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Article

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The mystery of zombie enterprises – “stiff but deathless”

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ABSTRACT

Drawing on social exchange theory, this study uses data on China's Shanghai and Shenzhen A-share listed companies from 2009 to 2016 to examine why zombie enterprises are “stiff but deathless.” We find that these enterprises are able to “linger breathlessly” due to government support in the form of increased subsidies and bank loans. The government is more inclined to grant subsidies to zombie companies that assume greater policy burdens, specifically those offering more jobs. Furthermore, an enterprise's property rights do not influence the level of “blood transfusions” received, and government assistance fails to bolster operating efficiency or value. This phenomenon is further explored in the context of the incentives local government officials have to maintain employment stability. Our conclusions highlight the necessity and urgency of cleaning up zombie enterprises.

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1. Introduction

China's economic development has entered a new normal. The significant slowdown in economic growth has led to upgrades of the industrial infrastructure (Zheng, 2016), and it also provides an opportunity to adjust production capacities and advance market-clearing processes. On November 4, 2015, the State Council held an executive meeting to discuss Chinese industry's location in a critical period of transformation and advancement. The current focus is to stabilize industrial growth and to continually improve the efficiency of enter-

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prises. The meeting stressed the need to “accelerate the zombie enterprise reorganization and integration or help them exit the market, and increase support for state-owned enterprises to solve historical baggage.” Zombie enterprises are characterized by low operational efficiency and production, and they suffer from long-term losses or insolvency. They consume social funds and resources, and although they should have been eliminated by the market, they continue to exist (Chen, 2015). Since the end of the 20th century, overcapacity has gradually become one of China’s most important macroeconomic phenomena. Since 2009, the State Council has issued three important documents on managing overcapacity due to its serious economic and social impacts. Research shows that overcapacity is more prominent in industries that have more zombie enterprises (Caballero et al., 2008). In the process of “supply side” structural reform, cleaning up zombie enterprises has become an urgent task. They squeeze resources, hinder the emergence of new innovative enterprises and seriously affect improvements to social productivity. In addition, zombie enterprises have the ability to bear higher losses than general enterprises. In the context of a macroeconomic downturn, this may lead to a situation of “the bad wins the best,” exacerbating economic problems. As zombie enterprises have such a large negative impact on China’s economy, how do they continue to exist? What is the underlying logic behind this phenomenon? This study examines the problem theoretically and provides possible explanations, supported by empirical evidence.

The conditions necessary for the survival of enterprises are good production, strong management and the ability to produce outstanding technological innovations. Enterprises need to accomplish three tasks: produce quality products to sell; turn their inventory into cash flow for further production and innovation; and continually create profits. Zombie enterprises have low operational efficiency and bear long-term losses; to “stay alive,” they often accept support from external resources. From the perspective of resource allocation, these are direct salvage operations undertaken by the government. Why do government departments spend huge amounts of resources keeping zombie companies alive? Social exchange theory’s view of behavior as an exchange of tangible or intangible commodities or services (Hou, 2006) provides a useful lens for analyzing this process. That is, the act itself is the social interaction process: an actor trades a “resource” for some kind of “reward” (Chen and Qu, 2012). Social exchange activities can be divided into market exchange, redistribution exchange and reciprocal exchange (Homans, 1958). Reciprocal exchange between enterprises and governments is commonplace (Antia et al., 2013). China’s current political system is characterized by political centralization and fiscal decentralization (Yao and Zhang, 2013). In this system, a local government official’s promotion is entirely in the hands of the central government, and standards for promotion depend on the needs of the government. China has a large population, and employment problems are an important concern for the government. Solving citizens’ employment difficulties has become a major task for the Chinese government and its officials. This has also become one of the main indicators for evaluating local government officials’ promotion prospects (Zhang et al., 2013). To perform well on these assessments, local officials, under the pressure of a political promotion system, require the help of enterprises that can maintain employment volume and social stability. Although zombie enterprises are inefficient, they can still offer jobs. Within the framework of social exchange theory, local officials are incentivized to allocate government resources to zombie enterprises that have lost their ability to operate efficiently.

Based on the preceding analysis, we chose Chinese Shanghai and Shenzhen A-share listed companies as our research sample to examine the mystery of zombie enterprises and uncover the underlying logic of continuing to breathe life into these “stiff but deathless” entities. Our conclusions reveal that zombie enterprises obtain the direct support and credit endorsement of the government, and that these “blood transfusions” in the form of government subsidies and bank loans are the direct reasons that zombie enterprises persist. However, the distribution strength of government subsidies has heterogeneous characteristics. Specifically, a zombie enterprise with more jobs to offer receives more government subsidies, but an enterprise’s property rights have little to no influence. Furthermore, this kind of blood transfusion seldom boosts the enterprise’s operating efficiency or value. This study considers the direct cause of these stiff but deathless zombie enterprises from the perspective of resource rationing. The potential logic behind this phenomenon is further explored in the context of the incentives provided to local government officials to maintain employment stability to secure their own paths to promotion. Our research conclusions highlight the necessity and urgency of cleaning up zombie enterprises.

The remainder of this paper is organized as follows. Section 2 outlines the institutional background and hypothesis. Section 3 describes the research design. Section 4 provides the empirical results. Section 5 discusses further analysis and the robustness test, and Section 6 concludes the paper.

2. Institutional background and hypothesis

Zombie enterprises first emerged in the late 1980s, when the US Federal Deposit Insurance Corporation set an unrealistically low credit criterion (Kane, 1987; Zhu and He, 2016). The literature on Japan's economic development shows that from 1995 to 2002 the proportion of zombie enterprises in Japan increased, and this is considered the main reason for Japan's long-term economic decline (Fukuda and Nakamura, 2011; Kawai and Morgan, 2013). According to current research, zombie enterprises are formed by various factors. Zombie enterprises can be the result of poor production quality, low or no technological innovation or a lack of entrepreneurial spirit (Cheng and Hu, 2016). Some studies suggest that the root cause of zombie enterprises is the support they receive from external resources. For example, Liu and Mao (2016) argue that economic agents (banks and governments) and institutional and cultural elements play an important role.

This raises interesting questions about the survival of Chinese zombie enterprises in China's institutional context. In the Chinese government's top-down approach to governance, realizing a national-level goal depends on the performance of local government officials. Compared with local governments, the central government has a structural power advantage. In the early days of liberation, the central government controlled the key powers, such as the cadres, the military and important economic resources (Sun, 2011). China is now in a period of economic reform and transformation. As military control can no longer be used as a common means for managing the states, the present system is economically decentralized, but politically centralized, which means that many economic resources are transferred to local governments, but the central government harnesses its power by tightly controlling the tenure length and promotion opportunities of the local personnel (Zhang et al., 2012). Hence, local government officials, under the pressure of the political promotion system, have strong incentives to achieve the central government's objectives.

The central government's performance evaluations of local government officials is becoming more diversified, but employment stability continues to be the main criterion for assessment (Xue and Bai, 2008). Improvements to social welfare are an important embodiment of government and an important way to maintain social stability. They also depend on optimized social employment (Zheng and Li, 2015). The Outline of the 10th Five-year Plan for Economic and Social Development defines "full employment, price stability, economic growth and international balance of payments" as the overall requirements of macro-control for the People's Republic of China. The Recommendations for the 13th Five-Year Plan for Economic and Social Development advocated "persisting in employment priority strategies, implementing more active employment policies, creating more jobs and tackling structural employment contradictions," further confirming the employment issue as a strategic consideration. The overall economic development plan at the national level emphasizes the importance of stabilizing employment, and the performance criteria of government departments and their officials are aligned to support these goals. The State Council's Notice on promoting employment in 2008 required that employment should "be regarded as an important criteria of government performance appraisal." Liaoning Province began to emphasize employment and re-employment as a primary indicator of local government assessment in 2003 (Zheng and Luo, 2015). Influenced by the complex economic situation at home and abroad, China's rapid economic growth has gradually slowed, and economic development has entered a new state of normalcy (Lu and Zheng, 2016). Guaranteeing employment and maintaining social stability under this "new normal" has become the central government's biggest concern. Therefore, under this top-down approach to policy and the pressure of the promotion system, local government officials are motivated to advocate employment policies and maintain employment stability. As district enterprises are typically a region's main employers, they are an important starting point for local officials seeking to achieve employment stability, and government officials will often help these enterprises create more jobs to maintain social stability (Li et al., 2012).

Social exchange theory holds that an excellent paradigm for analyzing and understanding organizational and interpersonal behavior is to treat behavior as an exchange in the form of tangible or intangible commodities or services (Hou, Jun 2006). An actor exchanges some kind of remuneration with another actor at the

expense of their own resources (Chen and Qu, 2012). Social exchange activities can be divided into market exchange, redistribution exchange and reciprocal exchange (Homans, 1958). Reciprocal exchanges commonly exist between enterprises and governments (Antia et al., 2013). For enterprise organizations in pursuit of maximum economic benefit, non-economic decisions made by local government officials for political reasons will inevitably have an impact on their business operations, but local governments will find ways to support those enterprises in return. Many detailed studies support the government's use of promotions to motivate local government officials (Rosenstein-Rodan, 1943; Liu and Lin, 2013; Han et al., 2016; Zhang and Wu, 2017). Studies also show that government subsidies are both an important and a common method for providing reciprocal exchange (Du et al., 2015; Wang et al., 2015; Chen and Li, 2001). Although unable to turn a profit, zombie enterprises can still provide jobs and help maintain social stability. As this increases their likelihood of a favorable promotion assessment, local officials in exchange provide the enterprises with government subsidies that ensure their survival. As such, the immediate reason for the continued existence of zombie enterprises is the availability of government subsidies. Based on the principle of reciprocity, the more jobs they offer, the greater the government subsidy support a zombie enterprise will receive.

Based on the preceding analysis, the following hypotheses are put forward.

H1. Zombie enterprises are “stiff but deathless” due to their access to government resources in the form of government subsidies.

H2. Zombie enterprises that assume greater job placement responsibilities will receive greater government subsidies.

3. Research design

3.1. Sample selection and data source

For our empirical analysis of the causes of the “stiff but deathless” zombie enterprises and the government motives behind this phenomenon, we select data from Shanghai and Shenzhen A-share listed companies from 2009 to 2016. Following previous studies, the raw data are processed according to the following rules: financial enterprises are excluded from the sample; enterprises with missing data are eliminated; and the top and bottom 1% of the continuous variables are winsorized. Government subsidy data are sourced from the WIND database; the other financial data are collected from the CSMAR database.

3.2. Test model and variable definitions

We construct the following model to ascertain whether zombie enterprises obtain more government resources.

$$Sub = \beta_0 + \beta_1 \text{Zombie} + \beta \text{Control} + \sum \text{Ind} + \sum \text{YEAR} + \varepsilon \quad (1)$$

Sub represents the government resources, defined as the proportion of government subsidies in operating income, and *Zombie* is a dummy variable that identifies whether the enterprise is a zombie enterprise. Two methods have been used in other studies to identify zombie enterprises.

The first method, CHK, is proposed by Caballero et al. (2008). In this method, the basic characteristic of zombie enterprises is that the interest charges paid to banks are too low. There are two steps to the judgment process. First, the following formula is used to calculate the minimum required interest payment:

$$R_{i,t}^* = rs_{t-1} \times BS_{i,t-1} + \left(\frac{1}{5} \sum_{j=1}^5 rl_{t-j} \right) \times BL_{i,t-1} + rcb_{\min \text{ overlast5years},t} \times Bonds_{i,t-1},$$

where rs_{t-1} is the average short-term prime rate for the year $t - 1$, $\left(\frac{1}{5} \sum_{j=1}^5 rl_{t-j} \right)$ is the average long-term prime rate for the years $t - 1$ to $t - 5$ and $rcb_{\min \text{ overlast5years},t}$ is the lowest coupon rate for convertible bonds in the

years $t - 5$ to $t - 1$. $BS_{i,t-1}$ are short-term bank loans, $BL_{i,t-1}$ are long-term bank loans and $Bonds_{i,t-1}$ are the amount of bonds outstanding for company i in the year $t - 1$. A zombie enterprise judgment index is then calculated using

$$X_{i,t} = \frac{R_{i,t} - R_{i,t}^*}{BS_{i,t-1} + BL_{i,t-1} + Bonds_{i,t-1} + CP_{i,t-1}},$$

where $CP_{i,t-1}$ is the amount of commercial paper outstanding for company i in the year $t - 1$. If the value of $X_{i,t}$ is less than 0, the enterprise is judged to be a zombie enterprise.

The second method relies on the official definition of the State Council as the standard for judgment: “Enterprises that [are] not in line with the national energy consumption, environmental protection, quality or safety standards, sustained loss for more than three consecutive years and does not conform to the restructuring direction.”

We use both methods in our analysis. The CHK method is widely used in the literature (Giannetti and Simonov, 2013; Lin et al., 2015) and is denoted by the *Zombie1* variable. Based on the official definition, we eliminate the non-recurring gains and losses of each enterprise and denote the result as the *Zombie2* variable. Specifically, by deducting the non-recurring profit and loss earnings as the standard measure, if the earnings per share have been negative for three consecutive years, *Zombie2* is defined as 1; otherwise, it is defined as 0. *Control* is a placeholder for the control variables, including the enterprise management, the type of corporate governance and the industry and year.

To examine the deep-seated reasons why zombie enterprises receive more government subsidies, we construct the following model, based on social exchange theory, from the perspective of the policy burdens borne by enterprises:

$$Sub = \beta_0 + \beta_1 Z_{ombie} + \beta_2 Z_{ombie} \times Burden + \beta Control + \sum Ind + \sum YEAR + \varepsilon \quad (2)$$

Here, *Burden* is the number of employment placements provided by the enterprise, as measured by *Burden1* and *Burden2*. *Burden1* is the number of excess employees expressed as the residual of the regression of the company's employees after controlling for the factors that may affect the number of current employees (Zheng and

Table 1
Variable definitions.

Variable	Definition
Sub	Government subsidy/income
Zombie1	Calculated according to the CHK method
Zombie2	1 if earnings per share, after deducting abnormal profit and loss, is negative for three consecutive years, equals 0 otherwise years, and 0 otherwise
Burden1	Actual number of employees minus theoretical number of employees
Burden2	$10,000 \times$ number of employees/income
Size	Natural logarithm of a firm's total assets
Cash	Cash over total assets
ROA	Net profit over total assets
Lev	Total debt over total assets
Growth	Percentage growth in operating income
First	Percentage of shares held by the largest shareholder
Rela	1 if the chairman has political connections with the government, and 0 otherwise
Dual	1 if the chairman and CEO are the same person, and 0 otherwise
Fa_r	Fixed assets over total assets
State	1 if the company is state-owned, and 0 otherwise
Stime	Years elapsed since the firm was listed
Ind_r	Percentage of independent directors on the board
Shrz	Shareholdings of the first largest shareholder over shareholdings of the second largest shareholder
GDP	GDP growth rate of the province in which the firm is located
YEAR	Year dummy variables
IND	Industry dummy variables

Luo, 2015). *Burden2* is calculated as $10,000 \times \text{employee number}/\text{operating income}$ (Zeng and Chen, 2006). The control variables are the same as mentioned previously. The definitions for the variables are provided in Table 1.

4. Empirical results

4.1. Descriptive statistics of variables

The descriptive statistics of the variables are shown in Table 2. During the sample period, government subsidies accounted for 1% of operating income, but the maximum value was 9.1%. Whether zombie companies received a greater share of government subsidies is worth examining. The mean value of *Zombie1*, the CHK measure, is 21.5%, and the mean value of *Zombie2*, measured by earnings per share after deducting abnormal profit and loss for three consecutive years, is 6.7%, given a preliminary indication of the number of zombie enterprises in China's listed companies. The mean value of *Burden1* is 0, which reflects a 0 mean value property of the regression residuals, and the mean value of *Burden2* is 0.016, indicating that a company income of RMB10000 is able to provide 0.016 jobs. According to the statistical analysis of control variables, the standard deviation in enterprise size is 1.211, indicating that the size difference between the sample enterprises is large. The average cash holding is 0.179, indicating that the average enterprise holds 17.9% of its total assets as cash. The average corporate profitability (ROA) is 0.036, and the average financial leverage (*Lev*) is 0.456, suggesting that the sample firms use debt financing moderately. The average shareholding of the first largest shareholder is 35.4%, which means that it is a common phenomenon in China for the large shareholders in listed companies to hold an absolute advantage.

4.2. Regression analysis

4.2.1. Are zombie companies receiving more government resources?

Theoretical analyses have shown that China's zombie enterprises are still "standing up" despite losing their vitality, due to the intentional support of the government in the form of government subsidies. We validate this through Model (1) and list the regression results in Table 3. The dependent variable, *Sub*, is the subsidies obtained from the government. The coefficient for *Zombie1* is positively correlated with *Sub* at a significance level of 10%; *Zombie2* is positively correlated at 1%, suggesting that, among Chinese listed companies, zombie

Table 2
Descriptive statistics.

Variable	N	Mean	Std. dev	Min.	Max.
Sub	13,566	0.010	0.014	0.000	0.091
Zombie1	13,566	0.215	0.411	0.000	1.000
Zombie2	13,566	0.067	0.250	0.000	1.000
Burden1	13,566	0.000	0.017	-0.110	1.153
Burden2	13,566	0.016	0.013	0.001	0.071
Size	13,566	22.138	1.211	19.231	25.504
Cash	13,566	0.179	0.126	0.013	0.671
ROA	13,566	0.036	0.056	-0.239	0.220
Lev	13,566	0.456	0.206	0.056	0.900
Growth	13,566	0.431	1.283	-0.814	10.248
Frist	13,566	0.354	0.149	0.090	0.750
Rela	13,566	0.343	0.475	0.000	1.000
Dual	13,566	0.219	0.414	0.000	1.000
Fa_r	13,566	0.239	0.168	0.002	0.751
State	13,566	0.462	0.499	0.000	1.000
Stime	13,566	10.854	6.014	2.003	26.077
Ind_r	13,566	0.371	0.055	0.091	0.800
Shrz	13,566	12.776	21.430	1.007	135.783
GDP	13,566	0.099	0.059	-0.233	0.238

Table 3
Zombie enterprises and government subsidies.

Variable	(1) Sub	(2) Sub
Zombie1	0.001 [*] (1.85)	
Zombie2		0.010 ^{***} (6.98)
Size	-0.001 ^{***} (-5.96)	-0.001 ^{***} (-4.85)
Cash	0.001 (0.43)	-0.000 (-0.10)
ROA	-0.014 ^{***} (-3.72)	-0.005 (-1.09)
Lev	-0.003 [*] (-1.92)	-0.005 ^{***} (-3.00)
Growth	0.000 ^{**} (2.06)	0.000 ^{**} (2.04)
Frist	-0.006 ^{***} (-4.22)	-0.006 ^{***} (-3.88)
Rela	0.000 (1.00)	0.000 (0.88)
Dual	0.000 (0.64)	0.000 (0.81)
Fa_r	0.007 ^{***} (4.47)	0.006 ^{***} (4.18)
State	0.001 (1.31)	0.000 (0.86)
Stime	-0.000 (-1.15)	-0.000 ^{**} (-2.56)
Ind_r	0.006 [*] (1.79)	0.006 [*] (1.74)
Shrz	-0.000 (-1.02)	-0.000 (-1.10)
GDP	-0.002 (-0.40)	0.000 (0.10)
Cons	0.046 ^{***} (8.92)	0.040 ^{***} (7.89)
YEAR	Controlled	Controlled
IND	Controlled	Controlled
N	13,566	13,566
R ²	0.041	0.052
F	28.455	28.914
P	0.000	0.000

* Represents significance at the 10% level.

** Represents significance at the 5% level.

*** Represents significance at the 1% level.

enterprises have received more government subsidies. This result provides direct support for the existence of zombie enterprises in China and for [Hypothesis 1](#).

4.2.2. Why do zombie enterprises receive government support?

The logical follow-up question is as follows: why are these zombie companies able to secure a steady stream of government resources without being eliminated by the market? [Hypothesis 2](#) suggests the underlying reason is an exchange of interests between these enterprises and the local government. Despite their poor profitability, these companies can still provide jobs to the region, and thus they meet the needs of the local government. By this measure, zombie companies that offer more jobs should receive more government subsidies. [Table 4](#) shows

Table 4
Zombie enterprises – Employee scales and government subsidies.

Variable	(1) Sub	(2) Sub	(3) Sub	(4) Sub
Zombie1	0.001** (2.16)	−0.002 (−1.10)		
Burden1 × Zombie1	0.179** (4.84)			
Burden2 × Zombie1		0.166* (1.65)		
Zombie2			0.009*** (11.57)	0.008*** (5.58)
Burden1 × Zombie2			0.130*** (5.00)	
Burden2 × Zombie2				0.091* (1.68)
Burden1	0.108*** (9.39)		0.088*** (7.09)	
Burden2		0.116*** (3.35)		0.098*** (2.89)
Size	−0.001*** (−7.09)	−0.001*** (−3.93)	−0.001*** (−5.50)	−0.001*** (−3.28)
Cash	0.001 (0.54)	0.001 (0.39)	0.000 (0.05)	−0.000 (−0.01)
ROA	−0.015*** (−3.93)	−0.009** (−2.53)	−0.005 (−1.17)	−0.001 (−0.23)
Lev	−0.003* (−2.24)	−0.002 (−1.17)	−0.004*** (−3.44)	−0.004** (−2.31)
Growth	0.000** (2.16)	0.000** (2.50)	0.000** (2.26)	0.000** (2.36)
Frist	−0.005*** (−3.54)	−0.005*** (−3.83)	−0.005*** (−3.40)	−0.005*** (−3.57)
Rela	0.000 (0.94)	0.000 (0.99)	0.000 (0.83)	0.000 (0.78)
Dual	0.000 (0.71)	0.000 (0.75)	0.000 (0.87)	0.000 (0.90)
Fa_r	0.007*** (4.65)	0.006*** (3.59)	0.007*** (4.57)	0.006*** (3.66)
State	0.001 (1.62)	0.001 (1.41)	0.000 (1.00)	0.000 (0.89)
Stime	−0.000 (−1.60)	−0.000 (−1.45)	−0.000*** (−3.03)	−0.000*** (−2.77)
Ind_r	0.005 (1.58)	0.005* (1.71)	0.006 (1.64)	0.006* (1.78)
Shrz	−0.000 (−0.79)	−0.000 (−1.00)	−0.000 (−0.71)	−0.000 (−1.01)
GDP	−0.003 (−0.63)	−0.003 (−0.72)	−0.001 (−0.20)	−0.001 (−0.22)
Cons	0.047*** (10.51)	0.033*** (5.47)	0.040*** (8.96)	0.030*** (5.15)
YEAR	Controlled	Controlled	Controlled	Controlled
IND	Controlled	Controlled	Controlled	Controlled
N	13,566	13,566	13,566	13,566
R ²	0.052	0.054	0.062	0.063
F	17.360	28.450	20.812	28.797
p	0.000	0.000	0.000	0.000

* Represent significance at the 10% level.

** Represent significance at the 5% level.

*** Represent significance at the 1% level.

the regression results of this analysis. The results in columns (1) and (3) consider excess employees the independent variable, where excess employees are calculated as the difference between the actual number of employees and the theoretical number according to Zheng and Luo (2015). These authors calculate the regression as the residual of the size of the enterprise, total asset yield, corporate asset liability ratio, capital density, main business income growth rate, industry and year on the actual enterprise employee scale. The regression results in columns (2) and (4) consider the number of employees per million RMB of operating income as the independent variable (Zeng and Chen, 2006). Table 4 shows that the regression coefficients for *Zombie1* and *Zombie2* are positive in regressions (1), (3) and (4) (significance levels of 5%, 1% and 1%, respectively), which confirms the reliability of the preceding conclusions. In addition, the regression coefficients for *Burden1* and *Burden2* are both positive in all of the regressions, each with a 1% significance level, suggesting that companies that take on more employees are indeed rewarded with policy-driven government resources. The interaction of the zombie and burden variables paints a similar picture, with all of them showing significantly positive results in our regressions (1% in columns (1) and (3) and 10% in columns (2) and (4)). These results imply that the government is making a purposeful choice when allocating resources to zombie enterprises, and that zombie enterprises that assume a greater policy burden are likely to receive more government subsidies, in accordance with the reciprocity principle of social exchange theory. This partly reflects non-economic interventions by local government officials, who are seeking to secure better chances of promotion by exploiting zombie enterprises. The results of this analysis support Hypothesis 2.

Research holds that under the current property rights system, state-owned enterprises have significant advantages in resource acquisition because of their political connections with the government (Sheng, 2015). Scholars generally believe that, relative to non-state-owned enterprises, China's state-owned enterprises receive more government subsidies because they bear more of the policy burden (Kong et al., 2013; Xu et al., 2014). It is therefore worthwhile to investigate whether there is any difference between state-owned enterprises and non-state-owned enterprises in terms of the government subsidies allocated to the zombie enterprises. Based on the preceding findings, government officials are motivated to distribute subsidies to zombie enterprises that can maintain employment stability, and in so doing further their own career prospects. As both state-owned and non-state-owned enterprises have jobs to offer, we can infer that when a business is in trouble and needs an external blood transfusion to survive, the government is just as likely to support either type of enterprise in the belief that "no matter whether white or black, it is a good cat as long as it can catch mice." Therefore, there should be no significant differences in the level of government subsidies received by state-owned and non-state-owned zombie enterprises. The results of this analysis, provided in Table 5, show that the coefficients for both zombie variables are positive at a significance level of 10% in column (1) and 1% in column (2), offering further proof of the soundness of the preceding conclusions. In addition, the interaction terms between the zombie enterprises (*Zombie1* and *Zombie2*) and property rights (*State*) are not statistically significant in either regression. This suggests that there is no significant difference between the ability of state-owned and non-state-owned zombie enterprises to obtain government subsidies, and reflects that local governments allocate subsidies to zombie enterprises for the purpose of maintaining local stability, regardless of their property rights. As long as they can help local governments achieve the goal of stable employment, zombie enterprises will be granted subsidies.

5. Further analysis and robustness tests

5.1. *Zombie enterprises and credit acquisition: Institutional resources versus market resources*

One of the main reasons why zombie companies persist in their stiff, arthritic, but deathless existence is that they continue to survive on external resources. Government subsidies are an important aspect of these resources, but bank credit and commercial credit are two other important lifelines zombie enterprises can obtain. Bank credit consists of bank loans an enterprise obtains; commercial credit is based on the business transactions between enterprises in the industry supply chain, either upstream or downstream, including accounts payable and accounts receivable. Although both forms of credit are corporate debt, their natures are different. In the context of the Chinese institutional setting, acquiring a bank loan often requires implicit government guarantees, especially for zombie enterprises. Prior studies indicate that government intervention

Table 5
Zombie enterprises – Property rights and government subsidies.

Variable	(1) Sub	(2) Sub
Zombie1	0.001 [*] (1.78)	
State × Zombie1	−0.001 (−0.76)	
Zombie2		0.009 ^{***} (5.94)
State × Zombie2		−0.001 (−0.74)
State	0.000 (0.48)	0.000 (0.04)
Size	−0.001 ^{***} (−5.60)	−0.001 ^{***} (−4.58)
Cash	0.001 (0.79)	0.001 (0.47)
ROA	−0.015 ^{***} (−3.62)	−0.008 [*] (−1.95)
Lev	−0.003 ^{**} (−2.37)	−0.005 ^{***} (−3.17)
Growth	−0.000 (−0.87)	−0.000 (−0.83)
Frist	−0.007 ^{***} (−4.04)	−0.006 ^{***} (−3.73)
Rela	0.000 (0.28)	0.000 (0.16)
Dual	0.000 (0.87)	0.001 (0.96)
Fa_r	0.006 ^{***} (3.68)	0.006 ^{***} (3.46)
Stime	−0.000 (−0.59)	−0.000 [*] (−1.71)
Ind_r	0.006 (1.48)	0.006 (1.48)
Shrz	−0.000 (−0.49)	−0.000 (−0.59)
GDP	0.002 (0.37)	0.003 (0.56)
Edu	−0.001 [*] (−1.90)	−0.001 [*] (−1.68)
Age	0.000 (1.00)	0.000 (0.81)
Cons	0.043 ^{***} (7.59)	0.039 ^{***} (6.83)
YEAR	Controlled	Controlled
IND	Controlled	Controlled
N	11,188	11,188
R ²	0.040	0.046
F	10.787	12.453
P	0.000	0.000

* Represents significance at the 10% level.

** Represents significance at the 5% level.

*** Represents significance at the 1% level.

in the banking credit system is actually a part of the system of government, which helps the government to provide directional support to enterprises (Porta et al., 2002; Lian et al., 2011). Although the use and acquisition of commercial credit need to be based on the enterprise's operating capacity and profitability, institu-

tional intervention is irrelevant, and the market characteristics are more obvious. Only future-assured enterprises can gain the trust of upstream or downstream enterprises in the industry chain and are thus able to increase their access to more commercial credit. What are the characteristics of credit use for zombie enterprises? The results of the analysis are shown in Tables 6 and 7.

Table 6 displays the results for the analysis of whether zombie enterprises obtain more institutional credit. In columns (1) and (3), long-term loans from banks are the dependent variable, expressed as the proportion of long-term loans against operating income. In columns (2) and (4), short-term loans are the dependent variable. Our analysis shows that the *Zombie1* variable is positively correlated with both the long- and short-term loan variables at a significance level of 1%. The *Zombie2* variable is also positively correlated with both the loan

Table 6
Zombie enterprises and bank credit.

Variable	(1) Long-term loan	(2) Short-term loan	(3) Long-term loan	(4) Short-term loan
Zombie1	8.112*** (10.84)	9.187*** (17.85)		
Zombie2			0.989* (1.78)	0.474*** (5.07)
Size	0.081 (0.16)	0.327 (1.12)	-0.137 (-0.68)	0.512** (1.97)
Cash	4.772** (2.23)	2.343* (1.66)	4.933*** (4.38)	2.574 (1.33)
ROA	2.266 (0.62)	1.005 (0.45)	0.868 (0.63)	1.011 (0.66)
Lev	3.977** (2.27)	1.469 (1.20)	2.619** (2.41)	1.282** (2.09)
Growth	-0.006 (-0.09)	-0.169** (-1.96)	0.040 (0.44)	-0.181*** (-6.27)
Frist	-0.188 (-0.07)	-1.330 (-0.61)	-0.999 (-0.58)	-2.812*** (-2.65)
Rela	-0.453 (-0.95)	-0.092 (-0.28)	-0.613 (-1.35)	-0.239 (-0.77)
Dual	-0.383 (-0.72)	0.093 (0.25)	-0.634*** (-3.13)	-0.003 (-0.01)
Fa_r	1.613 (0.62)	3.821*** (2.61)	0.993 (0.45)	1.816* (1.69)
State	1.355 (0.89)	3.365*** (2.79)	1.471* (1.77)	2.492*** (2.85)
Stime	0.879*** (4.57)	0.940*** (6.93)	-0.066 (-0.64)	-0.099** (-2.10)
Ind_r	-4.030 (-0.88)	-4.338 (-1.34)	-2.234 (-0.61)	-7.477*** (-3.52)
Shrz	0.009 (1.17)	-0.000 (-0.08)	0.014*** (3.12)	0.002 (0.70)
GDP	-0.000 (-1.58)	-0.000 (-0.99)	0.000 (0.31)	0.000*** (3.07)
Cons	2.279 (0.21)	-3.728 (-0.59)	19.120*** (3.08)	5.566 (0.98)
YEAR	Controlled	Controlled	Controlled	Controlled
IND	Controlled	Controlled	Controlled	Controlled
N	2224	3719	2224	3719
R ²	0.214	0.316	0.020	0.022
F	6.428	17.555	116.708	43.604
p	0.000	0.000	0.000	0.000

* Represents significance at the 10% level.

** Represents significance at the 5% level.

*** Represents significance at the 1% level.

Table 7
Zombie enterprises and commercial credit.

Variable	(1) Credit	(2) Credit	(3) AP	(4) AP	(5) DR	(6) DR
Zombie1	−0.003*** (−4.70)		−0.001** (−2.25)		−0.001*** (−4.90)	
Zombie2		−0.008*** (−3.38)		−0.006*** (−6.76)		−0.002** (−1.97)
Size	−0.010*** (−9.73)	−0.011*** (−8.78)	−0.007*** (−8.20)	−0.008*** (−8.07)	−0.003*** (−12.40)	−0.004*** (−12.01)
Cash	−0.030*** (−6.81)	−0.029*** (−6.26)	−0.038*** (−28.10)	−0.037*** (−25.55)	0.008*** (3.42)	0.008*** (3.38)
ROA	0.081*** (6.79)	0.077*** (7.31)	0.032*** (6.09)	0.029*** (6.20)	0.044*** (12.14)	0.043*** (13.58)
Lev	0.177*** (26.21)	0.178*** (24.41)	0.101*** (83.34)	0.103*** (68.12)	0.070*** (14.59)	0.070*** (14.23)
Growth	0.002*** (2.87)	0.002*** (2.93)	0.001*** (4.17)	0.001*** (4.31)	0.001** (2.44)	0.001** (2.48)
Frist	0.023*** (3.43)	0.022*** (3.39)	0.010** (2.24)	0.010** (2.14)	0.013*** (8.44)	0.013*** (8.56)
Rela	−0.003*** (−3.06)	−0.003*** (−3.09)	−0.001 (−0.83)	−0.001 (−0.82)	−0.001** (−2.35)	−0.001** (−2.37)
Dual	−0.005*** (−6.64)	−0.005*** (−6.62)	−0.003*** (−5.40)	−0.003*** (−5.44)	−0.001** (−2.49)	−0.001** (−2.49)
Fa_r	−0.029*** (−4.44)	−0.028*** (−4.50)	0.005 (1.13)	0.005 (1.28)	−0.032*** (−18.29)	−0.032*** (−19.27)
State	0.001 (0.49)	0.001 (0.54)	−0.003 (−1.17)	−0.003 (−1.21)	0.004*** (2.87)	0.004*** (2.89)
Stime	0.001*** (3.52)	0.001*** (3.75)	0.001*** (9.14)	0.002*** (9.08)	−0.001*** (−18.55)	−0.001*** (−15.19)
Ind_r	−0.002 (−0.37)	−0.002 (−0.36)	−0.013** (−2.08)	−0.013** (−2.08)	0.007** (1.99)	0.007** (1.99)
Shrz	−0.000*** (−3.62)	−0.000*** (−3.76)	−0.000*** (−3.93)	−0.000*** (−4.18)	−0.000*** (−3.11)	−0.000*** (−3.13)
GDP	0.016** (1.97)	0.014* (1.86)	−0.003 (−0.59)	−0.004 (−0.88)	0.016** (2.57)	0.016** (2.48)
Cons	0.277*** (14.14)	0.293*** (12.51)	0.190*** (11.26)	0.202*** (10.81)	0.090*** (17.06)	0.094*** (17.97)
YEAR	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
IND	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
N	13,552	13,552	13,564	13,564	13,553	13,553
R ²	0.140	0.141	0.117	0.118	0.066	0.066
F	6785.127	4859.073	3516.099	2651.799	3676.668	4087.028
p	0.000	0.000	0.000	0.000	0.000	0.000

* Represents significance at the 10% level.

** Represents significance at the 5% level.

*** Represents significance at the 1% level.

variable at 10% in column (3) and 1% in column (4). This demonstrates that zombie enterprises have acquired relatively more long- and short-term bank loans than non-zombie loans. As a result of government endorsements of credit, companies that cannot even achieve normal operating profits have been able to obtain a greater amount of long- and short-term financing. In this light, it is not difficult to understand why zombie enterprises are “stiff but deathless” in China. The force behind this phenomenon is the purposeful support of government through direct government subsidies and indirect credit endorsements.

It is clear that zombie enterprises use more bank credit. However, do they also use more commercial credit? Table 7 shows the regression results. Here, we use three indicators as measures: *AP* is measured as the accounts payable over the total assets, *DR* is measured as the accounts receivable over the total assets and

Credit is measured as the sum of accounts payable and accounts receivable over the total assets. As we can see, the *Zombie1* and *Zombie2* variables are negatively correlated with all of the dependent variables, showing that the total amount of business credit, accounts payable and accounts receivable used in zombie enterprises is significantly less than that used in non-zombie enterprises. Commercial credit is based on one's ability to guar-

Table 8
Government subsidies and the productivity of zombie enterprises.

Variable	(1) TE	(2) TE
Zombie1	-0.001 (-1.24)	
Sub × Zombie1	0.038 (0.96)	
Zombie2		-0.004*** (-2.78)
Sub × Zombie2		0.004 (0.10)
Sub	-0.106*** (-5.75)	-0.090*** (-4.12)
Size	-0.008*** (-24.00)	-0.008*** (-24.24)
Cash	0.001 (0.27)	0.001 (0.41)
ROA	0.043*** (6.63)	0.039*** (6.05)
Lev	0.020*** (8.39)	0.020*** (8.59)
Growth	0.001** (2.38)	0.001** (2.37)
Frist	0.012*** (5.42)	0.012*** (5.36)
Rela	-0.001** (-2.33)	-0.001** (-2.33)
Dual	-0.000 (-0.31)	-0.000 (-0.39)
Fa_r	-0.124*** (-46.91)	-0.124*** (-46.76)
State	-0.001 (-1.24)	-0.001 (-1.14)
Stime	0.000*** (3.82)	0.000*** (4.25)
Ind_r	0.009* (1.71)	0.009* (1.73)
Shrz	-0.000 (-0.10)	-0.000 (-0.09)
GDP	-0.016** (-2.33)	-0.017** (-2.45)
Cons	0.924*** (128.08)	0.926*** (128.41)
YEAR	Controlled	Controlled
IND	Controlled	Controlled
N	13,524	13,524
LL	27241.834	27245.948
F	1261.130	1257.488
p	0.000	0.000

* Represents significance at the 10% level.

** Represents significance at the 5% level.

*** Represents significance at the 1% level.

ante a debt will be repaid, and zombie operations are in a difficult position. Zombie enterprises are seldom in a position to gain the trust of a transaction partner, and thus they can seldom take advantage of commercial credit. This reflects the counterclaim that the resources that support zombie companies' survival originate more from institutional support.

Table 9
Government subsidies and the value of zombie enterprises.

Variable	(1) L1. Roe	(2) L1. Roe	(3) L1. EVA	(4) L1. EVA
Zombie1	-0.000 (-0.04)		0.001 (0.23)	
Sub × Zombie1	-0.219 ^{***} (-2.99)		-0.258 ^{***} (-3.37)	
Zombie2		-0.052 ^{***} (-14.24)		-0.097 ^{***} (-25.98)
Sub × Zombie2		-0.212 ^{***} (-2.64)		-0.330 ^{***} (-4.03)
Sub	-0.176 ^{***} (-4.02)	-0.136 ^{***} (-3.33)	-0.392 ^{***} (-8.48)	-0.278 ^{***} (-6.62)
Size	0.015 ^{***} (17.55)	0.014 ^{***} (15.64)	0.023 ^{***} (24.69)	0.020 ^{***} (21.87)
Cash	-0.019 ^{***} (-2.83)	-0.016 ^{***} (-2.30)	-0.036 ^{***} (-5.03)	-0.028 ^{***} (-4.03)
ROA	0.679 ^{***} (42.35)	0.628 ^{***} (38.76)	0.794 ^{***} (47.02)	0.699 ^{***} (41.98)
Lev	-0.063 ^{***} (-11.76)	-0.053 ^{***} (-9.88)	-0.113 ^{***} (-20.00)	-0.093 ^{***} (-16.92)
Growth	-0.003 ^{***} (-4.14)	-0.003 ^{***} (-4.13)	-0.001 (-1.38)	-0.001 (-1.32)
Frist	0.013 [*] (2.10)	0.011 [*] (1.81)	0.015 ^{**} (2.19)	0.010 (1.62)
Rela	0.002 (0.90)	0.002 (0.99)	-0.000 (-0.22)	-0.000 (-0.15)
Dual	0.002 (0.85)	0.001 (0.66)	0.003 (1.52)	0.002 (1.20)
Fa_r	-0.037 ^{***} (-6.16)	-0.035 ^{***} (-5.79)	-0.077 ^{***} (-12.03)	-0.072 ^{***} (-11.66)
State	-0.008 ^{***} (-4.15)	-0.007 ^{***} (-3.32)	-0.013 ^{***} (-6.04)	-0.010 ^{***} (-4.75)
Stime	-0.000 ^{***} (-2.66)	-0.000 (-0.69)	-0.001 ^{***} (-4.25)	-0.000 (-0.82)
Ind_r	-0.019 (-1.34)	-0.019 (-1.31)	-0.018 (-1.19)	-0.017 (-1.14)
Shrz	-0.000 ^{***} (-3.57)	-0.000 ^{***} (-3.62)	-0.000 ^{***} (-5.11)	-0.000 ^{***} (-5.23)
GDP	0.069 ^{***} (3.05)	0.053 ^{**} (2.37)	0.187 ^{***} (7.89)	0.159 ^{***} (6.92)
Cons	-0.293 ^{***} (-14.97)	-0.255 ^{***} (-13.09)	-0.497 ^{***} (-24.15)	-0.429 ^{***} (-21.43)
YEAR	Controlled	Controlled	Controlled	Controlled
IND	Controlled	Controlled	Controlled	Controlled
N	12,419	12,419	12,472	12,472
R ²	0.257	0.273	0.344	0.389
F	101.799	110.486	155.493	83.862
P	0.000	0.000	0.000	0.000

* Represents significance at the 10% level.

** Represents significance at the 5% level.

*** Represents significance at the 1% level.

5.2. Government subsidies and the productivity of zombie enterprises

Under normal circumstances, government subsidies significantly enhance an enterprise's growth and ability to innovate (Wei et al., 2015) because they improve productivity. However, in the case of zombie enterprises, operating conditions are poor. As such, do government subsidies effectively enhancing the productivity of these enterprises? We explore this issue here. In Table 8, *TE* is an alternative variable for enterprise productivity, computed using the data envelopment analysis (DEA) method. Research shows that the DEA method is a good way of measuring the relative efficiency of decision-making units with multiple inputs and outputs. It is a nonparametric estimation method, suitable for the efficient estimation of multiple output indices (Chu et al., 2015). Following previous studies, we choose fixed asset investments and intangible asset investments as the increments for the input index of the DEA model. The total asset growth rate, the net asset yield and Tobin's *Q* values are selected for the output index to measure the productive efficiency of the enterprises (Wang and Yang, 2010). In the calculation process, the following formula is used to nondimensionalize the input and output indices.

$$X_i = 0.1 + 0.9 \frac{x_i - xMin}{xMax - xMin},$$

where x_i is the original input or output data and $xMin$ and $xMax$ are the minimum and maximum values of the original data. As according to the DEA method, the enterprise productivity index ranges from 0 to 1, which is truncated data, we use a TOBIT regression to investigate the effect of government subsidies on the productivity of zombie enterprises. The regression results given in Table 8 shows that both the *Zombie1* and *Zombie2* variables are negatively correlated with enterprise productivity performance, and the significance level in column (2) is 1%. This shows that the overall productivity of zombie enterprises is relatively lower than that of non-zombie enterprises. The interaction terms for the zombie variables (*Zombie1* and *Zombie2*) and the government subsidy variable (*Sub*) in columns (1) and (2) are statistically insignificant. This indicates that the government subsidies obtained by zombie enterprises do not play a role in improving their productivity.

5.3. Government subsidies and the value of zombie enterprises

The reason and logic underlying the tenacity of zombie enterprises is revealed above, including their overt acceptance of government subsidies. Yet, the supply of external resources does not improve productivity. Given the lack of a zombie enterprise's capacity to sustain healthy operations, we further expect that government subsidies serve only to sustain the survival of the enterprise, not improve its value. To test this assertion, we follow previous studies (Li et al., 2015) and select *ROE* as the measure of enterprise value. *ROE* takes into account that economic value added (*EVA*) is an important standard for assessing the value of an enterprise (Guo and Cui, 2004). It has been recognized by State-owned Assets Supervision and Administration Commission and is widely promoted in the enterprise (Li, 2016). We further choose the proportion of *EVA* in assets as the measure of enterprise value in our analysis of the impact of government subsidies on the value of zombie enterprises. As the transformation of government subsidies into enterprise value may take some time, we use a data lag of one year as the dependent variable. The regression results are shown in Table 9. The data in columns (2) and (4) show that *Zombie2* is negatively correlated with both one year of lagged *ROE* and one year of lagged *EVA* at a significance level of 1%, which suggests that the future value of zombie enterprises is significantly lower than that of non-zombie enterprises. Further analysis of the interaction terms in the table demonstrates that all of the interaction terms are negative at a significance level of 1%. This suggests that, compared with non-zombie companies, government subsidies to zombie companies reduce their future value, proving the preceding inference. Timely "blood transfusions" by the government to ensure the survival of zombie enterprises are useless for boosting their corporate value.

6. Conclusions

With the end of China's 30-year period of rapid economic growth, the call for economic restructuring and industrial upgrading is becoming louder. The reality of the decline in economic growth provides an opportu-

nity to adjust the capacity of enterprises and to promote a clearing out of the market. In this process, dealing with zombie enterprises has become a focus for government action. At the opening ceremony of the fourth session of the 12th National People's Congress, Premier, Li Keqiang presented a government work report, highlighting the need for the "active and safe disposal of zombie enterprises." The persistence of zombie enterprises not only occupies precious resources, but also causes financing problems for other enterprises and lowers the production efficiency of the whole industry. Perhaps more importantly, zombie enterprises are highly resistant to losses, and their voracious appetite for resources may endanger enterprises that are highly efficient but have a poor ability to withstand lean times. Any prescription for dealing with the zombie enterprise disease that can produce good results requires a clear understanding of the reasons behind their stiff but deathless existence.

In this study, we use data from China's Shanghai and Shenzhen A-share listed companies to examine why zombie enterprises are "stiff but deathless." The results of our analysis show that zombie enterprises exist as a direct result of the resources and credit endorsements they receive from the government. Government subsidies and bank loans serve as the main forms of sustenance for these enterprises, and the companies that offer a greater number of jobs receive more government subsidies. Further research shows that the property rights of the enterprise do not affect the level of these "blood transfusions"; whether an enterprise is state-owned or non-state-owned has no influence on the level of subsidies they receive. Additionally, government support fails to increase the enterprise's operating efficiency or value. This study frames the persistence of these "stiff but deathless" zombie enterprises from the perspective of resource rationing. The potential logic behind this phenomenon is further explored through the eyes of local government officials seeking to maintain employment stability as a means of meeting job performance criteria that will ensure their future promotion. Our research demonstrates that cleaning up zombie enterprises is a necessary and urgent task.

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