Negative Investment in China: Financing Constraints and Restructuring versus Growth[a]

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ABSTRACT

This paper addresses an interesting phenomenon in China's investment pattern: despite high aggregate investment and remarkable economic growth, negative investment is commonly found at the microeconomic level. Using a large firm-level dataset, mainly made up of unlisted companies, we show that private firms undertake negative investment in order to raise capital. We also find that, owing to over-investment and mis-investment in the past, state-owned firms have had to restructure by getting rid of obsolete capital in the face of increasing competition and hardening budget constraints. Finally, rapid economic growth counterweighs both effects for all types of firms, with a larger impact in the private and foreign sectors**.** Thus, the needs to redeploy resources and to overcome capital market imperfections help to explain the negative investment of many Chinese firms.

JEL classification: G3; O16; O53

Keywords: Negative investment; Financial constraints; Industrial restructuring; Economic transition; China

I. Introduction

Economic development is often characterized by a process of Schumpeterian creative destruction, in which new ideas, demands, products and processes render others obsolete. The capital stock has to be continuously churned to align it with changing market signals. This process can be important in developing countries that move from industrial protection to reliance on comparative advantage, or those, such as China, that move from inefficient state ownership to reliance on a private sector. Economic development can also be characterized by imperfect capital markets, so causing misallocation of investment and inducing responsive behavior by both favored and disfavored firms. Such behavior is particularly relevant in China, which has been slow to reform its state-dominated financial system. These two characteristics – redeployment of resources and imperfection of the capital market – can assist understanding of the phenomenon of negative investment in China, which is the objective of this paper.

During the last four decades, China's investment rate has been remarkably high. At the aggregate level, gross capital formation has averaged a fairly steady 40 percent of GDP over the entire reform period, the fixed capital formation component of which has risen, from an average of 29 percent between 1978 and 1992 to an average of 39 percent between 1993 and 2014 (World Development Indicators, 2016)[1]. The high aggregate investment rate and dramatic investment-generated improvements in productivity and technology have been viewed as the main driving forces behind China's remarkable growth over the reform period. Investment accounts for about two-thirds of the growth differences between China and Sub-Saharan Africa (Ding and Knight, 2009). Some have argued that high investment has been a necessary condition for China's growth success (e.g. Knight and Ding, 2012, ch. 6; Guariglia and Yang, 2016)[2]. Nevertheless, at the micro level, China has also experienced much negative investment. In line with this argument, using data from Thomson Financial for listed

companies over the period 2000-2007, we observe that although Chinese listed firms exhibit a rate of aggregate investment of 15.73%, they also show a rate of negative investment of 11.80%[3]. Yet, Chinese listed companies are not alone in having a high rate of negative investment coupled with a high investment rate. For instance, rates of aggregate investment (negative investment) were 13.14% (14.97%) in Singapore; 19.07% (13.45%) in the Philippines; 13.86% (11.30%) in South Korea; 12.32% (15.74%) in Malaysia; 17.41% (9.30%) in Taiwan; and 16.93% (7.62%) in Thailand[4].

It is, however, noteworthy that, compared to other economies, the Chinese listed sector is quite small. It is therefore important to focus on unlisted companies in China[5]. Our comprehensive nationwide annual dataset of about 60,000 mainly unlisted Chinese manufacturing firms covering the period 2000-2007 shows that, on the one hand, annual investment averaged 9% of fixed capital stock and 22% of value added, but, on the other hand, a staggering 32% of the firm-year observations in the sample actually showed negative investment. This number is more than double that observed for listed companies. It can be explained bearing in mind that unlisted firms are more likely to be characterized by adverse financial attributes such as a short track record, poor solvency, and low real assets compared to the quoted firms, which are typically large, financially healthy, long-established companies with good credit ratings (Guariglia, 2008). The combination of high investment for Chinese firms in aggregate and divestment among individual, and especially unlisted, firms presents an interesting phenomenon, which, to the best of our knowledge, has not been investigated[6]. Using the firm-level dataset referred to above, we fill this gap in the literature by providing, for the first time, answers to the following two broad research questions. First, why do Chinese firms divest? Second, why do some firms divest more than others?

We find that negative investment by private firms is mainly due to external financial constraints: they need to obtain funds in order to survive and grow. State-owned enterprises

(SOEs) divest mainly for inefficiency or restructuring reasons: they need to eliminate obsolete capital in the face of rising competition or other pressures to become efficient. The fact that firms are growing fast offsets both of these incentives for negative investment, particularly so in the case of the - more dynamic - private and foreign firms.

The remainder of the paper is organized as follows. Section 2 briefly reviews the relevant theories and empirical evidence on negative investment. Section 3 describes China's institutional context. Section 4 outlines possible motives for divestment in China. Section 5 sets out our baseline specifications and empirical methodology. Section 6 describes our data and sample, and presents some descriptive statistics. Section 7 reports and interprets our estimation results. Section 8 provides a number of robustness tests. Section 9 draws conclusions.

II. Literature review

Compared with the enormous literature on positive investment by firms, negative investment is under-researched. Moreover, the negative investment literature focuses largely on developed countries characterized by mature financial markets. According to Gadad and Thomas (2004), divestment can take many forms: sell-off, spin-off, equity carve-out, and management buyout[7]. Given that almost all firms in our sample are not listed in the stock market, our survey focuses on the first form of negative investment, the sell-off.

The finance literature has identified several reasons for negative investment, among which the following four are most prominent: the *financing* explanation, whereby divestment can raise capital without recourse to the capital market; the *efficiency* explanation, whereby assets are transferred to firms which can operate them more productively; the *focus* explanation, according to which divestment may permit concentration on core activities; the *liquidity* explanation, which stresses the need for assets to be liquid if divestment is to occur;

and the *defensive restructuring* explanation, according to which asset divestment is a response to rapid economic transition. This explanation may well be intertwined with the efficiency explanation. We will focus on the financing and efficiency explanations, which are most relevant for understanding the coexistence of widespread negative investment and huge positive investment among Chinese firms, and briefly discuss other explanations, which, however, are not tested owing to our data limitations.

A. The financing explanation

Shleifer and Vishny (1992) argue that selling assets can be more attractive and cheaper than debt rescheduling and issuing new securities as a way of raising funds to meet debt obligations. Asset sales can in fact reduce conflicts between creditors, control agency costs, and alleviate the problem of informational asymmetry between the firm and outsiders.

Based on a sample of US asset sales, Lang, Poulsen, and Stulz (1995) argue that managers sell assets to obtain funds when alternative funding is either more expensive or unavailable. As highly-leveraged or poorly-performing firms find it expensive to use capital markets owing to adverse selection costs (Myers and Majluf, 1984) or agency costs of managerial discretion (Jensen, 1986; Stulz, 1990), they are more likely to sell assets.

Using a US dataset, Hovakimian and Titman (2006) find that cash obtained from asset sales is an important determinant of corporate investment and that the sensitivity of investment to proceeds from asset sales is significantly stronger for firms that are likely to be financially constrained. A similar result is found by Borisova and Brown (2013), who link the proceeds from asset sales with corporate R&D investment in the US.

B. The efficiency explanation

Hite, Owers, and Rogers (1987) argue that managers retain only assets for which they have a comparative advantage, and that they sell assets if another party can manage them more

efficiently. Investigating cases for both partial or total sell-offs in the US[8], they find that asset sales are associated with the movement of resources to higher-valued uses and that sellers capture some of the resulting gains.

Using a US firm-level database, Maksimovic and Phillips (2001) find that assets are more likely to be sold when they are less productive than their industry benchmarks, when the selling division is less productive, when the selling firm has more productive divisions in other industries, and when the economy is undergoing positive demand shocks. The timing of sales and the pattern of efficiency gains suggest that divestments tend to improve the allocation of resources. Also focusing on US firms, Warusawitharana (2008) finds that it is less profitable firms who typically sell assets, whilst Yang (2008) argues that asset sales are driven by declines in productivity brought by shocks.

C. Other explanations

Both Berger and Ofek (1995) and John and Ofek (1995) emphasize focus as a motive for divestment: selling an unrelated asset leads to an increase in focus and to more efficient operation of the core business.

Schlingemann, Stulz and Walkling (2002) emphasize the role of asset liquidity in determining which assets are divested in the pursuit of firm objectives. They argue that more liquid assets are more likely to be divested.

According to Carlin *et al.* (2001), divestment can arise for different reasons in transition economies, and asset divestment can be forced on a firm when its survival is threatened. In other words, divestment may indicate restructuring and downsizing by firms that have difficulties in adapting to a new market environment. Using a World Bank survey covering 25 transition countries, they find that SOEs and old firms are significantly more likely to engage in defensive restructuring through labor shedding and plant closures, while firms with market power are less likely to do so.

In summary, the literature provides various motivations for firms to divest. Asset sales enable financially healthy firms to restructure and to improve efficiency by selling assets to more productive users or by selling assets unrelated to the core business. Asset sales may permit financially constrained firms to raise capital if debt and equity markets are unattractive or unavailable. Asset liquidity plays a role in determining which assets are divested. In transition economies, asset divestment may assist defensive restructuring or relieve financial distress[9].

III. China's institutional context

Our explanations for the presence of negative investment must take into account the Chinese context. China had a centrally planned economy until economic reform began in 1978. A distinguishing feature of China's institutional reform is the emergence of new forms of ownership.

The Chinese industrial sector was initially dominated by state-owned enterprises (SOEs), whose directive was to fulfill production quotas, to transfer profits to government, and to provide life-long employment. Deng Xiaoping's 'southern tour' of 1992 formally gave the green light to capitalist development. The Company Law adopted in 1994 provided a uniform legal framework into which all of the ownership forms fit, signaling the introduction of more clearly defined property rights and the start of the dramatic institutional change involved in the rapid downsizing of the state sector. Specifically, small SOEs and urban collective enterprises (UCEs) were closed, privatized, or turned into shareholding entities increasingly dominated by private owners (Lin and Zhu, 2001; Garnaut *et al.*, 2005), whilst larger SOEs were incorporated under state control (Hsieh and Song, 2015). This is known as the 'Grasp the large, let go of the small' reform [10]. However, SOEs remain dominant in

energy, natural resources and a few strategic or monopolistic sectors that are controlled and protected by central and local governments.

Figure 1 shows the shares of three different agents in investment in fixed assets over the period 1980-2008. SOEs accounted for the bulk of fixed investment until the early 1990s, after which the structure of investment altered dramatically. Between 1992 and 2008, the investment share of SOEs fell from two-thirds to one-third, whereas the share of private enterprises climbed to two-thirds. This has been viewed as a positive development, given that the average return on capital in SOEs was well below that in the private sector and many SOEs continued to make losses (Dougherty and Herd, 2005; Knight and Ding, 2010).

In line with these trends, our data set shows a substantial growth in the importance of private and foreign firms and a corresponding decline in the importance of state-owned firms over our period of study. Specifically, total real value added, based on majority ownership, of private firms rose from 47.2% to 51.2% of total manufacturing between 2000 and 2007, and the share of foreign firms rose from 16.6% to 20.1%, whereas the share of SOEs fell from 31.4% to 24.4%. This reallocation of resources in manufacturing occurred because private firms were generally more productive and more profitable than SOEs.

However, the reallocation was constrained by financial frictions: Domestic private firms had normally to finance their investments through internal saving whereas SOEs had access to cheap and subsidised funds, which helped to keep some of them going (Song, Storesletten and Zilibotti, 2011). The government has in fact intervened, and continues to intervene in bank lending to favor the state sector (Riedel, Jin and Gao, 2007). Despite the gradual reform of the banking sector, bank loans constitute a major share of investment financing only for SOEs, while private firms are generally discriminated against by the formal financial system (Allen, Qian and Qian, 2005; Knight and Ding, 2010; Guariglia, Liu and Song, 2011; Song *et al.*, 2011). Although these problems have become less severe since

2000 (Guariglia and Poncet, 2008), private investment has remained at a borrowing disadvantage (Haggard and Huang, 2008) [11].

IV. Possible motives for divestment in China

According to our first explanation (the *financing* motive), given the inefficient nature of the Chinese financial system, some firms may need to sell off assets in order to generate the funds required to pursue their objectives when other sources of finance are limited or costly. This explanation is likely to be particularly relevant to private firms, which, as documented by Song, *et al.* (2011), are typically discriminated against by the banking sector. We test this explanation by examining the link between two financial variables (cash flow and leverage) and the probability of negative investment and, if it occurs at all, the amount of negative investment.

Models of capital market imperfections imply that external finance is more costly than internal finance (Myers, 1984; Hubbard, 1998). For given levels of investment opportunities, information costs, and market interest rates, firms with higher cash flow (or, more generally, higher net worth) should invest more, and therefore have a lower probability, or lower amount, of negative investment. We therefore expect to observe a negative relationship between cash flow and negative investment. It should be noted, however, that cash flow is an imperfect proxy for changes in net worth, as it might also contain information about expected future profitability or, more generally, demand factors, which may be relevant to investment decisions even in the absence of capital market imperfections. Thus, the finding of a negative and significant association between cash flow and negative investment cannot be interpreted as necessarily indicating financial constraints (Cummins, Hassett and Oliner, 2006; Kaplan and Zingales, 1997; 2000). This is especially the case when investment opportunities are

omitted or mis-measured by standard measures such as Tobin's *Q* (Bond *et al*., 2003; Carpenter and Guariglia, 2008)[12].

In the light of these considerations, we introduce a second financial variable, namely leverage, to test the financing explanation. Leverage can be seen as a measure of the amount of external finance used by firms. On the one hand, high leverage may be interpreted as indicating high debt capacity or low external financial constraints (Fazzari, Hubbard and Petersen, 2000; Hovakimian, 2009): one would therefore expect leverage to be negatively related with the probability and/or the amount of negative investment. On the other hand, high leverage may indicate a firm's poor financial performance (Lang *et al.*, 1995; Kaplan and Zingales, 1997). In line with this argument, Denis and Shome (2005) show that the decision to downsize is positively related to firms' debt ratios. Both arguments are relevant in the Chinese context. The former matters for private firms, which have limited access to formal bank credit and may have to divest for financing purposes. For these firms, a high leverage ratio indicates high debt capacity, which reduces the need for negative investment. We therefore expect to observe a negative relationship between the probability and/or the amount of negative investment and leverage in the private sector. By contrast, the latter explanation holds for SOEs: the abundance of external funds as a result of soft budget constraints in the state sector can be viewed as an indicator of poor financial performance. Loss-making SOEs receive ready assistance from banks to help keep them afloat, but this weakens their balance sheets, which may in turn increase the pressure on them to cut back on investment. A positive relationship between leverage and negative investment is therefore expected for SOEs.

According to our second explanation (the *efficiency* motive), firms may show negative investment for efficiency reasons. This explanation is likely to be particularly relevant to SOEs as they are typically less efficient than non-state firms and hence more likely to

downsize for efficiency reasons. We test whether this is the case by examining the link between firm productivity and negative investment. We expect the relationship to be negative for all types of firms, and larger in absolute value for SOEs.

A distinguishing feature of the Chinese economy is its rapid growth: the growth rate of GDP per capita averaged 8.6% per annum over the three decades of economic reform (World Development Indicators, 2016). Moreover, the growth of real sales in our sample averaged 11.6% per annum over the period 2000-2007. This remarkable growth performance creates vast opportunities for investment. In the investment literature, Blomström, Lipsey and Zejan (1996) argue that growth induces subsequent capital formation more than capital formation induces subsequent growth. Thus, our third explanation (the *growth* motive) predicts a negative relationship between growth and negative investment. To the best of our knowledge, the role of firm growth has not been explored in the literature on negative investment.

In summary, to understand why Chinese firms divest, we investigate the extent to which firm financing, efficiency, and growth influence negative investment within each ownership group. Although we test them separately for convenience, some of our explanations are not mutually exclusive. For instance, the efficiency and financing motives may be intertwined. We will therefore conduct a number of robustness tests for this purpose.

V. Baseline specification and estimation methodology

A. Baseline specification

In order to test for the financing, efficiency, and growth explanations for negative investment, we start by estimating the following regression:

$$NI_{i,t} = \alpha_0 + \alpha_1 cash\ flow_{i,t-1} + \alpha_2 leverage_{i,t-1} + \alpha_3 TFP_{i,t-1} + \alpha_4 sales\ growth_{i,t-1} + \alpha_5 firm\ size_{i,t-1} + \alpha_6 firm\ age_{i,t} + \alpha_7 tangibility_{i,t-1} + \alpha_8 export_{i,t-1} + v_t + v_j + v_{tj} + \varepsilon_{i,t} \quad (1)$$

where the dependent variable, NI, represents negative investment. Unlike other studies in the literature, our dataset does not contain any information on asset sales. We therefore follow Liu and Siu (2011) and define the investment of firm i at year t ($I_{i,t}$) as the book value of tangible fixed assets at time t ($K_{i,t}$) minus the book value of tangible fixed assets at time $t-1$ ($K_{i,t-1}$) plus depreciation at time t ($Dep_{i,t}$), i.e. $I_{i,t} = K_{i,t} - K_{i,t-1} + Dep_{i,t}$[13]. Negative investment occurs when $I_{i,t} < 0$. Thus, our dependent variable is gross, not net, negative investment, which must be the result of selling or scrapping assets.

When focusing on the *probability* of NI, the dependent variable is a binary variable taking value of one if there is NI, and zero otherwise. When examining the determinants of the *amount* of NI, the dependent variable is a censored variable which is equal to zero if the firm does not have NI, and takes the value of the actual amount otherwise.

The independent variables in equation (1) include proxies aimed at testing the financing, efficiency, and growth explanations, as well as some control variables. Specifically, $cash\ flow_{i,t-1}$ and $leverage_{i,t-1}$ are included to test for the financing explanation. $cash\ flow_{i,t-1}$ is defined as the lagged cash flow to tangible fixed assets ratio. It is included as a proxy for changes in net worth. The second financial variable included in equation (1), $leverage_{i,t-1}$, is the lagged ratio of total debt over total assets. Both financial variables are lagged once to alleviate the potential endogeneity problem in the divestment regressions. Following the arguments outlined in Section 4, we expect α_1 to be negative for all firms and α_2 to be negative for private firms and positive for SOEs.

To test the efficiency explanation, we compute firm-level total factor productivity ($TFP_{i,t-1}$) using the Levinsohn and Petrin (2003) method, where intermediate inputs are used to proxy for unobserved productivity in order to alleviate both the selection bias and the simultaneity bias (between input choices and productivity shocks). Similar to the two financing variables, we lag our TFP measure once. According to the efficiency explanation, we expect α_3 to be negative. $sales\ growth_{i,t-1}$ is a proxy for the output growth of the firm, and is used to test for the growth explanation, which suggests that $\alpha_4 < 0$.

As for the control variables, we include firm size, firm age, the asset tangibility ratio, and an export dummy in our baseline model. $firm\ size_{i,t-1}$ is defined as the lagged value of the natural logarithm of real total assets. It can be important in explaining financing choices for corporate investment. According to Myers and Majluf (1984), size may serve as an inverse proxy for the extent of informational asymmetries between the firm's insiders and external finance providers: smaller firms are expected to face higher hurdles when raising external capital, whereas large firms, which are assumed to be more diversified and less prone to bankruptcy, can borrow more easily. We predict that firm size does not play an important role in *SOE*s' NI decisions owing to their soft budget constraints, but might be important for non-state firms.

Firm age may also serve as a proxy for the wedge between the costs of external and internal capital (Oliner and Rudebusch, 1992). Moreover, younger firms are more likely to face problems of asymmetric information and may therefore be more financially constrained compared to their older counterparts. On the other hand, younger firms are generally more dynamic and efficient than old ones. In the Chinese context, older firms may be less efficient and more likely to have *NI* for restructuring reasons, whereas younger firms may be more likely to have *NI* for funding reasons.

$tangibility_{i,t-1}$ is defined as the lagged ratio of tangible fixed assets to total assets. Firms with high asset tangibility are more likely to make a distress asset sale as it is easier to estimate their value. We therefore expect to observe a positive relationship between asset tangibility and NI.

We use an export dummy ($export_{i,t-1}$) to capture the expected performance-enhancing effects of export activities among Chinese firms. Consistent with widespread evidence that efficiency and exports are positively correlated in China (Kraay, 1999; Park *et al.*, 2010), we expect that firms conducting export business are more likely not to have NI or to have less NI.

Lastly, we include time dummies to account for macroeconomic fluctuations or business cycle effects (v_t), industry dummies to capture industry-specific effects (v_j), and the interactions of time and industry dummies to account for industry-specific shifts in investment demand or expectations (v_{tj})[14].

B. Estimation methodology

We first estimate a pooled probit model to examine the factors that determine the probability of negative investment for each ownership group. We then use a pooled tobit model to estimate the determinants of the amount of negative investment in the divesting firms. Both models allow us to control for unobserved firm-specific heterogeneity by using cluster-robust standard errors, clustered by firms[15].

To control for the potential endogeneity of our regressors, all variables except firm age are lagged once in our regression, the aim being to alleviate simultaneity bias. As a robustness test, we also estimate our equations using an Instrumental Variable (IV) approach.

VI. Data and descriptive statistics

A. Data

Firm-level data offer several advantages for the study of investment or divestment behavior: the problem of aggregation over firms is eliminated in estimation, and the heterogeneity among various types of firms can be taken into account (Bond and Van Reenen, 2007). This is particularly important for China owing to the institutional differences between state and non-state enterprises.

We use data drawn from the annual accounting reports filed with the National Bureau of Statistics (NBS) by industrial firms over the period 2000-2007[16]. The original sample contains more than 300,000 mainly unlisted firms, including all SOEs and other types of enterprises with annual sales of five million yuan (about $750,000) or more. These firms operate in the manufacturing and mining sectors and are located in all 31 Chinese provinces or province-equivalent municipal cities. We dropped observations with negative sales; as well as observations with negative total assets minus total fixed assets; total assets minus liquid assets; and accumulated depreciation minus current depreciation. Firms that lacked complete records on our main regression variables were also dropped. To control for the potential influence of outliers, we excluded observations in the one percent tails of each of the regression variables. Finally, we removed all firms with fewer than five years of consecutive observations.

The NBS data contain a continuous measure of ownership, which is based on the fraction of paid-in-capital contributed by six different types of investors, namely the state; foreign investors (excluding those from Hong Kong, Macao, and Taiwan); investors from Hong Kong, Macao, and Taiwan[17]; legal entities[18]; individuals; and collective investors[19]. We group all foreign firms (from Hong Kong, Macao, Taiwan, and other parts of the world) into a single *foreign* category; and all firms owned by legal entities and individuals into a *private*

category[20]. Thus our firms fall into four broad categories - state-owned, collective, private, and foreign - based on the shares of paid-in-capital contributed by the four types of investors each year.

As in Guariglia *et al.* (2011), we group firms according to the majority average ownership shares. For instance, if the average share of capital paid-in by private investors over the period 2000-2007 is greater than 50%, then the firm is classified as privately owned. Table A2 in the Data Appendix presents the distribution of observations by ownership. Our sample is dominated by private firms: 62.42% of firms are classified as privately-owned. SOEs, collective firms and foreign firms represent respectively 7.62%, 8.20% and 17.75% of our sample. Table A2 shows an interesting pattern of the evolution of ownership over the eight-year period. The proportion of SOEs in our sample declined dramatically, from 11.80% in 2000 to 5.28% in 2007. A similar pattern holds for collective firms, whose share declined from 11.06% to 6.93%. By contrast, the share of private firms climbed from 52.04% to 66.25%. The share of foreign firms remained roughly stable at between 17.23% and 19.49%. Privatization of small SOEs and TVEs became significant after 1998 (Haggard and Huang, 2008). Our dataset reflects the restructuring process involved in the shrinkage of the state and collective sectors and the expansion of the private sector.

Considering that the year 2000 is used to construct lagged variables, the final dataset that we use in estimation covers 63,069 mainly unlisted firms, which yield 270,691 firm-year observations over the period 2001-2007. The sample is unbalanced: the structure of the panel can be seen in Table A3 in the Data Appendix. The number of observations ranges from a minimum of 17,744 in 2001 to a maximum of 51,877 in 2005. Entry and exit of firms take place during our sample period: fewer than 30 percent of firms have the full 7-year accounting information. The active entry and exit of firms are the consequence of the

enterprise restructuring that began in the mid-1990s, and can be viewed as a source of dynamism (see, for instance, Brandt, Van Biesebroeck and Zhang, 2012).

B. Descriptive statistics

Table 1 presents descriptive statistics for some key variables. We focus this discussion on means. Fixed asset investment as a proportion of tangible fixed assets averages 8.8% in our sample. The investment rate is lowest for SOEs (2.5%) and highest for private firms (10.0%), followed by foreign firms (8.8%). The proportion of firms that have negative fixed asset investment is 32.1% for the full sample: it is highest for SOEs (43.4%) and lowest for foreign firms (29.7%) and private firms (31.0%)[21]. For divesting firms, NI amounts to 22.2% of tangible fixed assets for the full sample, being highest for private firms (23.6%) and lowest for SOEs (16.4%). Thus, NI is a widespread phenomenon among all types of firms in China, suggesting the presence of dramatic structural changes in the industrial sector.

Turning to the financial variables included in our baseline model, SOEs have the lowest cash flow ratio (15.1%), and the highest leverage ratio (63.3%). By contrast, foreign firms have the highest cash flow ratio (41.2%) and the lowest leverage ratio (47.7%). The ratios of private firms lie between those of SOEs and foreign firms. The co-existence of high leverage and low cash flow in the state sector is initial evidence in favor of easy credit and soft budget constraints enjoyed by SOEs[22].

SOEs have the lowest TFP (3.1) and foreign firms the highest (5.0), followed by private firms (3.4) and then collective firms (3.2). It is apparent that SOEs remain the least efficient. SOEs also have the lowest rate of sales growth (3.8%), whereas private firms have the highest (11.2%). Foreign firms also have a high growth rate (8.4%). The sales growth rate of collective firms (7.2%) is higher than SOEs' but lower than that of private and foreign

firms. Thus private and foreign firms are the faster growing groups, whereas SOEs are, relatively speaking, stagnating.

SOEs are generally older and larger than enterprises in the non-state sectors, and they have a higher asset tangibility ratio. Collective firms and SOEs are least involved in the exporting business: respectively only 14.8% and 16.1% of these firms export, compared to 72.9% and 29.5%, respectively for foreign and private firms.

It is noteworthy that collective firms are intermediate between SOEs and private enterprises in several characteristics, including their negative net investment ratio, TFP and sales growth. This might reflect the facts that they have a legacy of having been like SOEs, but have, in recent years, reformed further than (remaining) SOEs, being more subject to hard budgets and operating effectively as private enterprises (Naughton, 2007).

When separating the sample into firms with negative investment and those with positive investment (Table A4, Panel A in the Data Appendix), we observe that, for all ownership groups, firms with positive investment significantly outperform their counterparts with negative investment in terms of internal funds, productivity, investment opportunities, and exporting behavior (as proxied by cash flow, TFP, sales growth, and the export dummy, respectively)[23]. More interesting results are found for leverage: in the state and collective sectors, firms with negative investment have higher leverage. By contrast, higher leverage is observed for firms with positive investment in the private and foreign sectors. This provides initial evidence in favor of our explanation according to which high leverage can be seen as an indicator of poor financial performance (which may lead to NI) in the state sector, and of good economic prospect (which encourages investment) in the private sector. Finally, firms reporting NI tend to be smaller and older in all ownership groups.

In sum, the descriptive statistics show that over our sample period, SOEs were the least financially constrained, the least efficient, and the slowest growing. Given their easy

access to credit, reflected in their high leverage ratio, the poor performance of SOEs reflects inefficiencies in capital allocation and a sluggish response to market forces. It is therefore not surprising to observe that many firms in the state sector have negative investment. By contrast, private and foreign firms were the most profitable, efficient, and dynamic sectors. Collective firms had good financial performance but fewer growth opportunities. These differences make it plausible to hypothesize that firms owned by different agents have negative investment for different reasons. In the sub-section that follows, we aim at testing whether this is indeed the case.

VII. Empirical results

A. Probit results

Table 2 reports pooled probit estimates of our baseline model, estimated separately for SOEs, collective, private, and foreign firms. The marginal effect associated with cash flow is negative and significant for all four ownership groups, which accords with the financing explanation. In particular, a 10 percentage point lower cash flow ratio is associated with a 0.79 percentage point higher probability of NI for SOEs. The corresponding figures for collective, private and foreign firms are: 0.54, 0.38, and 0.26, respectively[24]. We had expected the effect of cash flow to be weakest for SOEs, being the least financially constrained. This reverse result might be due to the fact that cash flow is more persistent for these firms, making it more informative about future profitability[25].

The leverage ratio displays an interesting pattern across ownership groups. Its marginal effect is significantly positive for SOEs, significantly negative for private firms, and insignificant for collective and foreign firms. For SOEs, a 10 percentage point higher leverage ratio is associated with a 0.53 percentage point higher probability of showing NI.

Taking into account the fact that SOEs in general, and divesting SOEs in particular, have the highest leverage ratio, our regression result suggests that easy credit in previous years significantly impairs state firms' financial performance, so that these firms may now have to cut back on investment in order to survive. On the contrary, for private firms, the probability of showing NI is 0.59 percentage points lower in the presence of a 10 percentage point higher leverage ratio. It appears that those private firms which have not only the incentive but also the ability to borrow are more likely to avoid NI[26]. External finance does not affect the negative investment decisions of collective and foreign firms, perhaps because their links with local governments and international financial markets respectively may help them to obtain alternative sources of finance.

The firm-level TFP measure has a significantly negative marginal effect for all ownership groups: firms are more likely to suffer NI when they are less productive. This is in line with the efficiency explanation. The marginal effect is greatest for SOEs: a 10 percentage point higher TFP is associated with a 0.21 percentage point lower probability of displaying NI. The corresponding figures for collective, private, and foreign firms are 0.14, 0.11, and 0.06 percentage points, respectively. SOEs are generally less productive. The less productive among them – probably saddled with more over- or mis-investment in the past – have a stronger incentive to undertake NI. This finding is consistent with our efficiency explanation, according to which it is the least efficient firms (SOEs) that are most likely to downsize for efficiency reasons[27].

The growth rate of real sales significantly reduces the probability of showing negative investment for all types of firms, with the largest marginal effects for private and foreign firms: in the presence of a 10 percentage point higher sales growth, we observe a 0.9 and 1.0 percentage points lower probability respectively for these two groups of firms. This evidence supports our explanation that firm growth protects against negative investment. In their

negative investment decisions, private and foreign firms are more responsive to growth opportunities than are state and collective firms[28].

Turning to the control variables, the marginal effect associated with firm size is insignificant for SOEs and foreign firms, but it is significantly positive for collective and private firms. This is consistent with our prediction that their easy access to external finance insulates the negative investment decisions of SOEs from the influences of firm size. A similar argument applies to foreign firms who may access external finance through their parent companies (Manova, Wei and Zhang, 2011). By contrast, smaller collective and private firms are more likely to exhibit higher financial flexibility than their larger counterparts (Chow and Fung, 2000), and are therefore less likely to sell off assets.

The marginal effect associated with firm age is positive and significant for all groups of firms. In China, firm age does not perform an efficient role in alleviating informational asymmetry, as it does in many developed financial markets. Instead, younger firms, being generally more dynamic and efficient, are less likely to undertake negative investment.

Asset tangibility displays a positive and significant marginal effect for all firms. This can be explained considering that firms with high asset tangibility are more likely to make a distress asset sale as it is easier to estimate their value. The export dummy shows a statistically insignificant marginal effect for SOEs and collective firms, but a significantly negative marginal effect for private and foreign firms. The probability of negative investment declines when private and foreign firms have the opportunity to export. This is in line with Park *et al.* (2010) argument that exporting is a cause of superior performance.

In summary, our probit results suggest that negative investment can be mainly explained by financial constraints in the case of private firms, and by inefficiency in the case of SOEs. Rapid firm growth counterweighs both effects for all types of firms. Moreover, a high probability of negative investment in the non-state sectors is associated with certain firm

characteristics: being old, large, having a high asset tangibility ratio, and lacking access to overseas markets[29,30].

B. Tobit results

We next question which factors determine the amount of NI for those firms that actually do so. To answer this question, equation (1) is estimated using a pooled tobit model with cluster-robust standard errors. The results are shown in Table 3.

In line with the findings in the probit model, lower cash flow is associated with a higher level of NI for all firms. The leverage term is significantly negative for private firms, for which a 10 percentage point lower leverage ratio is associated with a 0.61 percentage point higher amount of NI. The finding that lower levels of external finance produce more NI confirms our explanation that the need for funds may explain NI by private firms. The tobit results on leverage differ from those of the probit in that the positive marginal effect for SOEs is no longer significant and collective firms now behave like private firms.

Once again, the marginal effect associated with TFP is significantly negative for all firms, with the largest effect for SOEs: for these firms, a 10 percentage point lower TFP is associated with a 0.15 percentage point higher amount of NI. This is consistent with our prediction that inefficiency is most important in explaining the massive NI of the state sector.

The growth rate of sales also shows a negative and significant marginal effect for all firms: a higher sales growth is associated with less NI. Larger marginal effects are found for private and foreign firms: a 10 percentage point higher sales growth is associated with a 0.57 and 0.67 percentage points lower amount of NI, respectively for these two groups of firms. This again suggests that the growth explanation holds most for the fastest-growing firms.

Several additional factors affect the amount of NI of the non-state firms. For instance, older firms with higher asset tangibility, and those which do not export, tend to show more NI. Overall the findings are consistent with our probit results.

VIII. Robustness tests

A. Alternative tests of the hypotheses

To test the robustness of our results in the baseline model, we use some alternative measures of our main right-hand-side variables. We first introduce an alternative proxy for firms' net worth in place of cash flow. One important component of the cash flow measure is depreciation. However there is no consensus as to whether depreciation is a source of funds, i.e. whether depreciation is a source of capital replacement or just one of the adjustments needed to convert the accrual net income to the cash provided from operating activities. As a robustness check for the financing explanation, we therefore deduct deprecation from cash flow, which gives a measure of net profit, and replace the lagged cash flow to tangible fixed assets ratio in equation (1) with the lagged net income to tangible fixed assets ratio.

Next, in order to test the robustness of the efficiency explanation, we replace TFP with two widely-used alternative proxies for firm-level productivity. First, following McGuckin and Nguyen (1995) and Maksimovic and Phillips (2001), we calculate lagged value added per worker ($value\ added\ per\ worker_{i,t-1}$), which is defined as the lagged value of total real value added divided by the number of workers. Second, we construct lagged average labor productivity ($productivity_{i,t-1}$), which is given by lagged total real sales divided by number of workers. Neither of these measures has the desirable theoretical properties of TFP, but they may have desirable statistical properties since they are not computed from a regression.

Lastly, to test the robustness of the growth explanation, we replace sales growth with different measures of growth. The first is the growth rate of value added ($value\ added\ growth_{i,t-1}$). We are also interested in various sources of output growth, i.e., the rate of factor accumulation (proxied by the growth rates of total assets, $asset\ growth_{i,t-1}$, and of employment, $employment\ growth_{i,t-1}$), and the rate of improvement in firm productivity (the growth rate of TFP, $TFP\ growth_{i,t-1}$).

We present summary statistics of these new variables in Table 4. Focusing on means, the net profit ratio is lowest for SOEs (6.3%), whereas for all non-state sectors, it is above 24%. There is a sharp contrast in productivity between the state and non-state firms. SOEs have the lowest efficiency as measured by value added per worker and average labor productivity, and private and foreign firms are the most efficient. SOEs also have the lowest rates of all four growth measures, i.e. value added growth (-0.1%), total asset growth (0.8%), employment growth (-4.0%), and TFP growth (3.6%). On the other hand, private firms have the highest rates of value added growth (10.8%), total assets growth (9.7%), and TFP growth (8.9%). Foreign firms have the highest growth in employment (3.8%). In brief, these statistics confirm our previous findings that SOEs are the worst performers in terms of profitability, efficiency and growth, whereas private and foreign firms are the best performers. Splitting firms into those with negative and positive investment further shows that the former consistently underperform the latter in terms of profitability, productivity, and growth in all ownership groups (Table A4, Panel B in the Data Appendix).

Table 5 reports the probit estimation results for the models including these new variables. To save space, we report only the marginal effects associated with the new variables. Net profit displays a very similar pattern to that of cash flow: for all firms, the probability of NI is lower, the more abundant the internal finance. Replacing cash flow with net profit does not change the features of the leverage term (not reported): excess leverage in

the state sector still worsens firms' performance and is associated with a higher probability of showing NI, whereas, for private firms, limited access to external finance creates incentives for NI.

The marginal effect on value added per worker is significantly negative for SOEs, insignificant for collective firms, and significantly positive for private and foreign firms. By contrast to the baseline model, the efficiency explanation of NI only holds for the state sector: for SOEs, a 10 percentage point lower value added per worker is associated with a 0.23 percentage points higher probability of undertaking NI. For private and foreign firms, the probability is higher, the higher the efficiency, implying that inefficiency, as proxied in this way, is not the cause of NI. The use of average labor productivity tells the same story except that collective firms also have a significantly positive marginal effect. Thus, these robustness tests confirm that the efficiency explanation applies to SOEs but they also suggest that it does not apply to non-state firms.

Growth of value added and of TFP do not affect the NI decisions of state and collective firms but are associated with lower probability of undertaking NI for private and foreign firms. In the case of real asset growth and employment growth, the marginal effect is significantly negative for all firms. Although there are minor differences according to the measure being used, our main finding of the growth explanation is robust: growth is generally associated with a lower chance of undertaking NI, especially and, more consistently, for private and foreign firms than for state and collective firms**.**

We also find that the baseline results for the control variables are robust when alternative financing, efficiency, and growth measures are used. Finally, our results also hold when the pooled tobit estimation method is employed. To save space we do not report these results, which are available upon request.

B. Instrumental variable methods

Our method of lagging the right-hand-side variables once might not be sufficient to alleviate potential endogeneity concerns. As a further robustness test, we therefore use the instrumental variable (IV) method to test our baseline model specification. We instrument all financing, efficiency, growth, asset tangibility, export, and firm size variables using their own values lagged twice. Both probit and tobit IV models are estimated. To save space, we report only the results of the former in Table 6.

The results relative to the variables representing our three explanations are generally consistent with those of the baseline model. One minor difference lies in the control variables of firm age and size. After being instrumented, the marginal effect of firm size becomes significantly positive only for private firms, suggesting that firm size is not important in determining the NI decisions of the other types of firms. A similar story holds for firm age, which is significant and positive only for private and foreign firms. These results strengthen our argument that the easy access of SOEs to external finance makes size and age irrelevant to their NI decisions. Only in the private and foreign sectors are smaller and younger firms more likely to outperform their counterparts, and therefore less likely to show NI. In brief, the instrumental variable results provide evidence that the baseline model findings are robust.

C. Further robustness tests

Since explanations for *NI* are not mutually exclusive, more robustness tests are conducted to provide additional evidence in favour of particular explanations. First, in order to shed further light on the efficiency motive of *NI*, we examine whether firms' productivity improves after making a *NI*. In Table 7, we report mean and median values of TFP in the year preceding (-1) and the year following (+1) a year characterized by the presence or absence of *NI*. We define group one (G1) as the group of firms which make a *NI* in year t, whilst not showing *NI* in

year t+1; and group two (G2) as the group of firms not showing *NI* in either year t or t+1. We observe that the TFP of all types of firms is higher in the year after a *NI* is made than in the year before it is made. Moreover, when comparing G1 and G2, the percentage change of TFP is the largest for SOEs. Considering that SOEs have the lowest TFP, this evidence suggests that the efficiency motive works for all types of firms, but more markedly for SOEs.

Second, when testing for the financing motive, we interpret high leverage as an indicator of access to external finance, which implies a lower need to divest to finance operations (especially for private firms). However, an alternative argument is that high leverage implies a higher need to repay debt, and thus a higher need to make a distress asset sale when debt obligations become due, if internal funds such as cash flow or profits turn out to be low in a particular year. To test for this second possibility, we include in our model for the probability of undertaking *NI* an interaction term between leverage and a high cash flow dummy (CF_high), which is equal to 1 in a given year if a firm's cash flow lies in the top three quarters of the distribution of the cash flow of all firms belonging to the same industry as that firm in that year, and 0 otherwise. If high leverage suggests a high need to repay debt, one would expect the marginal effect associated with leverage to be positive and that associated with the interaction term to be negative. The results are presented in Table 8. We observe that the marginal effects associated with the interaction terms are insignificant, which does not support the argument that the high leverage is associated with a high need to repay debt. However, our key finding of the opposite impact of leverage on the probability of *NI* between SOEs and private firms remains intact, supporting our claim that the financing motive works for private firms but not for the state sector. Our results are robust when alternative definitions are used for the high cash flow dummy[31].

Another important issue in our analysis is the definition of ownership groups. The use of average share of paid-in capital by different owners over the period of 2000-07 is useful to

mitigate the potential problem of measurement error. However, it omits some interesting patterns of ownership transition during the sample period. It is possible that firms divest or invest strategically before or after changing ownership class. To tackle such problems, we first use the ownership classification made on the basis of ownership shares immediately before the sample period begins (in 2000), so that the ownership is not endogenous to the act of divestment. Secondly, we use the ownership classification made on the basis of the share of capital paid-in by various owner categories in each year, which allows for the dynamics of ownership changes. In other words, each firm is allowed to transit from one ownership group to another during the sample period. The results are reported in Tables 9(a) and 9(b), respectively. Our main findings remain robust to these alternative ways of classifying ownership.

Our results were also robust to the removal of some control variables, such as firm size and age - which may capture debt capacity - from our *NI* equations. We also obtained similar results to those reported in the paper when focusing on persistent *NI*, which we defined as *NI* taking place for at least three years. Lastly, we adopted the linear probability model in estimation, and this too yielded results consistent with our main findings. For brevity, these additional results are not reported but are available on request.

IX. Conclusion

To the best of our knowledge, this paper represents a first attempt to investigate negative investment behavior in China. The issue is of particular interest because China's industrial sector exhibits a high rate of investment which co-exists with a high frequency of negative investment. We have explained this interesting fact using a large and comprehensive panel data set of mainly unlisted industrial firms over the period 2000-2007.

Our descriptive statistics show dramatic structural changes over the sample period, with the share of the state sector declining and that of the non-state sector expanding. SOEs remain the poor performers of the economy: they have the highest negative investment rate, lowest profitability, lowest efficiency, slowest growth rate, and the highest leverage rate. This suggests that the state sector has been cushioned by favorable access to credit and state subsidies. By contrast, the private and foreign sectors, which contain the most efficient, profitable, and fast-growing firms, have less access to the formal financial system. Collective firms exhibit good financial performance and improvements in productivity, but their growth prospects are not comparable to those of private and foreign firms.

Given this huge heterogeneity in firms owned by different agents, our study of negative investment in China required separate analysis of the different ownership groups. Specifically, we tested whether firms owned by different agents have negative investment for different reasons. Our results support the explanation that private firms do so in order to raise capital, whereas negative investment by SOEs can be explained largely by inefficiency. Rapid economic growth counterweighs both effects, especially in the private and foreign sectors**.**

Our paper supports and complements that of Song *et al.* (2011). Both account for the process of China's rapid industrial growth viewed in terms of differences between the public and private sectors in productivity, profitability, saving and funding. Both papers argue that its pace depends on the extent of those differences, the degree of product market competition, the amount of subsidies to ailing state-owned enterprises, and the ability of privately-owned enterprises to generate saving for investment. Our own further contribution is to highlight the different roles of negative investment in that transition process.

Our findings have an important policy implication: the limited access to external finance of the non-state sector is the most likely source of negative investment for private

firms. This suggests the need for further reform of the financial system, which has lagged behind most other economic reforms in China. For instance, banks should apply commercial lending criteria to all types of firms in order to provide and promote efficient financial market competition. The recent financial reforms discussed in Borst and Lardy (2015) are steps in the right direction.

Our study has limitations. The dataset does not allow us to observe the exact timing and amount of asset sales or divestment by firms, making interpretations difficult. The extent to which our findings can be generalized to all sectors of the Chinese economy may also be questioned, owing to the fact that only manufacturing and mining enterprises are covered in the NBS dataset. Ideally, future research should be extended to those less mature, faster growing sectors of the economy such as the more dynamic parts of the service sector, which have fueled China's economic growth over the last few years. Finally, the lack of segment-level data makes it impossible to test hypotheses of divestment such as the focus explanation and liquidity explanation, which may also be important in determining firms' negative investment behavior.

The relatively high negative investment rate observed among listed companies in other Asian economies is unlikely to have the same explanation as in China. A full analysis of the reasons behind the relatively high negative investment rates observed in other countries goes beyond the scope of this paper and is in the agenda for future research.

Data Appendix

Table A1 provides definitions of all variables used in the paper. Table A2 presents the distribution of observations by ownership over time. Table A3 describes the structure of our panel. Table A4 provides additional descriptive statistics of key variables for firms with positive and negative investment.

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TABLE 1
DESCRIPTIVE STATISTICS OF KEY VARIABLES

	Full sample	*SOEs*	*Collective firms*	*Private firms*	*Foreign firms*
Investment vs divestment					
fixed investment/tangible fixed assets	0.088	0.025	0.062	0.100	0.088
	(0.064)	(0.012)	(0.044)	(0.079)	(0.064)
negative investment ratio	0.321	0.434	0.355	0.310	0.297
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
negative investment/tangible fixed assets	-0.222	-0.164	-0.224	-0.236	-0.210
	(-0.051)	(-0.043)	(-0.050)	(-0.052)	(-0.048)
Independent variables in the baseline model					
cash flow	0.364	0.151	0.408	0.364	0.412
	(0.209)	(0.076)	(0.218)	(0.211)	(0.244)
leverage	0.572	0.633	0.591	0.598	0.477
	(0.584)	(0.645)	(0.602)	(0.616)	(0.472)
TFP	3.773	3.062	3.179	3.439	4.969
	(2.536)	(1.916)	(2.228)	(2.379)	(3.308)
sales growth	0.096	0.038	0.072	0.112	0.084
	(0.094)	(0.044)	(0.069)	(0.108)	(0.086)
Control variables in the baseline model					
firm size	5.544	5.879	5.236	5.370	5.951
	(5.432)	(5.917)	(5.151)	(5.237)	(5.888)
firm age	2.274	3.137	2.685	2.152	2.142
	(2.197)	(3.465)	(2.639)	(2.079)	(2.197)
tangibility	0.322	0.399	0.314	0.322	0.302
	(0.294)	(0.381)	(0.276)	(0.295)	(0.280)
export	0.377	0.161	0.148	0.295	0.729
	(0.000)	(0.000)	(0.000)	(0.000)	(1.000)
Observations	270,691	19,264	21,139	157,606	61,229

Note. Mean and median (in parentheses) values of each variable are reported. The negative investment ratio measures the proportion of firms that have negative fixed asset investment. The negative investment to tangible fixed assets ratio measures the mean/median ratio of the amount of negative investment to tangible fixed assets for those observations characterized by negative investment. All other variables are defined in Table A1 in the Data Appendix.

TABLE 2
BASELINE MODEL (PROBIT ESTIMATION)

	SOEs	*Collective firms*	*Private firms*	*Foreign firms*
$cash\ flow_{i,t-1}$	-0.079***	-0.054***	-0.038***	-0.026***
	(0.018)	(0.009)	(0.004)	(0.005)
$leverage_{i,t-1}$	0.053***	-0.008	-0.059***	0.012
	(0.017)	(0.016)	(0.006)	(0.009)
$TFP_{i,t-1}$	-0.021***	-0.014***	-0.011***	-0.006***
	(0.002)	(0.002)	(0.001)	(0.001)
$sales\ growth_{i,t-1}$	-0.068***	-0.071***	-0.090***	-0.100***
	(0.010)	(0.010)	(0.003)	(0.005)
$firm\ size_{i,t-1}$	-0.005	0.009**	0.004**	-0.003
	(0.004)	(0.004)	(0.001)	(0.002)
$firm\ age_{i,t}$	0.010*	0.011*	0.029***	0.056***
	(0.005)	(0.006)	(0.002)	(0.005)
$tangibility_{i,t-1}$	0.336***	0.271***	0.300***	0.249***
	(0.022)	(0.022)	(0.008)	(0.014)
$export_{i,t-1}$	0.003	-0.005	-0.031***	-0.051***
	(0.011)	(0.010)	(0.003)	(0.005)
Observations	19,264	21,139	157,606	61,229

Note. The dependent variable is a binary variable which takes value of one if the firm divests, and zero otherwise The table reports marginal effects and cluster-robust standard errors (in parentheses). Time dummies, industry dummies and their interactions are included in estimation but not reported. Also see Note to Table 1.
*Significant at 10%
** Significant at 5%
*** Significant at 1%.

TABLE 3
BASELINE MODEL (TOBIT ESTIMATION)

	SOEs	*Collective firms*	*Private firms*	*Foreign firms*
$cash\ flow_{i,t-1}$	-0.063***	-0.051***	-0.031***	-0.021***
	(0.014)	(0.007)	(0.003)	(0.004)
$leverage_{i,t-1}$	0.012	-0.035***	-0.061***	0.006
	(0.014)	(0.013)	(0.005)	(0.008)
$TFP_{i,t-1}$	-0.015***	-0.010***	-0.008***	-0.005***
	(0.002)	(0.002)	(0.001)	(0.001)
$sales\ growth_{i,t-1}$	-0.034***	-0.034***	-0.057***	-0.067***
	(0.008)	(0.009)	(0.003)	(0.005)
$firm\ size_{i,t-1}$	-0.003	0.008**	0.004***	-0.007***
	(0.003)	(0.004)	(0.001)	(0.002)
$firm\ age_{i,t}$	0.003	0.007	0.021***	0.052***
	(0.004)	(0.005)	(0.002)	(0.004)
$tangibility_{i,t-1}$	0.228***	0.233***	0.277***	0.236***
	(0.018)	(0.017)	(0.007)	(0.011)
$export_{i,t-1}$	0.009	0.006	-0.021***	-0.042***
	(0.009)	(0.009)	(0.003)	(0.004)
Observations	19,264	21,139	157,606	61,229

Note. The dependent variable is a censored variable which is equal to zero if the firm does not divest, and takes the value of the actual amount divested otherwise. The table reports marginal effects and cluster-robust standard errors (in parentheses). Time dummies, industry dummies and their interactions are included in estimation but not reported. Also see Note to Table 1.
*Significant at 10%
** Significant at 5%
*** Significant at 1%.

TABLE 4
DESCRIPTIVE STATISTICS OF ALTERNATIVE VARIABLES USED IN THE ROBUSTNESS TESTS

	Full sample	*SOEs*	*Collective firms*	*Private firms*	*Foreign firms*
Financing variable					
net profit	0.238	0.063	0.283	0.244	0.261
	(0.086)	(0.009)	(0.092)	(0.095)	(0.100)
Efficiency variables					
value added per worker	0.777	0.477	0.692	0.781	0.882
	(0.471)	(0.277)	(0.415)	(0.494)	(0.498)
productivity	2.856	1.504	2.514	2.914	3.223
	(1.854)	(0.868)	(1.558)	(1.960)	(2.051)
Growth variables					
value added growth	0.089	-0.001	0.042	0.108	0.094
	(0.086)	(0.026)	(0.047)	(0.099)	(0.091)
asset growth	0.077	0.008	0.044	0.097	0.065
	(0.042)	(-0.005)	(0.014)	(0.058)	(0.041)
employment growth	0.015	-0.040	-0.012	0.017	0.038
	(0.000)	(-0.015)	(0.000)	(0.000)	(0.000)
TFP growth	0.079	0.036	0.049	0.089	0.082
	(0.073)	(0.044)	(0.051)	(0.081)	(0.074)
Observations	270,691	19,264	21,139	157,606	61,229

Note. Mean and median (in parentheses) values of each variable are reported. All variables are defined in Table A1 in the Data Appendix.

TABLE 5
ROBUSTNESS TEST: USING DIFFERENT FINANCING EFFICIENCY, AND GROWTH VARIABLES (PROBIT ESTIMATION)

	SOEs	*Collective firms*	*Private firms*	*Foreign firms*
Alternative financing variable				
$net\ profit_{i,t-1}$	-0.068***	-0.038***	-0.023***	-0.018***
	(0.018)	(0.009)	(0.004)	(0.005)
Observations	19,264	21,139	157,606	61,229
Alternative efficiency variables				
$value\ added\ per\ worker_{i,t-1}$	-0.023***	0.001	0.006***	0.005***
	(0.006)	(0.005)	(0.002)	(0.002)
Observations	23,739	21,709	163,095	65,815
$productivity_{i,t-1}$	-0.005**	0.003*	0.005***	0.005***
	(0.002)	(0.002)	(0.001)	(0.001)
Observations	23,739	21,709	163,095	65,815
Alternative growth variables				
$value\ added\ growth_{i,t-1}$	-0.000	-0.008	-0.034***	-0.027***
	(0.006)	(0.007)	(0.002)	(0.003)
Observations	16,468	18,968	148,823	55,385
$asset\ growth_{i,t-1}$	-0.164***	-0.060***	-0.107***	-0.088***
	(0.018)	(0.014)	(0.004)	(0.007)
Observations	19,277	21,142	157,632	61,220
$employment\ growth_{i,t-1}$	-0.076***	-0.096***	-0.109***	-0.129***
	(0.015)	(0.013)	(0.004)	(0.007)
Observations	19,246	21,127	157,550	61,183
$TFP\ growth_{i,t-1}$	0.002	-0.003	-0.023***	-0.017***
	(0.007)	(0.007)	(0.003)	(0.003)
Observations	15,500	18,186	142,208	51,665

Note. The dependent variable is a censored variable which is equal to zero if the firm does not divest, and takes the value of the actual amount divested otherwise. The table reports marginal effects and cluster-robust standard errors (in parentheses). Time dummies, industry dummies and their interactions are included in estimation but not reported. For each model, we only report the marginal effects associated with the new variables to save space. Also see Note to Table 1.
*Significant at 10%
** Significant at 5%
*** Significant at 1%.

TABLE 6
ROBUSTNESS TEST: USING INSTRUMENTAL VARIABLES (PROBIT ESTIMATION)

	SOEs	*Collective firms*	*Private firms*	*Foreign firms*
$cash\ flow_{i,t-1}$	-0.125***	-0.065***	-0.049***	-0.046***
	(0.042)	(0.022)	(0.012)	(0.016)
$leverage_{i,t-1}$	0.081***	-0.010	-0.073***	0.018
	(0.022)	(0.022)	(0.009)	(0.013)
$TFP_{i,t-1}$	-0.027***	-0.018***	-0.013***	-0.007***
	(0.003)	(0.004)	(0.001)	(0.001)
$sales\ growth_{i,t-1}$	-0.077***	-0.083***	-0.086***	-0.101***
	(0.014)	(0.012)	(0.004)	(0.007)
$firm\ size_{i,t-1}$	0.005	0.010	0.008***	-0.002
	(0.005)	(0.007)	(0.003)	(0.004)
$firm\ age_{i,t}$	0.007	0.006	0.023***	0.046***
	(0.006)	(0.007)	(0.002)	(0.006)
$tangibility_{i,t-1}$	0.293***	0.224***	0.208***	0.181***
	(0.033)	(0.031)	(0.013)	(0.025)
$export_{i,t-1}$	-0.011	0.010	-0.032***	-0.050***
	(0.012)	(0.011)	(0.003)	(0.005)
Wald test of exogeneity	91.19 {0.000}	25.95 {0.000}	360.07 {0.000}	68.16 {0.000}
Observations	12,483	14,654	112,695	42,614

Note. The dependent variable is a binary variable which takes value of one if the firm divests, and zero otherwise The table reports marginal effects and cluster-robust standard errors (in parentheses). Time dummies, industry dummies and their interactions are included in estimation but not reported. All financing, efficiency, growth, asset tangibility, export, and firm size variables are instrumented using their own values lagged twice. This explains the smaller number of observations in this table compared to the previous ones. p-values of the Wald test of exogeneity of the instruments are shown in curly brackets. Also see Note to Table 1.
*Significant at 10%
** Significant at 5%
*** Significant at 1%.

TABLE 7
FURTHER ROBUSTNESS TEST FOR THE EFFICIENCY EXPLANATION: CHANGES IN TFP AFTER A FIRM MAKES A *NI*

	G1: $Divest_{i,t}=1$; $Divest_{i,t+1}=0$				G2: $Divest_{i,t}=0$; $Divest_{i,t+1}=0$				Comparing G1 and G2	
	Mean	Median	Change in Mean	Change in Median	Mean	Median	Change in Mean	Change in Median	Change in Mean	Change in Median
TFP(SOEs, year-1)	2.631	1.757			3.49	2.349				
TFP(SOEs, year+1)	3.098	2.019	17.7%***	14.9%***	4.024	2.645	15.3%***	12.6%***	2.4%	2.3%
TFP(Collective firms, year-1)	2.729	1.982			3.205	2.397				
TFP(Collective firms, year+1)	3.198	2.239	17.2%***	13.0%***	3.725	2.737	16.2%***	14.2%***	1.0%	-1.2%
TFP(Private firms, year-1)	2.726	1.943			3.228	2.298				
TFP(Private firms, year+1)	3.389	2.372	24.3%***	22.1%***	4.03	2.82	24.8%***	22.7%***	-0.5%	-0.6%
TFP(Foreign firms, year-1)	3.976	2.645			4.823	3.256				
TFP(Foreign firms, year+1)	4.805	3.212	20.9%***	21.4%***	5.806	3.971	20.4%***	22.0%***	0.5%	-0.5%

Note. This table presents total factor productivity (TFP) in the year preceding (year -1) and the year following (year +1) the year in which a NI is made (G1) or not made (G2). We provide the *t*-test for differences in means and the Wilcoxon rank-sum test for differences in medians of TFP between year -1 and year +1.
*Significant at 10%
** Significant at 5%
*** Significant at 1%.

TABLE 8
FURTHER ROBUSTNESS TEST FOR FINANCING EXPLANATION: ADDING AN INTERACTION BETWEEN LEVERAGE AND A HIGH CASH FLOW DUMMY (PROBIT ESTIMATION)

	SOEs	*Collective firms*	*Private firms*	*Foreign firms*
$cash\ flow_{i,t-1}$	-0.031**	-0.044***	-0.026***	-0.018***
	(0.015)	(0.009)	(0.004)	(0.005)
$leverage_{i,t-1}$	0.029*	-0.031*	-0.072***	0.003
	(0.016)	(0.016)	(0.006)	(0.009)
$CF\_high_{i,t-1}$	-0.106***	-0.097***	-0.079***	-0.045***
	(0.009)	(0.010)	(0.004)	(0.005)
$CF\_high_{i,t-1} * leverage_{i,t-1}$	-0.019	-0.013	-0.001	-0.004
	(0.031)	(0.038)	(0.013)	(0.020)
$TFP_{i,t-1}$	-0.015***	-0.009***	-0.008***	-0.006***
	(0.002)	(0.002)	(0.001)	(0.001)
$sales\ growth_{i,t-1}$	-0.060***	-0.064***	-0.084***	-0.096***
	(0.010)	(0.010)	(0.003)	(0.005)
$firm\ size_{i,t-1}$	-0.010***	0.001	-0.002	-0.003
	(0.004)	(0.004)	(0.001)	(0.002)
$firm\ age_{i,t}$	0.005	0.006	0.029***	0.058***
	(0.005)	(0.006)	(0.002)	(0.005)
$tangibility_{i,t-1}$	0.288***	0.237***	0.273***	0.237***
	(0.022)	(0.022)	(0.008)	(0.013)
$export_{i,t-1}$	0.001	-0.004	-0.030***	-0.050***
	(0.010)	(0.010)	(0.003)	(0.005)
Observations	19,264	21,139	157,606	61,229

Note. The dependent variable is a binary variable which takes value of one if the firm divests, and zero otherwise. The table reports marginal effects and cluster-robust standard errors (in parentheses). CF_high is a dummy variable equal to 1 in a given year if a firm's cash flow lies in the top three quarters of the distribution of the cash flow of all firms belonging to the same industry as that firm in that year, and 0 otherwise. The marginal effects associated with the *CF_high *Leverage* interaction are computed based on the difference between the average marginal effects for *Leverage* evaluated in turn at CF_high =1 and CF_high =0. Time dummies, industry dummies and their interactions are included in estimation but not reported. Also see Note to Table 1.

*Significant at 10%
** Significant at 5%
*** Significant at 1%.

TABLE 9(A)
FURTHER ROBUSTNESS TEST: USING A DIFFERENT OWNERSHIP CLASSIFICATION (PROBIT ESTIMATION)

	SOEs	*Collective firms*	*Private firms*	*Foreign firms*
$cash\ flow_{i,t-1}$	-0.087***	-0.050***	-0.053***	-0.032***
	(0.016)	(0.009)	(0.007)	(0.007)
$leverage_{i,t-1}$	0.039**	-0.011	-0.045***	0.005
	(0.016)	(0.015)	(0.010)	(0.012)
$TFP_{i,t-1}$	-0.018***	-0.014***	-0.011***	-0.007***
	(0.002)	(0.002)	(0.001)	(0.001)
$sales\ growth_{i,t-1}$	-0.077***	-0.058***	-0.104***	-0.103***
	(0.010)	(0.009)	(0.006)	(0.007)
$firm\ size_{i,t-1}$	0.001	0.002	0.005**	-0.001
	(0.003)	(0.004)	(0.002)	(0.003)
$firm\ age_{i,t}$	0.005	0.018***	0.026***	0.031***
	(0.005)	(0.006)	(0.003)	(0.009)
$tangibility_{i,t-1}$	0.345***	0.316***	0.254***	0.241***
	(0.021)	(0.020)	(0.013)	(0.018)
$export_{i,t-1}$	-0.004	-0.016*	-0.028***	-0.051***
	(0.009)	(0.008)	(0.005)	(0.006)
Observations	22,373	26,245	59,086	37,066

Note. The dependent variable is a binary variable which takes value of one if the firm divests, and zero otherwise. The table reports marginal effects and cluster-robust standard errors (in parentheses). Time dummies, industry dummies and their interactions are included in estimation but not reported. The ownership classification is made on the basis of ownership shares immediately before the sample period begins (in 2000). Also see Note to Table 1.
*Significant at 10%
** Significant at 5%
*** Significant at 1%.

TABLE 9(B)
FURTHER ROBUSTNESS TEST: USING A DIFFERENT OWNERSHIP CLASSIFICATION (PROBIT ESTIMATION)

	SOEs	*Collective firms*	*Private firms*	*Foreign firms*
$cash\ flow_{i,t-1}$	-0.084***	-0.055***	-0.037***	-0.027***
	(0.017)	(0.008)	(0.004)	(0.005)
$leverage_{i,t-1}$	0.051***	-0.021	-0.060***	0.013
	(0.016)	(0.015)	(0.006)	(0.009)
$TFP_{i,t-1}$	-0.018***	-0.013***	-0.011***	-0.006***
	(0.002)	(0.002)	(0.001)	(0.001)
$sales\ growth_{i,t-1}$	-0.069***	-0.071***	-0.089***	-0.102***
	(0.010)	(0.009)	(0.003)	(0.005)
$firm\ size_{i,t-1}$	-0.004	0.010**	0.004***	-0.004
	(0.003)	(0.004)	(0.001)	(0.002)
$firm\ age_{i,t}$	0.014***	0.013***	0.032***	0.053***
	(0.005)	(0.005)	(0.002)	(0.005)
$tangibility_{i,t-1}$	0.342***	0.275***	0.302***	0.250***
	(0.021)	(0.020)	(0.008)	(0.013)
$export_{i,t-1}$	-0.003	-0.024***	-0.030***	-0.050***
	(0.009)	(0.009)	(0.003)	(0.005)
Observations	21,139	24,976	160,378	60,508

Note. The dependent variable is a binary variable which takes value of one if the firm divests, and zero otherwise. The table reports marginal effects and cluster-robust standard errors (in parentheses). Time dummies, industry dummies and their interactions are included in estimation but not reported. The ownership classification is made on the basis of the share of capital paid-in by various owner categories in each year. Also see Note to Table 1.
*Significant at 10%
** Significant at 5%
*** Significant at 1%.

TABLE A1
VARIABLE DEFINITIONS

Variables	*Definitions*
Dependent variable in the pooled probit model with cluster-robust standard errors	
NI	Binary variable which takes value of one if the firm has negative investment at time *t* ($I_{i,t}$ <0), and zero otherwise. $I_{i,t}$ represents fixed investment at time *t* and is defined as the firm's book value of tangible fixed assets at time *t* ($K_{i,t}$) minus the book value of tangible fixed assets at time *t*-1 ($K_{i,t-1}$) plus depreciation at time *t* ($Dep_{i,t}$), i.e. $I_{i,t}=K_{i,t} - K_{i,t-1}+Dep_{i,t}$.
Dependent variable in the pooled tobit model with cluster-robust standard errors	
NI	Censored variable equal to zero if the firm does not have negative investment ($I_{i,t} \geq 0$), and equal to the actual amount divested, otherwise.
Independent variables (in both the baseline model and robustness tests)	
Financial variables	
cash flow	Ratio of cash flow (defined as the sum of the firm's net income and depreciation) to total tangible fixed assets.
leverage	Ratio of total debt to total assets.
net profit	Ratio of net income to total tangible fixed assets.
Efficiency variables	
TFP	Total Factor Productivity calculated using the Levinsohn and Petrin (2003) method.
value added per worker	Ratio of real value added to number of employees.
productivity	Average labor productivity: ratio of real sales to number of employees.
Growth variables	
sales growth	Growth rate of real sales
value added growth	Growth rate of real value added
asset growth	Growth rate of total real assets
employment growth	Growth rate of number of employees
TFP growth	Growth rate of TFP
Control variables	
firm size	Natural logarithm of the book value of total real assets (expressed in thousands of RMB *yuan*)
firm age	Natural logarithm of firm age
tangibility	Ratio of tangible fixed assets to total assets.
export	Dummy variable equal to one if the firm exports, and zero otherwise
high cash flow dummy	Dummy variable equal to 1 in a given year if a firm's cash flow lies in the top three quarters of the distribution of the cash flow of all firms belonging to the same industry as that firm in that year, and zero otherwise.

Note. All variables (except dummy variables) are deflated using provincial ex-factory producer price indices taken from various issues of the *China Statistical Yearbook*.

TABLE A2
DISTRIBUTION OF OBSERVATIONS BY OWNERSHIP

	SOEs	*Collective firms*	*Private firms*	*Foreign firms*	*Mixed ownership*	*Total*
2000	11.80	11.06	52.04	19.49	5.61	100.00
2001	9.49	9.62	58.00	18.20	4.69	100.00
2002	8.65	8.90	60.89	17.23	4.33	100.00
2003	7.57	8.04	63.36	17.25	3.77	100.00
2004	7.36	7.83	63.56	17.53	3.71	100.00
2005	6.75	7.62	64.42	17.47	3.73	100.00
2006	6.27	7.21	65.18	17.69	3.65	100.00
2007	5.28	6.93	66.25	17.99	3.55	100.00
Average	7.62	8.20	62.42	17.75	4.02	100.00

Note. All numbers in this table are percentages. The ownership classification is based on the majority rule.

TABLE A3
STRUCTURE OF THE UNBALANCED PANEL USED IN ESTIMATION

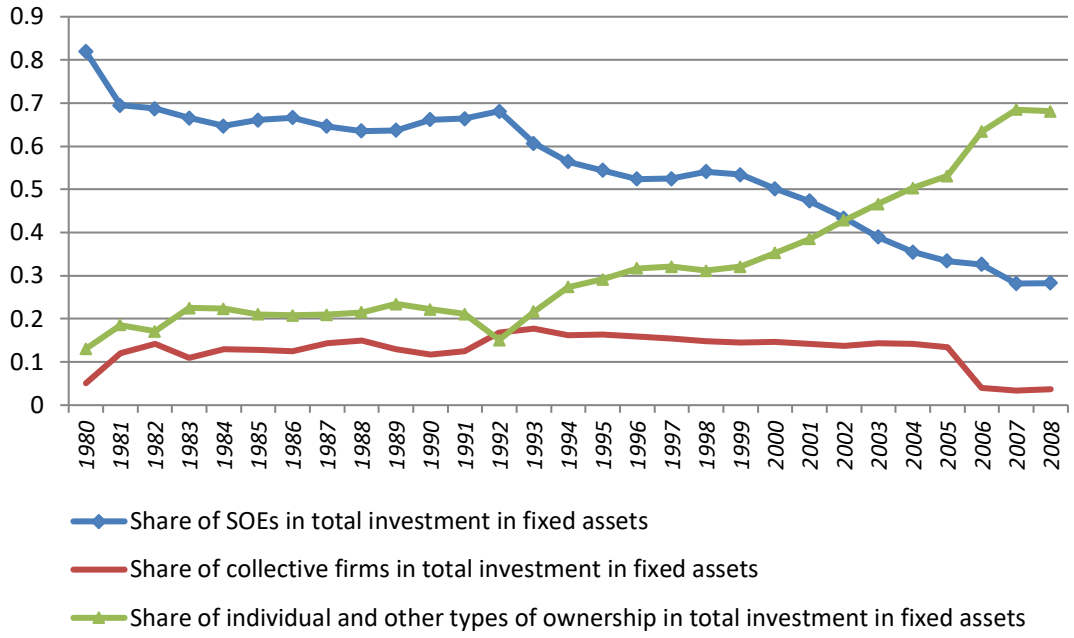
Year	*Number of observations*	*Percent*	*Cumulative*
2001	17,744	6.56	6.56
2002	24,830	9.17	15.73
2003	35,178	13.00	28.72
2004	43,031	15.90	44.62
2005	51,877	19.16	63.78
2006	50,514	18.66	82.45
2007	47,517	17.55	100.00
Total	270,691	100.00	

TABLE A4
DESCRIPTIVE STATISTICS OF KEY VARIABLES FOR FIRMS WITH NEGATIVE AND POSITIVE INVESTMENT

	Full sample			*SOEs*			*Collective firms*			*Private firms*			*Foreign firms*		
	NI	*PI*	*p*-value	*NI*	*PI*	*p*-value	*NI*	*PI*	*p*-value	*NI*	*PI*	*p* value	*NI*	*PI*	*p*-value
Panel A. Variables in the baseline model															
fixed investment/tangible fixed assets	-0.222	0.234	0.000	-0.164	0.171	0.000	-0.224	0.218	0.000	-0.236	0.252	0.000	-0.210	0.214	0.000
	(-0.051)	(0.161)		(-0.043)	(0.098)		(-0.050)	(0.141)		(-0.052)	(0.183)		(-0.048)	(0.141)	
cash flow	0.330	0.379	0.000	0.101	0.189	0.000	0.369	0.430	0.000	0.353	0.369	0.002	0.361	0.433	0.000
	(0.178)	(0.222)		(0.046)	(0.101)		(0.177)	(0.240)		(0.194)	(0.219)		(0.210)	(0.260)	
Leverage	0.573	0.570	0.000	0.652	0.618	0.000	0.600	0.587	0.000	0.593	0.601	0.000	0.475	0.478	0.000
	(0.585)	(0.584)		(0.669)	(0.629)		(0.613)	(0.596)		(0.609)	(0.620)		(0.468)	(0.474)	
TFP	3.190	4.046	0.000	2.468	3.507	0.000	2.735	3.419	0.000	2.965	3.651	0.000	4.225	5.282	0.000
	(2.148)	(2.743)		(1.535)	(2.244)		(1.893)	(2.438)		(2.071)	(2.532)		(2.773)	(3.547)	
sales growth	0.024	0.129	0.000	-0.009	0.075	0.000	0.016	0.102	0.000	0.038	0.146	0.000	0.012	0.115	0.000
	(0.036)	(0.120)		(0.007)	(0.071)		(0.028)	(0.090)		(0.048)	(0.135)		(0.027)	(0.111)	
firm size	5.402	5.611	0.000	5.729	5.995	0.000	5.143	5.287	0.000	5.217	5.439	0.000	5.799	6.016	0.000
	(5.293)	(5.499)		(5.745)	(6.046)		(5.061)	(5.201)		(5.087)	(5.305)		(5.706)	(5.958)	
firm age	2.343	2.242	0.000	3.177	3.106	0.000	2.716	2.668	0.000	2.191	2.135	0.000	2.181	2.126	0.000
	(2.302)	(2.197)		(3.496)	(3.434)		(2.708)	(2.639)		(2.079)	(2.079)		(2.302)	(2.197)	
Tangibility	0.311	0.327	0.000	0.399	0.398	0.000	0.303	0.319	0.000	0.306	0.329	0.000	0.287	0.309	0.000
	(0.280)	(0.301)		(0.382)	(0.380)		(0.264)	(0.283)		(0.275)	(0.303)		(0.260)	(0.288)	
Export	0.333	0.397	0.000	0.150	0.170	0.000	0.144	0.151	0.036	0.258	0.312	0.000	0.694	0.744	0.000
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(1.000)	(1.000)	
Observations	86957	183734		8364	10900		7505	13634		48925	108681		18201	43028	
Panel B. Variables in robustness tests															
net profit	0.214	0.250	0.000	0.028	0.090	0.000	0.258	0.297	0.000	0.239	0.247	0.821	0.220	0.278	0.000
	(0.062)	(0.098)		(0.001)	(0.018)		(0.065)	(0.108)		(0.079)	(0.101)		(0.074)	(0.112)	
value added per worker	0.718	0.806	0.000	0.401	0.536	0.000	0.623	0.729	0.000	0.741	0.800	0.000	0.837	0.901	0.000
	(0.421)	(0.495)		(0.233)	(0.314)		(0.369)	(0.441)		(0.454)	(0.512)		(0.458)	(0.516)	
Productivity	2.656	2.951	0.000	1.301	1.659	0.000	2.299	2.633	0.000	2.761	2.983	0.000	3.118	3.268	0.000
	(1.666)	(1.946)		(0.749)	(0.961)		(1.428)	(1.634)		(1.803)	(2.028)		(1.906)	(2.115)	
value added growth	-0.026	0.143	0.000	-0.095	0.069	0.000	-0.054	0.095	0.000	-0.007	0.159	0.000	-0.023	0.143	0.000
	(0.002)	(0.123)		(-0.036)	(0.072)		(-0.017)	(0.081)		(0.015)	(0.136)		(0.001)	(0.124)	
asset growth	-0.031	0.128	0.000	-0.062	0.063	0.000	-0.047	0.093	0.000	-0.022	0.151	0.000	-0.030	0.106	0.000
	(-0.030)	(0.085)		(-0.049)	(0.034)		(-0.040)	(0.052)		(-0.024)	(0.105)		(-0.026)	(0.076)	
employment growth	-0.031	0.037	0.000	-0.065	-0.021	0.000	-0.046	0.007	0.000	-0.029	0.038	0.000	-0.015	0.060	0.000
	(0.000)	(0.000)		(-0.026)	(-0.007)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.017)	
TFP growth	0.051	0.092	0.000	0.002	0.061	0.000	0.025	0.062	0.000	0.067	0.098	0.000	0.047	0.096	0.000
	(0.062)	(0.079)		(0.027)	(0.055)		(0.041)	(0.057)		(0.074)	(0.084)		(0.057)	(0.082)	
Observations	86957	183734		8364	10900		7505	13634		48925	108681		18201	43028	

Note. Mean and median (in parentheses) values of each variable are reported. All variables are defined in Table A1 in the Data Appendix. *NI* refers to observations with negative fixed investment. *PI* refers to observations with positive fixed investment. *p*-value denote the *p*-values associated with the *t*-tests for equality of means of the reported variables between firm-years with *NI* and *PI*.

FIGURE 1
SHARE OF FIRMS OWNED BY DIFFERENT AGENTS IN TOTAL INVESTMENT IN FIXED ASSETS



Data source. *China Statistical Yearbook* (Various issues).

Note. Individual firms include family firms and small private businesses. Other types of ownership consist of joint-ownership enterprises, shareholding companies, joint-venture enterprises, and foreign firms.

ENDNOTES

[1] Focusing on aggregate data over the same time period covered by our data (2000-2007), the World Bank (2019) reports the following average values of gross fixed capital formation (GFCF) to GDP ratio (manufacturing value added over GDP): 41% (32%) in China; 23% (24%) in Singapore; 17% (23%) in the Philippines; 33% (25%) in South Korea; 23% (26%) in Malaysia; 25% (31%) in Thailand. These statistics show that China has by far the largest GFCF to GDP ratio among these countries, and that this is driven by the manufacturing sector. In fact, the only countries with GFCF to GDP ratio higher than China over the period 2000-2007 are India (42%), Latvia (42%), Qatar (46%), and Suriname (46%). This confirms that China is very unusual if not unique. It should, however, be noted that the gross capital formation does not correspond exactly to the investment rate, but is a broader measure. It consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress." Net acquisitions of valuables are also considered capital formation.

[2] By contrast, Brandt and Zhou (2010) show that the contribution of the high investment rate to growth in China was quite limited. In fact, various estimates of the causal effect of investment on growth produce results of different strength, according to the methodology and data used (e.g. Brandt and Zhou, 2010; Knight and Ding, 2012, ch.6; Guariglia and Yang, 2016).

[3] The aggregate investment rate is defined as the aggregate investment to capital ratio. The rate of negative investment is defined as the percentage of companies in the sample showing

negative investment. We report data for the period 2000-2007, as our own empirical analysis is based on that period. See endnote 16 for details on why more recent data could not be used.

4 These data are also taken from Thomson Financial and refer to listed companies over the period 2000-2007.

5 According to the World Bank (2019), over the period 2000-2007, there were only 1530 listed companies in China, whereas the full National Bureau Statistics (NBS) dataset, which we use in this paper, contains over 300,000 companies. This suggests that listed companies make up less than 0.5% of the total. Unfortunately, our dataset does not allow separate identification of publicly listed companies, as their legal identification numbers were changed when they went public (Liu and Xiao, 2004).

6 To the best of our knowledge, data on unlisted firms for other Asian countries are not available. Moreover, unlisted companies are likely to play a smaller role in those countries than in China, as the listed sector is much larger in those countries. For instance, according to World Bank (2019), the average number of listed companies per 1,000,000 people over the period 2000-2007 was only 0.99 in China. The corresponding figures for other Asian countries were: 102.31 in Singapore; 2.81 in the Philippines; 31.58 in South Korea; 36.99 Malaysia; and 6.78 in Thailand.

7 A sell-off occurs when a firm sells a part of its assets to another firm. A spin-off takes place when ownership of the divested asset is transferred to a new company formed by a pro-rata distribution of equity shares in the new company to current shareholders. An equity carve-out occurs when ownership of the divested assets is transferred to a new company formed by the issue of equity shares in the new company to the public. A management buyout means that the incumbent management team buys all the equity shares of either a firm or a subsidiary from current shareholders.

[8] A partial sell-off is the sale of a subsidiary, division, or other operating assets; a total sell-off (or liquidation) occurs when a firm sells all its assets.

[9] It should be noted that all these explanations are not mutually exclusive. For instance, when it divests, a firm may be responding to both the efficiency and the financing motive.

[10] The reform was announced in 1999. The meaning of the slogan is that small SOEs were to be closed or privatized, whereas large SOEs were to be merged into large industrial conglomerates and the control over these conglomerates was to be consolidated by the central and local governments.

[11] The more recent reforms to the financial system documented in Borst and Lardy (2015) also contributed to making finance more accessible to all companies: Lardy (2014) documents a significant increase in the flow of loans to private companies in recent years.

[12] As more than 99% of the firms in our dataset are unlisted, we are unable to include Tobin's *Q* in our model.

[13] Definitions of all variables are presented in Table A1 in the Data Appendix.

[14] In the absence of Tobin's *Q*, time dummies interacted with industry dummies, or, more specifically, time-varying demand shocks at the industry level, also contribute to capturing investment opportunities (Brown and Petersen, 2009; Brown, Fazzari and Petersen, 2009; Duchin, Ozbas and Sensoy, 2010; Guariglia *et al.*, 2011).

[15] Although pooled probit and tobit models do not take into account the panel nature of the dataset, they provide consistent estimators of relevant parameters. We use a robust estimator of the covariance matrix that allows for clustering within firms to ensure appropriate inference. An important characteristic of pooled estimators is that they do not require the regressors to be strictly exogenous and can accommodate predetermined variables (Wooldridge, 2002). This makes the estimators more robust compared to random-effects

models, which assume strict exogeneity. Our results were robust to using random-effects probit and tobit estimators.

16 It was, unfortunately, not possible to use more recent waves of the NBS dataset in our analysis, owing to the fact that key variables such as depreciations are no longer provided after 2007.

17 The rationale for dividing foreign investors into those from Hong Kong, Macao, and Taiwan, and those from other parts of the world is that the former capture the so-called 'round-tripping' foreign direct investment, whereby domestic firms may register as foreign invested firms from nearby regions to take advantage of the benefits (such as tax and legal benefits) granted to foreign invested firms (Huang, 2003).

18 Legal entities represent a mix of various domestic institutions, such as industrial enterprises, construction and real estate development companies, transportation and power companies, security companies, trust and investment companies, foundations and funds, banks, technology and research institutions etc.

19 Collective firms are typically owned collectively by communities in urban or rural areas. The latter are known as township and village enterprises (TVEs).

20 Within this category, firms owned by individuals represent about two thirds of the total. As firms owned by legal entities include firms owned by state legal entities, one could question their inclusion in the *private* category. One reason for including them is that while the state's primary interest is political (i.e. aimed at maintaining employment levels or control over certain strategic industries), legal entities are profit-oriented (Wei, Xie and Zhang, 2005). Since our dataset does not allow us to discriminate between state and non-state legal entities, we are unable to exclude the former from the *private* category. However, our results were generally robust to excluding firms owned by legal entities from the *private* category.

[21] Descriptive statistics calculated for different industries showed that the percentages of firms with negative investment were not too different across industries, ranging from 27.8% in the transport industry to 37.3% in the petroleum industry. These statistics, which are not reported for brevity, suggest that negative investment is not concentrated in some shrinking industries, but is widespread.

[22] The difference in the leverage term between SOEs and private firms is statistically significant according to a two-sample mean-comparison test.

[23] All such differences are statistically significant at the 5% level according to a two-sample mean-comparison test.

[24] Note that all the differences between marginal effects across the four ownership groups discussed in the paper are statistically significant at the 5 percent significance level.

[25] We tested whether this is the case by running a system-GMM (Blundell and Bond, 1998) regression of cash flow on lagged cash flow, time, and industry dummies for various ownership groups, and found that SOEs display the highest coefficient on the lagged dependent variable. These results, which are available upon request, confirm that cash flow is indeed more persistent for SOEs.

[26] See Section VIII. C for a further discussion of this point.

[27] These results were robust to including the marginal product of capital (MPK) in our model, as an additional measure of efficiency. However, we decided to omit MPK owing to its high correlation with cash flow.

[28] The larger negative marginal effect of private firms relative to SOEs might be the net effect of opposing forces: growth in the presence of credit constraints can be expected to increase their sale of assets, but investment in fixed assets (which is positively associated with cash flow and with TFP) might signal creditworthiness, and might therefore be positively related

to market forces, including current growth, suggesting a negative relationship between negative investment and growth.

[29] One could question whether these results might be driven by the high rate of firm entry and exit characterizing our sample period (Brandt, Van Biesebroeck, and Zhang, 2012). To test whether this is the case, we re-estimated our baseline model on a balanced sample, which only contains firms, which have been present throughout the available period. The results, not reported for brevity but available upon request, were very similar to those reported in Table 2.

[30] We also re-estimated our baseline specification for the full sample adding interactions of cash flow, leverage and TFP with both a dummy equal to one for SOEs and 0 otherwise, and a dummy equal to 1 for private firms and 0 otherwise. The marginal effects associated with these interactions respectively indicate the extent to which changes in cash flow/leverage/TFP affect the probability of undertaking negative investment for SOEs compared to all other firms, and for private firms compared to all other firms. We found that, in line with the results reported in Table 2, relative to the base group made up by foreign and collective firms, the association between cash flow and the chance of showing negative investment was highest (in absolute value) for SOEs. A similar result was observed for the association between TFP and the probability of showing negative investment. Furthermore, leverage was negatively (positively) associated with the probability of undertaking negative investment for private firms (SOEs). The marginal effects associated with other control variables were also qualitatively similar to those reported in Table 2. These results are not reported for brevity but are available upon request.

[31] Specifically, we used a 50% threshold as an alternative way to define the high cash flow dummy (*CF_high*).