample for the analysis of labor productivity.¹³

Another empirical challenge is to obtain the correct standard errors for the point estimates. Since we only have a small number of clusters (20 in total), we bootstrap

¹³ 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 compared to the results in Table 3. See Table A2 for details. Other studies that use this method include Matsa and Miller (2013).

standard errors at the province level using the wild cluster bootstrap approach following Cameron, Gelbach, and Miller (2008) and Cameron and Miller (2015). The wild cluster bootstrap approach accounts for over-rejection of the null hypothesis when there are a small number of clusters. In Appendix A, we report the results using the standard clusters at the province level in a fixed-effect model. We also cluster standard errors at the firm level.¹⁴

III. The Effect of the Corruption Crackdown on Firm Behaviors

A. Labor Productivity

To estimate the effect of the crackdown on firm productivity, we consider the following specification to utilize the panel data structure:

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

where Y_{it} is firm i 's labor productivity in year t . We define labor productivity as the log of value added per employee.¹⁵ $Post2004_t$ 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 ; α_i are time-invariant firm characteristics; τ_t is a time trend; λ_j are industry dummies.

Since the wild cluster bootstrap approach is not compatible with panel data (Cameron and Miller, 2015), we first run a standard difference-in-difference specification treating our data as repeated cross sections by adding in province dummies in equation (1). To take advantage of the panel data structure and include firm-fixed effects, we then estimate equation (1) using demeaned data with the wild cluster bootstrap approach. The results are reported in Table 3. The demeaned estimators in

¹⁴ See Online Appendix C for details.

¹⁵ 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). Appendix B provides more details on the two estimation strategies for total factor productivity. See Tables A3 and A4 for results using the OP and the LP methods. The results are qualitatively unchanged compared to the results using the simple labor productivity measure. We thus adopt the most straightforward measure of productivity. Other studies that use this productivity measure include Bernard et al. (2003) and Klapper et al. (2006).

columns 2 and 4 in Table 3 are comparable with the fixed-effect estimators in Table A4 using standard clustering approach on province level.

We start with the effect of the corruption crackdown on all firms in columns 1 and 2 in Table 3. From column 1, labor productivity declined by 11% among Heilongjiang firms after 2004 relative to changes in productivity in firms in other inland provinces during the same period ($p < 0.1$). In column 2, after controlling for firm's time-invariant characteristics by demeaning the data, the point estimate becomes -0.165 and is statistically significant at one percent level. That is, labor productivity declined by a substantial 17% among Heilongjiang firms after 2004 compared to changes in productivity among firms in other provinces.

Columns 3 and 4 look at the impact of the crackdown on existing firms. We define existing firms as those 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' labor productivity. To be specific, column 4 shows that firms in Heilongjiang after the crackdown have on average a 16% lower productivity compared to firms in other inland provinces. This effect is significant at one percent level.

To estimate 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 firms in their entering year. To be specific, we consider the following specification:

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

where γ_s is the province dummies.

The results are reported in columns 5 of Table 3. We find that newly entering firms in Heilongjiang after the crackdown had a 10% lower productivity compared to the productivity change in other inland provinces.

We next examine whether the corruption crackdown affects all firms uniformly. Marketization in China and the privatization of state-owned enterprises (SOEs) 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.¹⁶ 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.¹⁷

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 mainly borne by private and foreign firms. In particular, the existing private firms in Heilongjiang after the crackdown experienced a decline in labor productivity close to 20% (column 2) relative to firms in other provinces. The decrease in labor productivity among foreign firms amounts to a substantial 28% (column 8). Both estimates are statistically significant at one percent level. In contrast, the crackdown had no impact on the SOEs' labor productivity. The point estimators for the SOEs are even positive (column 5). When we look at firms in their entering years in columns 3, 6, and 9, we again find a strong negative impact of the crackdown on entering private and foreign firms' labor productivity with a 12% lower productivity for private firms (column 3) and a 32% lower productivity for foreign firms (column 9). In contrast, the entering

¹⁶ There are six categories of ownership types: state-owned, collective investors, private legal entities, private individuals, foreign-owned, Hong Kong-Macao-Taiwan (HKMT) owned. We further combine state-owned and collective investors as state-owned firms; private legal entities and individuals as private firms; foreign and HKMT owned as foreign firms. Other studies using paid-in-capital to classify ownership types include Ayyagari et al. (2010) and Dollar and Wei (2007).

¹⁷ Table A5 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 conversion in Heilongjiang after the crackdown (column 2), which might occur if firms respond to the crackdown by seeking for shields from political turmoil in the future. Overall, the crackdown increases ownership type changes of all kind in Heilongjiang (column 3). However, we do not find any difference in the changing rate between Heilongjiang and the inland provinces before the crackdown.

SOEs' productivity in Heilongjiang did not change differently from the SOEs in other provinces (column 6).

In summary, we find a substantial negative impact of the corruption crackdown on firms' labor 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' labor productivity at the intensive margin. We now turn our focus to firms' entry and exits at the extensive margin as the crackdown may work on firms' production and entry/exit 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.¹⁸

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, a time trend, and province dummies. The results are reported in Table 5. In particular, Heilongjiang industries experienced a 0.024 lower entry rate compared to industries in other provinces (column 1). This number accounts for 14% of the mean entry rate. On the other hand, the crackdown has no impact on exits (column 2) in Heilongjiang relative to firms in other provinces.

When we break up our sample by firms' ownership types, we find that only private and foreign firms experienced declines in entry rate for 0.069 and 0.036, respectively. The crackdown even increases state-owned firms' entry rate in Heilongjiang.¹⁹

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 6. If the

¹⁸ 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.

¹⁹ We find no impact of the crackdown on private firms' exits, positive impact on SOEs' exits, and a negative impact on foreign firms' exits. The result is upon request.

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, newly entering firms' value-added and employment increased by 48% and 35%, respectively, while their sales and assets increased by a substantial 72% and 88%, respectively. We observe some moderate increases in sales and employment among private firms and an increase in assets among foreign firms in Heilongjiang.

These patterns suggest that SOEs enter even when entry barriers are higher in Heilongjiang than in other provinces after the crackdown despite a decrease in entry among non-state firms. This finding is not surprising since the crackdown does not affect SOEs' productivity but significantly reduces non-state firms' productivity in Heilongjiang, which may make the Heilongjiang market more lucrative to the SOEs. However, only large SOEs can afford to enter Heilongjiang since the entry barrier is higher due to the removal of the grease-of-the-wheels after the crackdown.

Firms' entry decisions likely depend on their perceived corruption about the local economy that affects firms expected returns. 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 as a proxy for individuals' perception on corruption. If more people think that government officials benefit the most, it means the perceived corruption is high. The results are rather interesting. From Table 7, we can see 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. One possible explanation for this observation is that the crackdown in Heilongjiang reveals rampant corruption (more than 100 officials were affected and the total amount taken by Han amounts to 1.5 million USD) that people 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 from the wild cluster bootstrapping on demeaned data in Figure 3. Overall, we find no pre-trend before 2004 in entry rate and labor productivity among existing firms.²⁰ This gives us more 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 8 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 by excluding all SOEs with annual sales of less than 5 million. The results are shown in Table 9. We find that private firms' entry rate decreases in Heilongjiang and the SOEs entry rate increases after the crackdown, which

²⁰ There is, however, a stable positive trend in labor productivity among newly entering firms.

is consistent with our findings in Table 5 using the entire sample. We also re-estimate Table 4 and applying the five-million cutoff to all firms. The results are presented in Table 10. We find very consistent results that the crackdown reduces private and foreign firms' productivity in Heilongjiang, but has no impact on SOEs' productivity. Nevertheless, we cannot rule out the possibility that the entry dynamics that we observe result from sample selections. We thus should interpret the results on entry and entry barriers with caution.

IV. Discussion of Mechanisms

Although we do not have direct measures of political connections, the above evidence on productivity and entry, especially the heterogeneous effects of the corruption crackdown on private, foreign, and the state-owned firms, points to the important role of political connections in a corrupt economy.

In our analysis, we use firms' ownership types as proxies for political connections. As we discussed in the introduction, firms' ownership types extend the standard measures of political connections as it encompasses connections not only to individual officials (i.e., the personal ties) but also to the local administration as a whole (i.e., the institutional ties). This proxy allows us to differentiate the strength of the political connections as the institutional ties to the entire administration are naturally stronger than the personal ties to individual officials, especially during a crackdown. The reason is that the state ownership connects SOEs to the government regardless of who assumes the office. Therefore, a crackdown on corrupt officials is likely to break the connections formed through personal ties but not the connections formed through institutional ties.²¹

Since the SOEs' institutional ties to the government are more resilient during a corruption crackdown, it is not surprising to find that the SOEs are intact while the non-

²¹ In our dataset, there are two types of private firms: those represented by legal entities and those presented by individuals. The former is more likely to have institutional connections to the government as legal entities can be non-state entities or state related institutions such as banks. In Table A13, we break up our sample by six ownership types. We can see that those private firms represented by legal entities indeed behave more closely to state-owned firms after the crackdown.

SOEs suffer significantly in 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 the fact that the entry barrier is higher after the crackdown. The fact that more SOEs enter suggests that the SOEs are well connected or at least they can rebuild their connections more easily so that they enter regardless of the crackdown.

The fact that the entry barrier is higher after the crackdown suggests that the corruption crackdown removes the “grease of the wheels” that helps firms in weak market institutions.

Furthermore, given the removal of the grease-of-the-wheels and non-strengthening of the political connections after the crackdown, we should have seen a decrease in SOEs’ entry. The fact that more large-scale SOEs enter the market after the crackdown suggests that the crackdown makes the market in Heilongjiang more lucrative for state-owned firms possibly because the crackdown reduces the non-state competitors’ productivity and entry.

V. Alternative Explanations?

In this section, we discuss other plausible explanations for our findings. To be specific, 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 higher political uncertainty, as they have no change in their capital intensity conditional on the firm’s employment. In Table 12, 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, which suggests that there is an increase in capital deepening among the existing firms in Heilongjiang after the crackdown. This is unlikely to happen if the existing firms perceive a great deal of

political uncertainty. We do, however, find some increase in uncertainty facing new firms that the crackdown decreases the capital intensity among newly entering firms in Heilongjiang (column 3).

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.²² 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 impacts 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' performance 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. More interestingly, these negative impacts are mainly borne by private and foreign firms while the SOEs are intact. We attribute these different impacts across firm types to political connections. The corruption crackdown also increases

²² See Online Appendix D for details.

entry barriers for all types of firms, suggesting that it removes the “grease of the wheels” that helps firms in weak market institutions. We examine our argument against alternative mechanisms. We find that the decrease in labor 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 and our findings are best reconciled with the breaking up of firms’ political connections and the removal of the “grease of the wheels” that helps firms perform in weak market institutions.

The effect of the corruption crackdown on the actual levels of corruption remains ambiguous. Unfortunately, we do not have direct 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 to get things done. In addition, the government officials take the high risk of being caught only when 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 unlikely that one corruption crackdown can change the norm on corruption to reduce the corruption level.²³ Nevertheless, without considering firms’ political connections, we cannot explain the different impacts of the crackdown on firms that differ by their ownership types.

Although our data is limited to make inference about long-term outcomes of anti-corruption measures, we find strong negative impacts of an anti-corruption effort

²³ There is a difference between the anti-corruption measure that we focus on in this paper – a corruption crackdown – 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).

on economic outcomes at least in the short-run (a three year period). 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. Future work is needed to examine long-term consequences of anticorruption on firms' performances. Besides, we use firms' ownership types as proxies to the strength of political connections due to data limitations. Future work using direct measures of the strength of political connections before and after the crackdown would be valuable.

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Fig. 1 Heilongjiang Province and Other Inland Regions in China

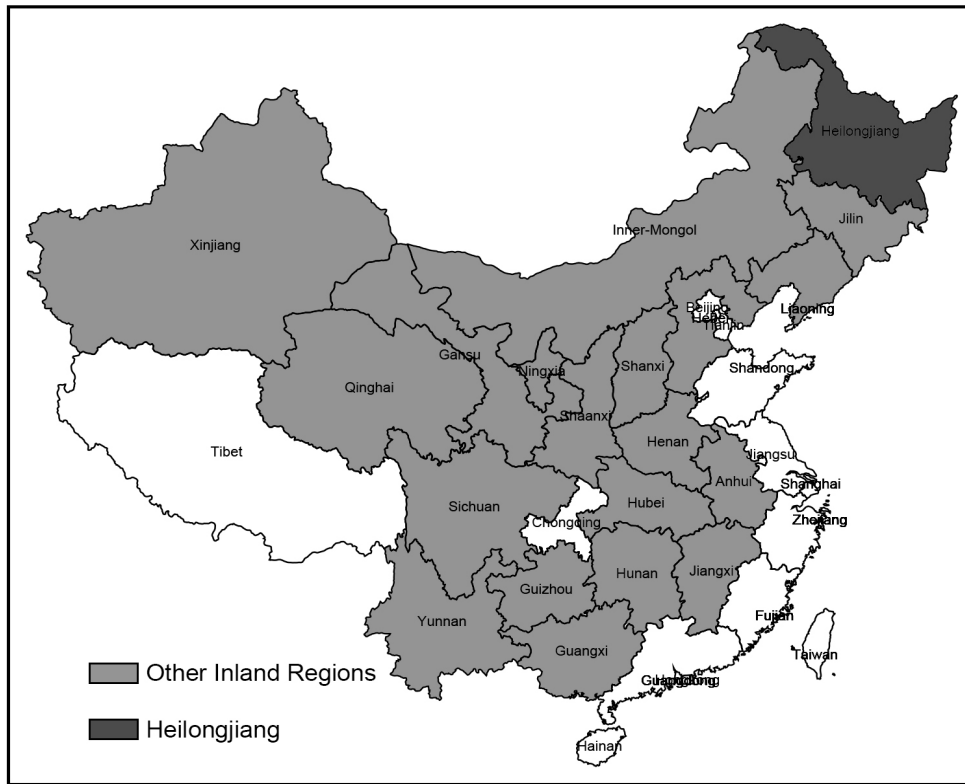


Fig. 2 Total industry output as percent of GDP for large-scale manufacturing firms by year, 2002 - 2006

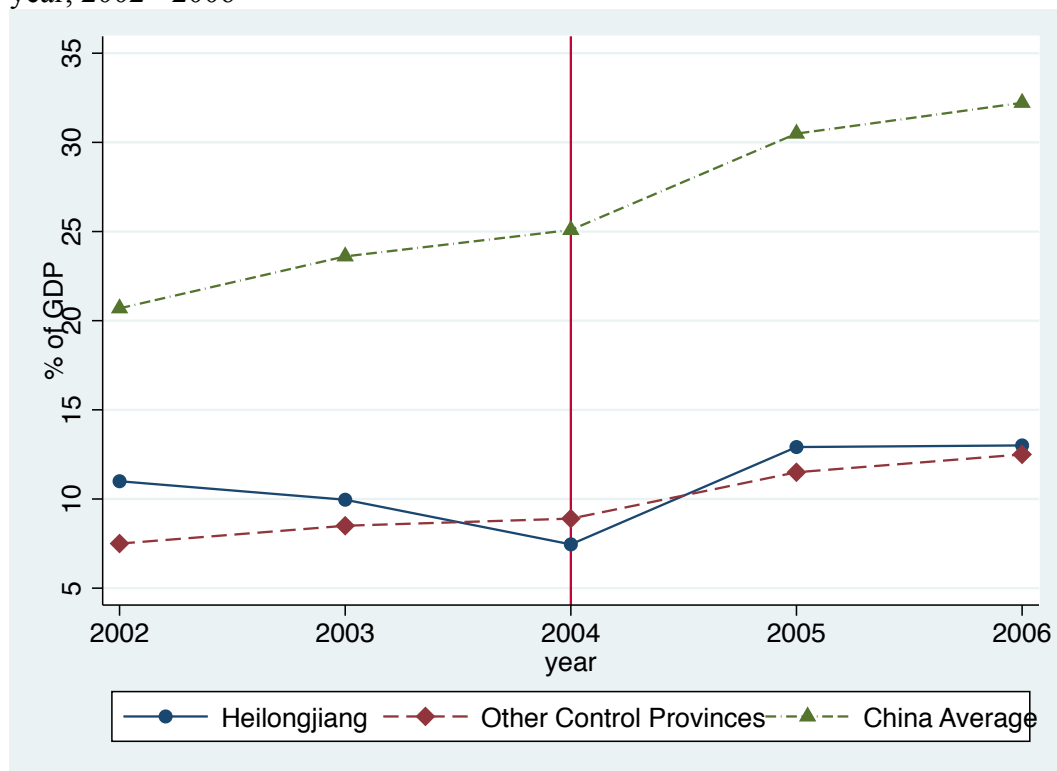
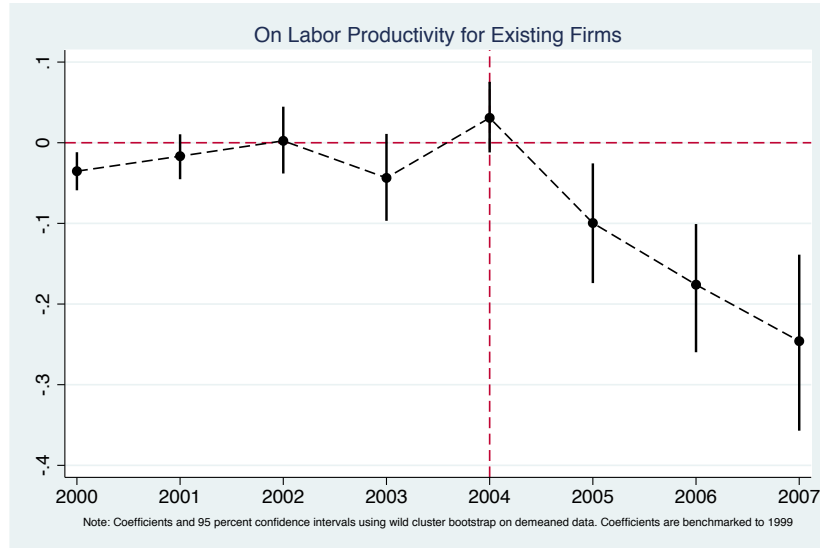
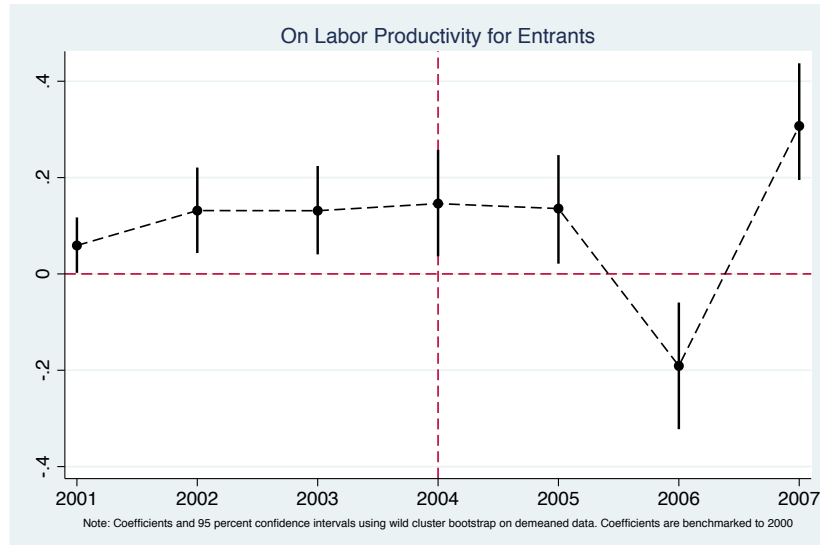


Fig 3. Pre-existing trends analysis

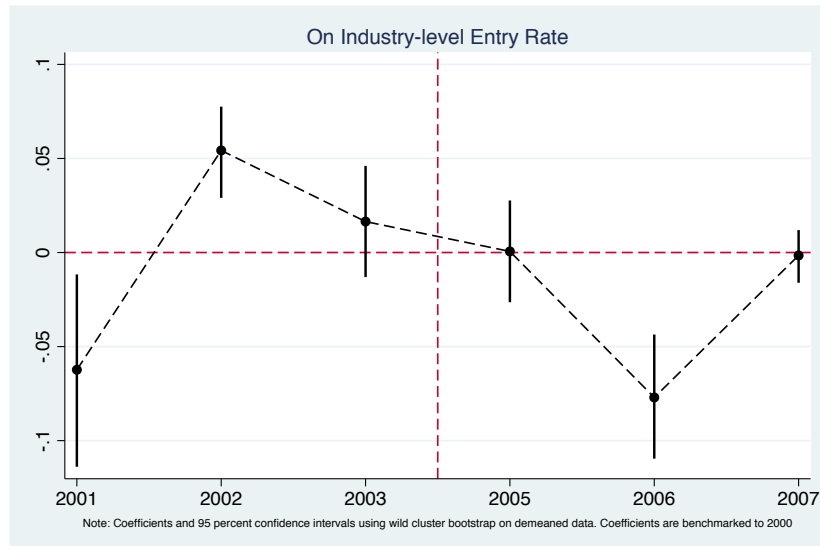
a.



b.



c.



Note: Each graph represents coefficient from a regression of outcome variables on interactions of Heilongjiang and year dummies where 2004 is the outburst year. All estimates are benchmarked to effects in the beginning year. Standard errors are clustered at the province level using the wild cluster bootstrap method.

Table 1. Business operations and informal payment in China

services	% firm applied	% bribed if 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	No Obstacle	73.7%
is an obstacle to business	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 using wild cluster bootstrap

	All firms		Existing firms		New Firms
	(1)	(2) Demean	(3)	(4) Demean	(5)
Heilongjiang X After2004	-0.106*	-0.165***	-0.141***	-0.156***	-0.097*
	(0.060)	(0.059)	(0.055)	(0.056)	(0.058)
After2004	0.815***	0.652***	0.705***	0.727***	0.671***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
State Fixed Effect	X		X		X
Year Fixed Effect	X	X	X	X	X
Industry Fixed Effect	X	X	X	X	X
Firm characteristics	X	X	X	X	X
Observations	489,775	489,775	222,213	222,213	88,834
Number of firms	133,307	133,307	36,639	36,639	88,834
R ²	0.261	0.168	0.223	0.205	0.147

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 and firm levels in columns (1) and (3) and at province level in columns (2), (4), and (5). Standard errors are bootstrapped at the province level. Samples in columns (2) and (4) are demeaned to capture the panel data structure in the original data set. Firm characteristics include firm's ownership type (i.e., private, state, or foreign owned) and log assets. The samples in columns (1) and (2) include all 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 column (5) includes 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 types using wild cluster bootstrap

	Private			State			Foreign		
	Existing firms		New firms	Existing firms		New firms	Existing firms		New firms
	(1)	(2) Demean	(3)	(4)	(5) Demean	(6)	(7)	(8) Demean	(9)
Heilongjiang X After2004	-0.202*** (0.072)	-0.196*** (0.070)	-0.122* (0.067)	-0.017 (0.044)	0.026 (0.046)	0.092 (0.073)	-0.214*** (0.076)	-0.277*** (0.099)	-0.319*** (0.113)
After2004	0.759*** (0.000)	0.781*** (0.000)	0.567*** (0.000)	0.723*** (0.000)	0.621*** (0.000)	1.086*** (0.000)	0.408*** (0.000)	0.528*** (0.000)	0.206*** (0.000)
State Fixed Effect	X		X	X		X	X		X
Year Fixed Effect	X	X	X	X	X	X	X	X	X
Industry Fixed Effect	X	X	X	X	X	X	X	X	X
Firm characteristics	X	X	X	X	X	X	X	X	X
Observations	96,725	96,725	63,019	30,645	30,645	9,302	9,263	9,263	3,118
R ²	0.203	0.240	0.129	0.190	0.137	0.188	0.243	0.109	0.178

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 and firm levels in columns (1), (4), and (7) and at province level in columns (2), (3), (5), (6), (8), and (9).

Standard errors are bootstrapped at province level. Samples in columns (2), (5), (8) are demeaned to capture the panel data structure in the original data set.

Firm characteristics include log assets. Samples restricted to firms with no ownership changes during their sampling periods. The samples in columns (1), (2), (4), (5), (7) and (8) include firms enter before 2004 and exit after 2004. The samples in columns (3), (6), and (9) 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 using wild cluster bootstrap

	Entry	Exit	Entry by Firm Type		
	All	All	Private	State	Foreign
	(1)	(2)	(3)	(4)	(5)
Heilongjiang X After2004	-0.024** (0.009)	-0.001 (0.003)	-0.069*** (0.025)	0.018* (0.010)	-0.036** (0.014)
After2004	-0.003 (0.021)	0.063*** (0.000)	-0.045** (0.019)	-0.048*** (0.017)	-0.039 (0.035)
Mean of dependent var.	0.174	0.159	0.261	0.110	0.192
State Fixed Effect	X	X	X	X	X
Year Fixed effect	X	X	X	X	X
Firm characteristics	X	X	X	X	X
Observations	41,669	41,679	29,540	22,393	7,348
R ²	0.096	0.080	0.157	0.045	0.084

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 and bootstrapped at province level. Entry and exit rates are calculated for each year-province-industry (four-digit)-ownership type cell. Firm characteristics include cell-level average log assets. 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. Samples in columns (3), (4), and (5) are restricted to firms with no ownership changes during their sampling years.

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

Table 6. The effect of a corruption crackdown on new firms' size by firm's ownership type using wild cluster bootstrap

	Log(sale) (1)	Log(vad) (2)	Log (asset) (3)	Log(labor) (4)
Panel A: Private firms				
Heilongjiang X After2004	0.135* (0.080)	-0.019 (0.122)	-0.025 (0.059)	0.103** (0.046)
After2004	0.209* (0.107)	0.220** (0.102)	0.265* (0.138)	-0.349*** (0.124)
Observations	65,384	63,019	65,384	65,384
R ²	0.092	0.072	0.054	0.114
Panel B: State Firms				
Heilongjiang X After2004	0.715*** (0.000)	0.477*** (0.185)	0.877*** (0.000)	0.354* (0.184)
After2004	0.916*** (0.000)	0.836*** (0.000)	0.234 (0.209)	-0.281 (0.237)
Observations	9,815	9,302	9,815	9,815
R ²	0.225	0.190	0.095	0.112
Panel C: Foreign Firms				
Heilongjiang X After2004	0.121 (0.110)	-0.138 (0.111)	0.660*** (0.000)	0.138 (0.102)
After2004	-0.024 (0.115)	0.036 (0.285)	-0.188 (0.232)	-0.161 (0.170)
Observations	3,318	3,118	3,318	3,318
R ²	0.094	0.086	0.130	0.150

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 and bootstrapped at province level. Each regression includes a time trend, state fixed effect, industry fixed effect, and firms' log assets. 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 7. The effect of a corruption crackdown on individuals' perceptions on corruption using wild cluster bootstrap, the CGSS 2003 and 2005

	All individuals	Non-state Employees	State Employees
	(1)	(2)	(3)
Heilongjiang X After2004	0.166*** (0.000)	0.204*** (0.000)	0.121*** (0.000)
After2004	-0.063* (0.035)	-0.039 (0.050)	-0.035 (0.040)
State Fixed Effect	X	X	X
Individual characteristics	X	X	X
Observations	7,411	4,068	3,343
R ²	0.058	0.069	0.082

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 and bootstrapped 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 8. The effect of a corruption crackdown on existing firms' sales using wild cluster bootstrap

	Private		State		Foreign	
	(1)	(2) Demean	(3)	(4) Demean	(5)	(6) Demean
Heilongjiang X After2004	-0.161*** (0.062)	-0.134*** (0.052)	-0.101*** (0.039)	-0.068* (0.038)	0.065 (0.077)	-0.109** (0.052)
After2004	0.604*** (0.000)	0.953*** (0.000)	0.283*** (0.000)	0.328*** (0.000)	0.289*** (0.000)	0.772*** (0.000)
State Fixed Effect	X		X		X	
Firm Fixed Effect	X	X	X	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	99,200	99,200	32,393	32,393	9,563	9,563
R ²	0.157	0.358	0.182	0.105	0.133	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, Shanxi, Gansu, Qinghai, Ningxia, Xinjiang. Standard errors are clustered at province and firm levels in columns (1), (3), and (5) and are clustered at province level in columns (2), (4), and (6). Standard errors are bootstrapped at province level. Firm characteristics include log assets. Samples in columns (2), (4), and (6) are demeaned to capture the panel data structure in the original data set. 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 9. The effect of a corruption crackdown on entry by firm's ownership type using wild cluster bootstrap, sales larger than 5m

	Private	State	Foreign
	(1)	(2)	(3)
Heilongjiang X After2004	-0.058*** (0.021)	0.021** (0.010)	0.003 (0.009)
After2004	-0.025 (0.022)	-0.015** (0.008)	-0.036 (0.033)
Mean of dependent variable	0.219	0.121	0.178
State Fixed Effect	X	X	X
Year Fixed effect	X	X	X
Firm characteristics	X	X	X
Observations	27,210	16,022	6,783
R ²	0.161	0.047	0.085

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 and bootstrapped at province level. Entry rates are calculated for each year-province-industry (four-digit)-ownership type cell. Firm characteristics include cell-level average log assets. 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 10. The effect of a corruption crackdown on firm's labor productivity by firm's ownership type using wild cluster bootstrap: sales larger than 5m

	Private			State			Foreign		
	Existing firms		New firms	Existing firms		New firms	Existing firms		New firms
	(1)	(2) Demean	(3)	(4)	(5) Demean	(6)	(7)	(8) Demean	(9)
Heilongjiang X After2004	-0.182*** (0.065)	-0.185*** (0.066)	-0.150** (0.065)	0.045 (0.034)	0.020 (0.037)	-0.120 (0.087)	-0.172*** (0.061)	-0.267*** (0.095)	-0.359*** (0.128)
After2004	0.765*** (0.000)	0.808*** (0.000)	0.507*** (0.000)	0.762*** (0.000)	0.666*** (0.000)	0.820*** (0.000)	0.441*** (0.000)	0.547*** (0.000)	0.192*** (0.000)
State Fixed Effect	X		X	X		X	X		X
Year Fixed Effect	X	X	X	X	X	X	X	X	X
Industry Fixed Effect	X	X	X	X	X	X	X	X	X
Firm characteristics	X	X	X	X	X	X	X	X	X
Observations	82,868	82,868	56,535	19,804	19,804	5,781	8,545	8,545	2,873
Number of firms	14,711	14,711	56,535	2,999	2,999	5,781	1,374	1,374	2,873
R ²	0.206	0.244	0.127	0.195	0.171	0.169	0.238	0.110	0.182

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 and firm levels in columns (1), (4), and (7) and at province level in columns (2), (3), (5), (6), (8), and (9). Standard errors are bootstrapped at the province level. Samples in columns (2), (5), (8) are demeaned to capture the panel data structure in the original data set. Firm characteristics include log assets. 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), (2), (4), (5), (7) and (8) include firms enter before 2004 and exit after 2004. The samples in columns (3), (6), and (9) include firms in their entering year after 1999.

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

Table 11. The effect of a corruption crackdown on firms' capital intensity using wild cluster bootstrap

	Existing firms		New firms
	(1)	(2) Demean	(3)
Heilongjiang X After2004	0.086*** (0.000)	0.033* (0.017)	-0.070** (0.034)
After2004	0.359*** (0.000)	0.457*** (0.000)	0.468*** (0.000)
State Fixed Effect	X		X
Year Fixed Effect	X	X	X
Industry Fixed Effect	X	X	X
Observations	228,161	228,161	91,496
Number of firms	36,643	36,643	91,497
R ²	0.093	0.086	0.078

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 and firm levels in column (1) and are clustered at province level in columns (2) and (3). Standard errors are bootstrapped at province level. The sample in column (2) is demeaned to capture the panel data structure in the original dataset. 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

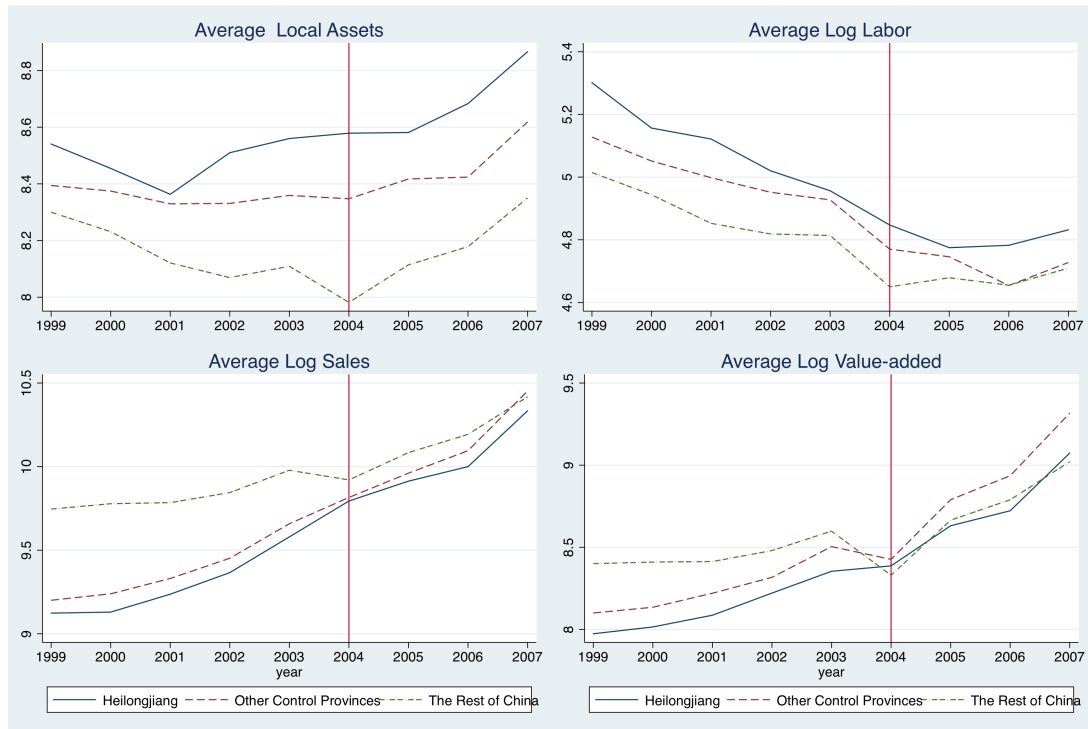


Table A1. Value Added by Industry in Treated and Control Regions (in 100 million RMB), 2002-2006 average

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)
After2004	0.941*** (0.051)	1.037*** (0.073)	1.037*** (0.073)	0.946*** (0.069)
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 ²	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 log assets. 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	Existing	New
	(1)	(2)	(3)
Panel A. Productivity Measure: TFP OP Method, 10% depreciation			
Heilongjiang X After2004	-0.235*** (0.028)	-0.230*** (0.028)	0.109** (0.048)
After2004	0.964*** (0.063)	1.014*** (0.064)	1.100*** (0.118)
Observations	216,058	122,028	21,566
Number of firms	52,118	18,943	21,566
R ²	0.158	0.198	0.216
Panel B. Productivity Measure: TFP OP Method, 5% depreciation			
Heilongjiang X After2004	-0.235*** (0.028)	-0.230*** (0.028)	0.109** (0.048)
After2004	0.964*** (0.063)	1.014*** (0.064)	1.100*** (0.118)
Observations	216,058	122,028	21,566
Number of firms	52,118	18,943	21,566
R ²	0.159	0.200	0.219
Panel C. Productivity Measure: TFP LP Estimation			
Heilongjiang X After2004	-0.253*** (0.030)	-0.247*** (0.030)	0.133** (0.050)
After2004	0.864*** (0.062)	0.923*** (0.062)	0.961*** (0.104)
State Fixed Effect			X
Firm Fixed Effect	X	X	
Year Fixed Effect	X	X	X
Industry Fixed Effect	X	X	X
Firm characteristics	X	X	X
Observations	216,058	122,028	21,566
Number of firms	52,118	18,943	21,566
R ²	0.123	0.176	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, Shanxi, 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 log assets. The samples in column (1) include all firms from years 1999 to 2007. The samples in column (2) include firms that enter before 2004 and exit after 2004. The sample in columns (3) 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 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)	-0.091* (0.047)	-0.097* (0.049)
After2004	1.201*** (0.054)	1.168*** (0.055)	1.163*** (0.058)	1.127*** (0.058)	1.597*** (0.068)	1.449*** (0.074)
State Fixed Effect					X	X
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 ²	0.168	0.170	0.203	0.206	0.093	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 log assets 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 A5. 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)
After2004	0.099*** (0.007)	0.052*** (0.003)	0.171*** (0.011)
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 ²	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 log assets. 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 A6. The effect of a corruption crackdown on firm's labor productivity by firm's ownership types

	Private		State		Foreign	
	Existing (1)	New (2)	Existing (3)	New (4)	Existing (5)	New (6)
Heilongjiang X After2004	-0.197*** (0.032)	-0.121** (0.051)	0.028 (0.043)	0.094 (0.069)	-0.280*** (0.045)	-0.313*** (0.041)
After2004	1.214*** (0.050)	1.403*** (0.072)	0.988*** (0.076)	1.418*** (0.156)	0.691*** (0.066)	0.792*** (0.214)
State Fixed Effect		X		X		X
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	9,302	1,507	3,118
R ²	0.241	0.130	0.139	0.188	0.109	0.181

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 log assets. 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 (6) include firms in their entering year after 1999.

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

Table A7. The effect of a corruption crackdown on firm entry and exit

	Entry	Exit	Entry by Firm Type		
	All	All	Private	State	Foreign
	(1)	(2)	(3)	(4)	(5)
Heilongjiang X After2004	-0.024** (0.010)	-0.001 (0.011)	-0.069*** (0.012)	0.018** (0.008)	-0.036*** (0.012)
After2004	-0.159*** (0.016)	0.083*** (0.011)	-0.264*** (0.023)	-0.097*** (0.016)	-0.196*** (0.021)
Mean of dependent var.	0.174	0.159	0.261	0.110	0.192
State Fixed Effect	X	X	X	X	X
Year Fixed Effect	X	X	X	X	X
Firm Characteristics	X	X	X	X	X
Observations	41,669	41,679	29,540	22,393	7,348
R ²	0.096	0.080	0.157	0.045	0.084

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. Firm characteristics include cell-level average log assets. 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. Samples in columns (3), (4), and (5) are restricted to firms with no ownership changes during their sampling years.

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

Table A8. 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)
<u>Panel A: Private firms</u>				
Heilongjiang X After2004	0.135* (0.067)	-0.019 (0.068)	-0.025 (0.050)	0.103*** (0.036)
After2004	1.006*** (0.110)	1.172*** (0.083)	0.695*** (0.126)	-0.244** (0.092)
Observations	65,384	63,019	65,384	65,384
R ²	0.092	0.072	0.055	0.115
<u>Panel B: State Firms</u>				
Heilongjiang X After2004	0.715*** (0.114)	0.476*** (0.113)	0.881*** (0.148)	0.350** (0.136)
After2004	2.201*** (0.172)	2.067*** (0.185)	1.466*** (0.219)	0.620*** (0.117)
Observations	9,815	9,302	9,815	9,815
R ²	0.225	0.190	0.095	0.114
<u>Panel C: Foreign Firms</u>				
Heilongjiang X After2004	0.122 (0.084)	-0.135 (0.083)	0.660*** (0.123)	0.137* (0.077)
After2004	0.511** (0.187)	0.742*** (0.213)	0.173 (0.236)	-0.106 (0.140)
Observations	3,318	3,118	3,318	3,318
R ²	0.094	0.087	0.131	0.151

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, state fixed effect, 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 A9. The effect of a corruption crackdown on individuals' perceptions on corruption, the CGSS 2003 and 2005

	All individuals	Non-state Employees	State Employees
	(1)	(2)	(3)
Heilongjiang X After2004	0.166*** (0.029)	0.205*** (0.040)	0.121*** (0.033)
After2004	-0.064** (0.030)	-0.040 (0.041)	-0.035 (0.035)
State Fixed Effect	X	X	X
Individual characteristics	X	X	X
Observations	7,380	4,047	3,333
R ²	0.058	0.069	0.082

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 A10. 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)
After2004	1.367*** (0.068)	0.454*** (0.048)	0.884*** (0.050)
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 ²	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. Firm characteristics include log assets. 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 A11. 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	-0.058*** (0.012)	0.021** (0.008)	0.003 (0.012)
After2004	-0.243*** (0.022)	-0.081*** (0.012)	-0.193*** (0.022)
Mean of dependent variable	0.219	0.121	0.178
State Fixed Effect	X	X	X
Year Fixed Effect	X	X	X
Firm Characteristics	X	X	X
Observations	27,210	16,022	6,783
R ²	0.161	0.047	0.085

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 rates are calculated for each year-province-industry (four-digit)-ownership type cell. Firm characteristics include cell-level average log assets. 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 A12. The effect of a corruption crackdown on firm's labor productivity by firm's ownership type: sales larger than 5m

	Private		State		Foreign	
	Existing (1)	New (2)	Existing (3)	New (4)	Existing (5)	New (6)
Heilongjiang X After2004	-0.184*** (0.033)	-0.149*** (0.047)	0.022 (0.036)	-0.116* (0.067)	-0.273*** (0.05)	-0.354*** (0.055)
After2004	1.203*** (0.054)	1.304*** (0.088)	0.977*** (0.071)	1.066*** (0.138)	0.711*** (0.062)	0.683*** (0.213)
State Fixed Effect		X		X		X
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 ²	0.247	0.127	0.172	0.171	0.111	0.186

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 log assets. 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 (6) include firms in their entering year after 1999.

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

Table A13. The effect of a corruption crackdown on firm's labor productivity by detailed firm types using wild cluster bootstrap

	State-owned			Collective investors		
	Existing		New	Existing		New
	(2)		(3)	(5)		(6)
	(1)	Demean		(4)	Demean	
Heilongjiang X After2004	-0.034	0.050	-0.040	-0.136**	-0.130**	0.038
	(0.049)	(0.040)	(0.077)	(0.061)	(0.058)	(0.086)
After2004	0.710***	0.723***	0.419***	0.608***	0.686***	0.392***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	36,465	36,465	7,672	28,839	28,839	8,553
R ²	0.215	0.152	0.177	0.127	0.165	0.174
	Private legal entities			Private individuals		
	Existing		New	Existing		New
	(8)		(9)	(11)		(12)
	(7)	Demean		(10)	Demean	
Heilongjiang X After2004	0.259***	-0.222***	-0.050	-0.142**	-0.202***	0.249***
	(0.092)	(0.079)	(0.051)	(0.058)	(0.072)	(0.089)
After2004	0.714***	0.755***	0.582***	0.747***	0.795***	0.573***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	60,013	60,013	26,038	82,866	82,866	42,261
R ²	0.174	0.213	0.121	0.200	0.242	0.135
	Foreign			HK, Macao, Taiwan		
	Existing		New	Existing		New
	(14)		(15)	(17)		(18)
	(13)	Demean		(16)	Demean	
Heilongjiang X After2004	0.185***	-0.097	0.276***	0.098***	-0.129***	0.459***
	(0.066)	(0.061)	(0.000)	(0.038)	(0.046)	(0.163)
After2004	0.500***	0.678***	0.362**	0.447***	0.552***	0.193**
	(0.000)	(0.000)	(0.181)	(0.000)	(0.000)	(0.075)
State Fixed Effect	X		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	4,921	4,921	1,678	9,109	9,109	2,632
R ²	0.224	0.151	0.167	0.237	0.120	0.170

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 and firm levels in columns (1), (4), (7), (10), (13), and (17) and at province level in the other columns. Standard errors are bootstrapped at province level. Samples in columns (2), (5), (8), (11), (14), (17) are demeaned to capture the panel data structure in the original data set. Firm characteristics include assets (log). Existing firms refer to firms enter before 2004 and exit after 2004. New firms refer to firms in their entering year after 1999.

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

Table A14. 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** (0.030)
After2004	0.640*** (0.024)	0.833*** (0.044)
State Fixed Effect		X
Firm Fixed Effect	X	
Year Fixed Effect	X	X
Industry Fixed Effect	X	X
Observations	228,161	67,338
Number of firms	36,643	67,338
R ²	0.086	0.090

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 B Notes on Productivity Estimation

B.1 Setup

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

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

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

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

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:

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

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

B.3 Control function approach to estimate ω_{it}

In industrial organization literature, ω_{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 α and β . Because firms make capital and labor choices by their own productivities, the OLS estimators for α and β 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:

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

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

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

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 β . 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 ξ_{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:

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

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.