Three Essays on Government Subsidies and Zombie Firms

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This thesis contains 46,834 words, including title page, tables, and footnotes.

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Abstract

This thesis consists of three self-contained essays on government subsidies and zombie firms, and each essay answers distinct research questions.

Government subsidies, as an essential form of government intervention in economic activities, are widely used globally. In the first essay, I focus on sell-side analysts as financial intermediaries, and investigate the association between government subsidies and analyst forecast accuracy. Using a novel data set from China, I find that the amount of government subsidies is positively associated with the level of analyst forecast accuracy, and the association is more pronounced for firms with more opaque information environments and for firms receiving greater negative publicity. Further analysis shows that the relationship between subsidies and forecast accuracy is stronger for subsidies that are more likely to be granted at the discretion of politicians. The results suggest that subsidized firms tend to reduce political costs via improved transparency. Overall, my findings shed new light on the financial reporting outcomes of government subsidies.

The second essay examines how socio-political scrutiny affects firms' voluntary disclosure of subsidy information. In 2015, China enforced a regulation to crack down on "zombie firms", which rely heavily on government subsidies to survive, within the following five years. This has aroused widespread socio-political scrutiny of the provision of subsidies. Using a difference-in-differences model, I find that the treatment group (i.e., zombie firms) significantly reduce their voluntary disclosure of the subsidies received after the regulatory shock. Cross-sectional analyses show that the effect is stronger for firms with more public attention, firms whose performance is more vulnerable to subsidies, and politically connected firms. Overall, these findings suggest that subsidy recipients tend to withhold subsidy information to mitigate socio-political scrutiny.

As an unintended product of government subsidies, zombie firms have been blamed for having poor performance, negative spill-overs onto industrial peers, and damage to the whole economy. The third essay investigates the effect of zombie firms on the cost of debt of other firms within a novel setting: business groups. Using a large sample of European firms, I find that the presence of zombie subsidiaries in business groups increases the cost of debt of non-zombies. The effect is more pronounced when the non-zombie firms have more pledgeable income, face less financial constraint, and have closer relationships with the zombies. Moreover, the effect is stronger for business groups with greater business complexity. The results are robust to a battery of sensitivity tests. Overall, this paper sheds light on a negative spill-over impact of zombie firms onto healthy firms in the context of business groups.

Declaration

No portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

Copyright Statement

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Chapter 1

Introduction

1.1 Overview

This thesis consists of three self-contained essays answering unique research questions on government subsidies and zombie firms.

Government subsidy is an important tool of government intervention in the form of offering direct payment, remitting charges, or supplying products or services at the costs lower than market price, aimed at achieving specific socio-economic targets (Robinson, 1967; Schwartz & Clements, 1999; Rubini, 2009). Globally, the governments provide a great deal of subsidies every year,[1] but the heavy subsidies have aroused criticisms both in academia and media coverage.[2] While existing literature mostly focuses on the economic impact of government subsidies, little attention has been paid to their consequences to capital market participants. Therefore, the first two essays add to this part of literature by analyzing the impact of government subsidies on analyst forecast accuracy and the socio-political influence on voluntary subsidy disclosure.

As a stubborn unintended product of government subsidies (Chang *et al.*, 2021), zombie firms (i.e., firms that remain alive in the market even though their earnings cannot cover interest expenses) have also triggered extensive

[1] For instance, only in the first quarter of 2022, the US federal government provides USD147 billion subsidies, and the disclosure of government subsidy provision can be accessed through the official website of the United States government (https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=3&isuri=1&1921=survey&1903=86). The European Union also has various programs supporting small businesses and other public bodies. In a less developed economy, the planned tax incentive of Chinese government in 2022 is up to USD371 billion (more information through http://www.gov.cn/xinwen/2022-03/13/content_5678838.htm), and observable subsidies take up approximately 15% of total profit for an average listed firm in 2020.

[2] Some examples in the literature have accused subsidies of demotivating resource allocation (Lapan, 1976), triggering economic risks (Schwartz & Clements, 1999) and unfair trade (Desai & Hines, 2008), crowding out non-subsidized employment (Bruhn, 2020) and R&D investment (Boeing, 2016), and being associated with corporate fraud (Raghunandan, 2021) and income smoothing (Pappas *et al.*, 2022). In media coverage, the disadvantages of subsidies are mentioned in a battery of events in recent years, such as the US-China trade war, Covid-19, the Airbus-Boeing trade war, etc. Some anecdotal evidence can be accessed through https://www.wsj.com/articles/biden-administration-takes-aim-at-chinas-industrial-subsidies-11631295257, https://www.wsj.com/articles/small-businesses-object-to-clawback-of-covid-19-aid-11650274203, and https://www.reuters.com/world/highlights-17-year-airbus-boeing-trade-war-2021-06-15/.

discussion. Advocates of zombie firms argue that keeping zombies alive can create excess production capacity and alleviate inflation (e.g., Acharya *et al.*, 2020), and zombie firms can recover through self-saving activities (e.g., Fukuda & Nakamura, 2011). However, those firms have also been accused of their negative externality to other market participants and the whole economy (e.g., Caballero *et al.*, 2008; Giannetti & Simonov, 2013; Lin, 2014; Gopinath *et al.*, 2017; Adalet McGowan *et al.*, 2018). To extend the understanding about the impact of zombie firms, the third essay analyzes their effect in an unexplored context: business groups. The findings present direct evidence on the financing effect of zombie firms on other affiliated firms within the same business group and provide implications for the potential influence of group coinsurance on zombie prevalence. The overview of the three essays are as follows.

In Chapter 2, I examine the effect of government subsidies on analyst forecast accuracy. Sell-side security analysts play important roles in analyzing, interpreting, and disseminating information to their clients in capital markets (Brown *et al.*, 2015), and their forecast accuracy reflects the overall quality of the information environment. Despite existing studies on the analyst properties and regulatory changes, little is known about the role of government intervention, and this essay fills the gap by analysing the effect of government subsidies. I formulate a null hypothesis based on existing literature. On the one hand, firms that receive subsidies are associated with higher political costs, so they are more willing to increase information disclosure to maintain government support and protect politicians through which they receive subsidies (Lee *et al.*, 2017; Huang, 2022). Subsidized firms also have less financial constraint and rely less on external financing, and therefore they have less incentives to manipulate their earnings (He, 2016). Increased information disclosure and lower earning manipulation incentives improve the analysts' ability to make accurate forecasts. On the other hand, to the extent that firms may acquire

subsidies through political connections, those firms tend to have higher levels of information transparency due to political protection (Chen *et al.*, 2010). The income smoothing behaviour (Pappas *et al.*, 2022) and hidden corporate fraud (Raghunandan, 2021) of subsidized firms may also impair information quality and analyst forecast accuracy.

Using a sample of Chinese listed firms, I find that government subsidies are positively associated with analyst forecast accuracy, suggesting that subsidized firms tend to have better information environments. I also use alternative measures, the firm fixed effect model, the instrumental variable approach and propensity score matching to mitigate the potential effect of measurement error, omitted variables and reverse causality. The results are robust to all the endogeneity tests. To explore the mechanisms through which government subsidies take effect, I also conduct a battery of cross-sectional tests and find that the positive effect of subsidies is stronger for firms with more opaque information environments and firms with higher political costs. Further tests indicate that non-tax-related subsidies, which are in the discretion of government officials, are the main drivers of the results.

In Chapter 3, I investigate the effect of socio-political scrutiny on voluntary disclosure of subsidy information. The stakeholder theory depicts that firms often consider a series of relationships between themselves and external stakeholders, and to maintain their reputation, firms need to weigh up the benefits and potential risks of their behaviour (Freeman *et al.*, 2010). In the case of government subsidies, when the central government increases scrutiny on subsidized firms, the local government and the public read the sign and pay more attention to these regulated firms. Under intensified socio-political scrutiny, firms face a cost-benefit trade-off on their disclosure behaviour. On the one hand, subsidized firms have incentives to protect the politicians through whom they acquire subsidies and suppress negative information to protect their rep-

utation (e.g., Piotroski *et al.*, 2015; Li *et al.*, 2021a). On the other hand, subsidized firms can benefit from higher transparency because increased disclosure can reduce the agency cost between taxpayers and the shareholders and politicians can also maintain their reputation (Huang, 2022). Thus, the impact of intensified scrutiny on subsidy disclosure is an empirical question.

Utilizing the "anti-zombie" regulatory shock in 2015 aimed at cracking down on zombie firms in China, I conduct a difference-in-differences research design. The results show that following the shock, the treated zombie firms decrease their voluntary disclosure of subsidies received. The findings are robust to parallel trend analysis, placebo tests and alternative definitions of the treated zombie firms and subsidy disclosure measures. To mitigate the concern that the results are driven by observable heterogeneity between the treatment group and the control group, I also employ entropy balancing approach and obtain similar results. Cross-sectional analyses reveal that the reduction in subsidy disclosure is more pronounced when the firm is politically connected, receives higher media attention and relies more on subsidies. Further tests show that the regulatory shock does not change the amount of the subsidies received or the disclosure of general information about operation, ruling out potential concerns of alternative explanations.

In Chapter 4, I focus on the spill-over effect of zombie firms on the cost of debt of other affiliates in the same business group. The three unique characteristics of business groups summarized by Holmes *et al.* (2018)—the internal market, complex governance structure and diversification—indicate that the spill-over effects of zombie firms within groups can work through multiple channels. First, the internal market within business groups facilitates members to provide coinsurance for each other (e.g., Belenzon & Berkovitz, 2010; Jia *et al.*, 2013; Larrain *et al.*, 2019; Faccio & O'Brien, 2020), and group members also share reputational gain and loss (e.g., Bae *et al.*, 2008; Hsueh, 2016;

Joe & Oh, 2017). Therefore, when there is a zombie firm in the group, other affiliates may have to support zombies in order to avoid a ripple effect of reputation loss, but such resource reallocation inhibits the development of these non-zombies and increases their default risk. Second, similar to the negative externality of zombie firms on industrial peers, zombie congestion in business groups takes up resources that should have been allocated to those healthy affiliates. With less support from the whole group, non-zombies have lower anti-risk capability, and lenders may charge a higher cost of debt due to a greater default risk. Third, the complex governance structure and diversified operation increase the agency cost within business groups (e.g., Baek *et al.*, 2006; Lin *et al.*, 2011), and therefore the lenders have higher information uncertainty when they consider issuing new debt to firms with zombie affiliates. Based on the above discussion, I predict a negative spillover of zombie firms within business groups.

Following Shroff *et al.* (2014), I construct a data set containing European business groups with four levels of subsidiaries. Since the majority of these observations are private firms, I use the interest rates as a proxy for the cost of debt financing. Results suggest that zombie firms increase the cost of debt of other affiliates in the same business group. Although non-zombies have lower cost of debt than zombie firms, the difference vanishes when the group is dominated by zombies (i.e., when zombie firms take up over 60% total assets of the whole group). Cross-sectional tests show that the negative spill-over is more pronounced for firms with higher pledgeable income, firms with lower financial constraints and firms with closer relationships with zombies. Further cross-sectional tests about the mediation effect of business group characteristics show that the negative externality is stronger for larger and more diversified groups, indicating the role of complicated information environment in such groups. In addition, zombie firms do have real impact on the investment and

profitability of other non-zombie affiliates, and even the ultimate owners are not spared.

1.2 Contribution

This thesis contributes to several strands of the literature. First, it extends the existing research on government subsidies. Prior literature mainly analyzes the economic outcomes of government subsidies (e.g., Schwartz & Clements, 1999; Karhunen & Huovari, 2015; Groh *et al.*, 2016; Wang & Zhang, 2020), while only a few recent studies focus on the financial reporting consequences and the disclosure pattern of government subsidies. Specifically, those studies find that subsidized firms are more likely to obfuscate their earnings (Pappas *et al.*, 2022), engage in more corporate fraud (Raghunandan, 2021), disclose more general information and subsidy-goal-related information (Huang, 2022) and increase their voluntary corporate social responsibility (CSR) reports (Lee *et al.*, 2017). This study contributes to this stream of literature by linking government subsidies with sell-side analysts and provides novel evidence of the positive effect of government subsidies on analyst forecast accuracy.

Second, this thesis adds to the literature about subsidy disclosure. To the best of my knowledge, the only studies working on the disclosure pattern of subsidies are Li *et al.* (2021a) and Li *et al.* (2021b), who find that political connection and anti-subsidy actions can reduce the firms' voluntary disclosure incentives of subsidy information. Complementing to these existing studies, this paper also shed light on the effect of political and social scrutiny on subsidy disclosure.

Third, this thesis makes contribution to studies on the impact of government intervention on information quality. Sell-side analysts are important intermediaries closely affected by corporate information environments. While

existing studies on analyst forecast performance mainly focus on the effect of analysts' personal characteristics (e.g., Gu *et al.*, 2013; Dong *et al.*, 2019), firms' characteristics (e.g., Brown *et al.*, 1987; Lang & Lundholm, 1996; Hope, 2003; Chen *et al.*, 2010; Dhaliwal *et al.*, 2012; Gentry & Shen, 2013), and regulatory changes (e.g., Bradshaw, 2009; Tan *et al.*, 2011; Singer & You, 2011; Fang *et al.*, 2020), less is known about the role of government intervention. Therefore, studying the effect of government subsidies, as an important tool of government intervention, on the forecast accuracy of sell-side analysts can provide more insights for the political influence on information environment.

Fourth, although some studies analyze the effect of social and political scrutiny on firm disclosure incentives on the environmental performance and earnings quality (e.g., Reid & Toffel, 2009; Marquis *et al.*, 2016), little is known about the effect on other financial items. This paper fills the gap through directly examining the effect of socio-political scrutiny on subsidy disclosure with a difference-in-difference approach.

Fifth, this study adds to the emerging literature on zombie firms. Prior studies have demonstrated the underperformance of zombie firms and their negative externality to industrial peers. Since zombies take up resources that should have been allocated to healthy firms, firms operating in zombie-congested industries suffer from credit misallocation, ending up with lower profitability, investment efficiency, employment growth, factor productivity and financial reporting quality (Caballero *et al.*, 2008; Giannetti & Simonov, 2013; Lin, 2014; Gopinath *et al.*, 2017; Adalet McGowan *et al.*, 2018; Acharya *et al.*, 2019). In Chapter 4, I analyse the effect of zombie congestion in an unexplored context—business groups—and document that zombie congestion in business groups can also inhibit the development of other firms and increases their cost of debt financing. In addition, although existing literature has identified the role of weak banks (e.g., Caballero *et al.*, 2008; Acharya *et al.*,

2019; Andrews & Petroulakis, 2019), government support (e.g., He *et al.*, 2018; Chang *et al.*, 2021) and the downward trend of interest rates (e.g., Borio & Hofmann, 2017; Banerjee & Hofmann, 2018) in the persistence of zombie firms, this study indicates that the coinsurance of business group members also plays an important role.

Sixth, this thesis contributes to studies on business groups. As an essential form of business entity, prior studies have identified the unique characteristics and functions of business groups (e.g., Bae *et al.*, 2008; Belenzon & Berkovitz, 2010; Jia *et al.*, 2013; Joe & Oh, 2017; Holmes *et al.*, 2018; Beaver *et al.*, 2019; Larrain *et al.*, 2019). Through an analysis of how zombie firms affect the cost of debt of other group members, this paper improves understanding about the coinsurance within business groups and the impact of business group characteristics on how stakeholders perceive group-affiliated firms.

Finally, this study provides practical implications for market participants including policy makers, investors, banks and practitioners. Policy makers need to cogitate about the real impact of their intervention, as firms change disclosure incentives in existence of external pressure, and external information users may also analyse the firms' reporting quality with signals from the government. Since FASB required firms listed in the United States to disclose subsidy information in 2021, this thesis also provide policy implications on how subsidy information should be disclosed. Investors can rely more on the information disclosed by the subsidized firms and following analysts, but they should be cautious about subsidized zombie firms and their related parties. Banks can be more confident about the information of subsidized firms, whereas they also need to take the performance of related firms into consideration when they issue new loans as their under-performance can spill over onto the default risks of the borrowing entities. Moreover, analysts can consider the receipt of subsidies as a positive sign of corporate information quality when

they make forecasts.

1.3 Thesis Structure

The thesis structure follows the format accepted by Alliance Manchester Business School at the University of Manchester, which allows chapters to be incorporated into a format suitable for submission and publication in peer-review academic journals. Chapters 2, 3 and 4 are self-contained studies, each containing a separate literature review and using distinct data sets to answer unique and different research questions. The page numbers, titles, subtitles, equations, tables, figures and appendices have a sequential order throughout the thesis, while the footnotes are independent and are numbered from the beginning of each chapter.

The remainder of this thesis proceeds as follows. Chapter 2 analyzes the effect of government subsidies on analyst forecast accuracy. Chapter 3 examines how socio-political scrutiny affects the voluntary disclosure of subsidy information. Chapter 4 investigates the spill-over effect of zombie firms on the cost of debt of other non-zombies in the same business group. Chapter 5 concludes and provides suggestions for future research.

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Chapter 2

Do Government Subsidies Affect Analyst Forecast Accuracy?

Abstract

Government intervention in economic activities, through the provision of subsidies, is pervasive worldwide, yet little is known about how subsidies affect the perceptions of capital market participants. I focus on sell-side analysts as financial intermediaries and investigate the association between government subsidies and analyst forecast accuracy. Using a novel dataset from China, I find that the receipt of government subsidies is positively associated with the level of analyst forecast accuracy, and the association is more pronounced for firms with more opaque information environments and for firms receiving greater negative publicity. Further analysis shows that the relationship between subsidies received and forecast accuracy is stronger for subsidies that are more likely to be granted at the discretion of politicians. My results suggest that subsidized firms tend to reduce political costs via improved transparency. Overall, my findings shed new light on the capital market consequences of government subsidies.

Keywords: Subsidies, Analyst Forecast, Information Quality, Publicity

2.1 Introduction

As a major policy tool used by governments worldwide to achieve their socio-economic objectives, subsidies have attracted growing interest in the academic and business communities.[1] While there is extensive research on the economic consequences of government subsidies, relatively little is known about the financial reporting outcomes of subsidy for capital market participants. This study attempts to fill this literature gap by investigating whether the receipt of government subsidies improve or deteriorate the accuracy of earnings forecasts made by sell-side security analysts, who play a crucial role in analyzing, interpreting, and disseminating information to their clients in the capital markets (Brown *et al.*, 2015).

China offers an ideal setting to examine my research question for the following reasons. First, China is often described by commentators and academics as the largest state capitalist economy in the world, in which the government has a substantial influence over critical economic resources and the corporate information environment (Marquis & Qian, 2013; Piotroski *et al.*, 2015). Allen *et al.* (2005) show that government subsidies are one of the four most important sources of finance for Chinese firms, along with bank loans, firms' own fundraising, and foreign direct investment. Second, the disclosure of the amount of subsidy received in their annual reports is mandatory for Chinese listed companies. In contrast, subsidized firms are not required to disclose any subsidy-related information in the U.S..[2] China's disclosure rule offers

[1] A subsidy is a kind of governmental intervention provided to economic actors in the form of direct payments (in di erent forms such as grants, capital injections, loans, guarantees, etc.), reductions of charges (such as tax reductions in some industries or for some commodities), or the supply of products or services at a cost lower than the market price, aimed at achieving a speci c economic target (Robinson, 1967; Rubini, 2009) The subsidy is regarded as \the most obvious contribution" that the government makes to economic performance (Stigler, 1971)

[2] In November 2015, the Financial Accounting Standards Board (FASB) issued a proposed project requiring disclosures generally consistent with International Financial Reporting Standards (IFRS), for example, the types, terms, and conditions of subsidies, although the proposed amendments did not address the recognition and measurement of government

a unique opportunity to investigate whether analyst forecast performance is affected by subsidies received by firms.

The impact of government subsidies on analyst forecast accuracy is unclear ex ante. On the one hand, firms that receive subsidies are associated with higher political costs because they are essentially being propped up by the money of taxpayers and the fiscal resources of the government. Consequently, to avoid potential backlashes or to maintain government support, subsidized firms may want to be more transparent than unsubsidized firms (Lee *et al.*, 2017; Huang, 2022). Moreover, financial support from the government decreases recipient firms' dependence on external financing channels to raise capital, which in turn reduces managers' propensity to engage in earnings management (He, 2016). As such, subsidized firms are likely to provide higher-quality information than their unsubsidized counterparts, leading to improved analyst forecast accuracy.

On the other hand, government subsidies reflect not only a firm's prospects but also its connectedness with the government (Jin & Zhang, 2019; Aobdia *et al.*, 2018). To shield the politicians who award subsidies from public scrutiny, firms have incentives to obfuscate reported earnings (Pappas *et al.*, 2022). Also, politicians in charge of granting subsidies do not want their names tarnished by any scandals involving the subsidy recipients. They may push for enforcement agencies or the media to turn a blind eye to any subsidized firms that engage in financial misconduct (Raghunandan, 2021). Due to a lower likelihood of prosecution, subsidized firms may have more freedom to engage in fraudulent behavior including earnings management, causing a deterioration in analyst forecast accuracy. When these arguments are taken together, the relationship between government subsidies and analyst earnings forecast accuracy remains an open empirical question.

subsidies. The proposed amendments have become e ective for U.S. public rms in scal years ending after December 15, 2020.

Utilizing a sample of 11,943 firm-year observations (2,243 unique firms) over the period 2007-2016, I find that the amount of government subsidies are positively associated with analyst forecast accuracy. This effect is not only statistically significant but also economically meaningful. A one-standard-deviation increase in subsidies increases analyst forecast accuracy by approximately 10.5% relative to its sample mean. This finding suggests that government subsidies help improve receiving firms' information transparency, which in turn translates into more accurate analyst forecasts.

One concern about my analysis is that government subsidies are endogenous and my findings could be due to unobserved factors associated with both subsidies and analyst forecast accuracy. To mitigate this endogeneity concern, I conduct several robustness checks. To begin with, I perform a firm fixed effect regression to control for unobserved time-invariant omitted variables. My results are insensitive to this alternative model specification. Next, to tackle time-variant omitted variable issues, I conduct a two-stage least squares (2SLS) regression. My instrumental variable (IV) is the geographical coincidence between local political leaders and firms. Existing studies have documented that firms with a geographical connection to the incumbent provincial leader are more likely to receive favorable treatment from the government (e.g., Cohen *et al.*, 2011). However, to the extent that the appointment decisions about provincial leaders are made by the central government, the geographical coincidence between firms and political leaders is unlikely to have a direct impact on analyst behavior, except through the impact of subsidies.[3] The IV regression results reveal a similar pattern to the main results. I do not claim that the IV test is a perfect way to tackle the endogeneity concerns. Nevertheless, it can be viewed as another piece of evidence suggesting that endogeneity is unlikely

[3] In order to curb localism and break up provincial leaders' networks among the local elites, provincial party secretaries are often moved laterally to head other provinces every few years.

to be the driving force behind my main results. To further strengthen identification, I create a matched sample using propensity score matching (PSM), to mitigate the concern that the observed relation between subsidies and forecast accuracy is confounded by differences in observable covariates between subsidized and unsubsidized firms. I repeat my main regressions using the matched sample and obtain qualitatively similar results.

I then perform several cross-sectional variation analyses to explore the channels through which government subsidies affect analyst forecasts. First, as discussed earlier, to the extent that subsidized firms face greater political costs, they tend to increase transparency to mitigate the risk of a potential backlash and to maintain government support (e.g., Lee *et al.*, 2017; Huang, 2022). As a result, I expect the effect of government subsidies on analyst forecast accuracy to be more pronounced for firms with higher political costs. I use negative media coverage to measure political costs. Firms receiving more negative media reports are subject to a higher level of negative publicity, and therefore greater political costs. Consistent with this prediction, I find that the positive relation between subsidies and analyst forecast accuracy is stronger for firms with more negative media reports. Second, I consider the role of information opacity in the relation between government subsidies and analyst forecast accuracy. If subsidies indeed improve a firm's information transparency, as posited in my main hypothesis, this effect should be stronger for firms with more opaque information environments preceding the receipt of subsidies. Following prior research (e.g., Chen *et al.*, 2009), I measure information opacity using loss-making status and financial reporting fraud. I find that the positive relation between government subsidies and analyst forecast accuracy is more pronounced among loss-making firms and firms that have committed financial reporting fraud.

An alternative explanation for my finding is that the receipt of subsidies

may contain value-relevant information that enables analysts to better analyze and forecast a firm's earnings. If this is the case, then I should observe an enhanced positive relation between subsidies and forecast accuracy when the subsidy information is more informative. Lee *et al.* (2014) suggest that non-tax-related subsidies are less persistent and value relevant than tax-related subsidies, because the former are often granted based on the discretion of government officials and come in a windfall fashion. By decomposing subsidies into tax-related and non-tax-related components, I find that analysts tend to make more accurate forecasts based on non-tax-related subsidies than on tax-related subsidies. These findings lend little support to the alternative explanation that the value relevance of subsidy information is the underlying channel through which subsidies improve analyst forecast accuracy. In contrast, these results reinforce the aforementioned information and political-cost channels, because firms receiving more discretionary subsidies are more likely to signal their innocence via improved transparency (Lee *et al.*, 2017).

My study contributes to the literature in the following ways. First, my findings contribute to the analyst forecast literature. A general finding in this literature is that analyst forecast accuracy is associated with analysts' personal characteristics (e.g., Gu *et al.*, 2013; Brown *et al.*, 2015; Dong *et al.*, 2019), firms' characteristics (e.g., Brown *et al.*, 1987; Lang & Lundholm, 1996; Hope, 2003; Behn *et al.*, 2008; Chen *et al.*, 2010; Dhaliwal *et al.*, 2012; Gentry & Shen, 2013; Zhang, 2006), and regulatory changes (e.g., Irani & Karamanou, 2003; Bradshaw, 2009; Tan *et al.*, 2011; Singer & You, 2011; Lang *et al.*, 2019; Fang *et al.*, 2020). However, much less attention has been paid to the effect of government intervention on analyst forecast properties. To the best of my knowledge, my study is the first to investigate the influence of government subsidies, a typical tool for government intervention, on analyst forecast accuracy. To the extent that sell-side analysts significantly influence investors'

beliefs and therefore represent investors (Walther, 1997), my study provides insights into the informational content subsidies provide to investors, and could have policy implications for the development of the FASB's standards on the disclosure of government subsidies.

Second, I extend the existing research on government subsidies. Prior literature mainly focuses on the economic outcomes of government subsidies. However, there is little research into government subsidies from the accounting and disclosure perspective. Among few such studies, Pappas *et al.* (2022) document that subsidized firms in the U.S. are more likely to obfuscate their earnings than unsubsidized firms, whereas Huang (2022) shows evidence that U.S. subsidized firms tend to make more voluntary disclosures than their unsubsidized peers. Using Chinese data, Lee *et al.* (2017) find that subsidy recipients increase their voluntary corporate social responsibility (CSR) disclosure to mitigate political costs. However, a recent paper by Sun *et al.* (2022) shows that insiders trade opportunistically on subsidy-related information. Despite the important role of analysts as financial intermediaries, no study to date has investigated the impact of government subsidies on analyst activities. My study attempts to fill this gap in the literature.

The paper proceeds as follows. Section 2.2 discusses the institutional background and reviews the literature on analyst forecast accuracy and government subsidies. Section 2.3 develops my hypothesis. Section 2.4 presents the sample selection and research design. Section 2.5 reports the main regression results and presents additional analyses. Section 2.6 concludes.

2.2 Institutional Background and Literature Review

2.2.1 Government Subsidies in China

As a typical "visible hand", the subsidy is a crucial financing resource for Chinese firms (Allen *et al.*, 2005). The Chinese Accounting Standards Committee defines government subsidies as monetary or non-monetary assets that the government provides for free to enterprises. The objectives of subsidies include giving priority to certain industries, such as agriculture, public utilities, and high-tech industries (Chen *et al.*, 2008), assisting firms with capital limits or those in financial difficulties (Claro, 2006), and helping the authorities to achieve social-political goals like reducing unemployment (O'Connor *et al.*, 2006).

Both central and local governments can grant subsidies, but in recent years, local governments in China have been more empowered to do so. Local governments share common interests with firms within their jurisdictions, so they have incentives to help local firms circumvent central government regulations by providing subsidies (Chen *et al.*, 2008). As the allocation of subsidies is partly decided by government officials, firms tend to build political connections with the authorities in an attempt to gain priority.

Based on previous research (e.g., Lee *et al.*, 2014), subsidies can be categorized into tax-related and non-tax-related items. Tax-related subsidies are associated with value-added tax (VAT), corporate income tax, and export tax, the intention being to inspire the development of certain industries or projects. Such subsidies, under strong regulation by the central government, are usually given to firms with better prospects, less risk, or of great significance. In contrast, governments, especially local governments, also provide non-tax-related subsidies in the form of direct cash payments, loan guarantees, and debt for-

giveness. Compared with tax-related subsidies, non-tax-related subsidies allow for more discretion, and rely more on the individual preferences of the authorities (He, 2016). As such, non-tax-related subsidies are more likely to invite a public outcry than tax-related subsidies (Lee *et al.*, 2017).

Chinese listed firms are required to disclose subsidy information in their annual reports. Specifically, the *Enterprise Accounting System* published in December 2000, for the first time, clearly defined the scope of the accounting treatment for government subsidies. Before 2006, listed firms were required to report subsidies as a separate line item in the income statement. Since the issuance of *Chinese Enterprise Accounting Principles No. 16 (Government Subsidies)* in 2007, public firms have been required to report subsidies under "other income" and to disclose in the notes of their annual reports some details of the received subsidies, such as their amounts and types. This reporting practice facilitates my investigation of the impact of subsidies on analyst forecast accuracy. In 2017, several further changes (e.g., disclosure format and recognition methods) were made to the accounting policies in relation to government subsidies. In particular, government subsidies related to the daily activities of enterprises must now be included in "other income" or used to offset relevant costs and expenses based on the nature of the enterprise's business activities, while subsidies unrelated to the daily business activities of enterprises must be included in "non-operating income".

2.2.2 Literature on Government Subsidies

Government subsidies serve as a policy tool for offsetting market imperfections, encouraging economies of scale, and achieving various social policy objectives (Schwartz & Clements, 1999). Most previous research in this literature has focused on the economic consequences of government subsidies and has revealed a mixed picture. The results on the positive consequences

of subsidies suggest that they can improve production efficiency (Karhunen & Huovari, 2015), increase employment of college graduates, less-skilled, and disabled people and maintain employment during economic downturns (Groh *et al.*, 2016), and improve firms' environmental responsibility as well as the social welfare (Jung & Feng, 2020). Additionally, subsidies can reduce the capital constraints of corporations (Claro, 2006; Mateut, 2018), and enhance the competitive advantages of domestic firms in global trade as well as firms' willingness to export (Hopewell, 2019).

On the other hand, there is also evidence suggesting that subsidies can have various disadvantages. For example, subsidies may reduce the incentives for resource reallocation (Lapan, 1976). The unintended effects on resource allocation are difficult for the government to forecast and control, bringing potential risks for the economy (Schwartz & Clements, 1999). Wage subsidies fail to incentivize firms to retain workers with job-specific skills, and may even crowd out non-subsidized employment (Bruhn, 2020; Collischon *et al.*, 2020). R&D subsidies crowd out R&D investment by businesses, and firms cease to conduct R&D activities once the government stops providing subsidies, which inhibits long-term innovation (Boeing, 2016). Also, while bringing advantages to domestic firms and foreign customers, subsidies are provided at the expense of the domestic taxpayer (Desai & Hines, 2008).

Despite the extensive literature on the economic consequences of subsidies, little attention has been paid to the accounting perspective on subsidies. A few exceptions have yielded mixed findings. Lee *et al.* (2017) and Huang (2022) find evidence consistent with government subsidies encouraging firms' voluntary disclosure. However, Pappas *et al.* (2022) suggest that subsidized firms are more likely to obfuscate reported earnings than their unsubsidized counterparts. Raghunandan (2021) finds that subsidized firms are more likely to engage in fraudulent activities. This study adds to this literature through

the lens of sell-side financial analysts.

2.2.3 Literature on Analyst Forecast Properties

Sell-side financial analysts, who work in brokerage houses, independent research institutes, or investment banks, are major users of the information in corporate financial reports. They behave as intermediaries in the capital markets, and help to reduce information asymmetry by providing industry knowledge and through private access to management (Brown *et al.*, 2015). Previous literature sheds lights on various dimensions of analyst forecast properties, including forecast error/accuracy (e.g., Lang & Lundholm, 1996; Duru & Reeb, 2002; Hope, 2003; Dhaliwal *et al.*, 2012; Francis *et al.*, 2019), forecast dispersion (e.g., Lang & Lundholm, 1996; Lehavy *et al.*, 2011), analyst coverage/following (e.g., Li *et al.*, 2015), timeliness (e.g., Dehaan *et al.*, 2017), and stock recommendations (e.g., Li *et al.*, 2015). In this paper, I focus on analyst forecast accuracy, an important indicator that reflects the information asymmetry between information providers (insiders) and information users (e.g., investors, lenders, and regulators). Hope (2003) conducts an international study to analyse the association between the accuracy of analysts' earnings forecasts and financial reporting disclosure, and documents that a more accurate analyst forecast reflects greater information transparency. In a similar vein, Zhang (2006) finds that greater information uncertainty increases the level of analyst bias and results in less accurate forecasts.

Prior research has documented various factors that can affect analyst forecast accuracy. First, the characteristics of both analysts and the brokerage firms where they work can have an impact on their forecast accuracy. For instance, Clement (1999) shows that forecast accuracy is positively associated with analysts' experience and employer size, and negatively associated with the number of firms and industries followed by the analysts. Dambra *et al.* (2018)

analyze the effect of the JOBS Act and find that analysts with more involvement in the IPO process tend to provide less accurate forecasts. Moreover, forecast accuracy depends on information disclosure and other characteristics of the firms that analysts cover. For example, Gu & Wu (2003) show that earnings skewness leads to a larger forecast bias. Duru & Reeb (2002) find that international diversification leads to higher forecast error because of increased task complexity. Chen *et al.* (2010) find that politically connected firms have a lower level of forecast accuracy. Lehavy *et al.* (2011) suggest that annual report readability has a positive influence on forecast accuracy. Dhaliwal *et al.* (2012) find that the issuance of stand-alone CSR reports reduces forecast error and hence improves accuracy. Francis *et al.* (2019) document that forecast accuracy decreases as the firm spends more on tax planning. My study is related to this stream of literature but differs in that I investigate the effect of the firm-level financial support provided by the government on analyst forecast performance.

2.3 Hypotheses Development

There are competing predictions regarding the impact of subsidies on analyst forecast accuracy. When a firm receives government subsidies, a signal is released to the public that the firm has a good relationship with the government. To avoid possible political backlash, subsidized firms tend to signal their innocence by exhibiting greater transparency (Guedhami *et al.*, 2014). Huang (2022) finds that subsidized firms provide more voluntary managerial forecasts in order to improve their reputations for transparency and lower the possibility of public scrutiny. In a similar vein, Lee *et al.* (2017) suggest that firms receiving subsidies are more willing to disclose CSR reports, which provide more valuable non-financial information to analysts. In addition, to the extent that

the allocation of subsidies may be subject to corruption (Fang *et al.*, 2020), noticeable unethical behavior by subsidized firms might bring the politicians who approved the subsidies to the public's attention. To maintain their relationships with the politicians who support their subsidization, firms receiving subsidies are expected to behave ethically, and therefore to be less likely to engage in financial reporting misconduct.

Apart from this, subsidized firms may have weaker incentives to manipulate their reported earnings due to a lower demand for external capital. While earnings management, if not detected, may benefit firms by boosting stock prices, it is not costless due to potential risks such as those of reputational losses and litigation (He, 2016; Chen *et al.*, 2005). Haw *et al.* (2005) suggest that investors in the Chinese stock market are able to see through earnings management and adjust their investment decisions. Government subsidies, as direct cash injections, help the recipient firms to reduce their liquidity risks. In addition, subsidies can act as endorsements, helping firms to obtain larger bank loans and easing their financial constraints (Lim *et al.*, 2018). Thus, subsidized firms may have lower motivation to engage in earnings manipulation. Taken together, the above arguments collectively predict an improvement in analyst forecast accuracy.

However, there are also several reasons why I may not observe a positive relation between government subsidies and analyst forecast accuracy. First, subsidies can be obtained through political connections. Chaney *et al.* (2011) document that politically connected firms tend to have reported accounting information of a lower quality. Chen *et al.* (2010) suggest that analysts face greater difficulty in predicting the earnings of firms with political connections. Second, subsidized firms may obfuscate their earnings information to shield the politicians who awarded the subsidies from public scrutiny. Pappas *et al.* (2022) find that subsidized firms have more aggressive income smoothing, lead-

ing to a lower level of informativeness of reported earnings. Third, politicians may provide subsidized firms with protection against prosecution, because they do not want to be seen by the public as having relationships with any scandals involving the subsidy recipients. Due to a lower litigation risk, subsidized firms may have more freedom to engage in earnings management, causing a deterioration in analyst forecast accuracy.

Given the above tension, I formulate the following null hypothesis:

Hypothesis: There is no association between government subsidies and analyst forecast accuracy.

2.4 Data and Methodology

2.4.1 Sample Selection

I manually collect data on subsidies from the notes of the annual reports of all firms listed on the Shanghai Stock Exchange and the Shenzhen Stock Exchange over the period 2007-2016. I select this sample period because the disclosure requirement for subsidies, *Chinese Enterprise Accounting Principles No. 16-Government Subsidies*, was first introduced and enacted in 2007, and the disclosure requirement was then changed in 2017. I then acquire analyst forecast data and data on accounting and return information from the China Stock Market & Accounting Research Database (CSMAR). After removing financial firms and firm-year observations with missing values for control variables, my final sample consists of 11,943 firm-year observations, representing 2,243 unique firms, for my baseline regression.

Panel A of Table 2.1 presents the yearly distribution of my sample. The number of observations gradually rises from 628 in 2007 to 1,827 in 2016, which indicates an increasing number of firms obtaining subsidies over time. The average amount of the subsidies also increases dramatically over time.

For example, the average subsidy in 2016 was more than three times that in 2007 in my sample. Panel B presents the subsidy firm-year sample distribution by industry.[4] Companies in the manufacturing industry are most heavily subsidized, so I further divide the manufacturing industry into nine secondary categories. The machinery, equipment, and instrument subsectors within the manufacturing industry have the greatest number of observations, followed by the information technology subsector. As for the mean subsidy amount, mining and transport are the two leading industries, with average subsidies of 151 million CNY and 95 million CNY respectively.

[4] Following previous literature, I use the industry classification standard issued in 2001.

Table 2.1: Distribution of Subsidies

Panel A: Distribution of Subsidies by Year, in million CNY						
Year	N	Mean	S.D.	Min	Median	Max
2007	628	14.513	122.732	0.000	0.505	2,780.682
2008	716	14.706	72.974	0.000	1.590	1,080.140
2009	955	14.808	68.136	0.000	2.147	1,280.793
2010	1,029	22.709	129.443	0.000	2.372	2,499.461
2011	1,066	22.503	113.920	0.000	3.168	2,368.710
2012	1,084	24.019	98.481	0.000	3.743	2,108.253
2013	1,306	65.282	337.458	0.000	13.924	10347.000
2014	1,570	69.624	347.345	0.000	13.599	10931.000
2015	1,762	78.044	336.990	0.000	14.799	7,906.000
2016	1,827	74.510	302.859	0.000	19.536	8,509.000
Total	11,943	48.178	254.442	0.000	7.863	10931.000
Panel B: Distribution of Subsidies by Industry, in million CNY						
Industry	N	Mean	S.D.	Min	Median	Max
Agriculture, forestry, livestock farming, fishery	183	21.355	34.032	0.000	10.036	197.695
Mining	459	151.111	950.447	0.000	4.065	10931.000
Food and beverage	558	29.469	84.763	0.000	6.904	1,058.265
Textile, clothes and fur	248	34.572	89.613	0.000	7.787	713.170
Timber and furniture	11	41.855	45.095	6.396	18.183	155.866
Paper making and printing	180	30.127	66.399	0.000	6.665	482.366
Petroleum, chemistry, rubber and plastic	1,118	28.470	93.118	0.000	7.679	1,213.649
Electronic	51	47.913	106.930	0.693	11.445	588.939
Metal and non-metal	1,126	57.546	147.719	0.000	11.412	1,768.926
Machinery, equipment and instrument	2,354	51.085	199.638	0.000	10.932	3,985.004
Medicine and biological products	832	17.809	32.574	0.000	7.544	496.824
Electric power, gas and water production and supply	587	67.034	239.060	0.000	5.170	2,872.969
Construction	329	50.843	145.540	0.000	4.055	1,090.168
Transport and storage	540	95.172	409.763	0.000	1.494	4,257.120
Information Technology	1,692	60.072	215.675	0.000	12.721	2,780.682
Wholesale and retail trade	819	14.752	34.697	0.000	3.073	381.148
Social service	565	15.825	57.528	0.000	3.110	1,050.967
Communication and Cultural Industry	185	30.493	46.407	0.000	11.631	258.904
Comprehensive	106	12.297	34.003	0.000	2.495	315.966
Total	11,943	48.178	254.442	0.000	7.863	10931.000

This table presents the distribution of government subsidies by year (Panel A) and by industry (Panel B) for the sample used in the main regression.

2.4.2 Model Specification

In order to examine the effect of government subsidies on analyst forecast accuracy, I run the following ordinary least squares (OLS) model:

$$Accuracy_{i;t} = \quad + \quad TotalSubAsset_{i;t} + \Sigma Controls + YearFE + IndustryFE + \tag{2.1}$$

Following Dhaliwal *et al.* (2012), my dependent variable (*Accuracy*) is defined as the negative value of firm *i*'s average absolute analyst forecast error in fiscal year *t*. The absolute analyst forecast error is the absolute difference between forecast and actual earnings per share (EPS), scaled by the stock price at the beginning of the year. In order to exclude the effect of financial reporting for previous years, the year *t* is restricted to the period between the disclosure of the annual report for the fiscal year *t* 1 and the disclosure of the annual report for the fiscal year *t*. I use the latest report from each analyst *j* issued in year *t* for firm *i* to calculate the consensus forecast accuracy used in my main regression, which excludes the effect of stale reports.[5]

The independent variable of interest (*TotalSubAsset*) is the total subsidy amount received by firm *i* in fiscal year *t*, deflated by the total assets at the fiscal year end. In robustness tests, I also use the total operating revenue and the market value in year *t* as deflators of the subsidy. If government subsidies improve (deteriorate) forecast accuracy, then the coefficient should be significantly positive (negative).

Following previous studies (Duru & Reeb, 2002; Chen *et al.*, 2010; Dhaliwal *et al.*, 2012), I control for firm-level and report-level characteristics that have systematic effects on analyst forecast properties. As firm-level attributes, I

[5] I also use all reports from each analyst *j* issued in year *t* for rm *i* to calculate the consensus forecast accuracy as a robustness check. My conclusions remain the same. The results are not reported but are available upon request.

include firm size (*Size*), leverage (*Leverage*), standard deviation of cash flow from operations for the last five years (*SD_CFO*), standard deviation of operating revenue for the last five years (*SD_Rev*), operating cycle (*OperCycle*), and the percentage of shares held by institutional shareholders (*Institution*). I also include discretionary accruals (*Acc_Quality*) to control for accrual quality, because Chaney *et al.* (2011) find that firms with more discretionary accruals have reduced forecast accuracy. I use a loss dummy (*Loss_OP*) to control for whether a firm is loss-making or not based on operating profit, and a dummy to control for state-owned enterprises (*SOE*). For analyst- and report-level characteristics, I include the average forecast horizon (*Horizon_mean*), as longer forecast horizons are associated with less accurate analyst earnings forecasts. I also include the number of analyst reports issued for the firm in year *t* (*Report_Coverage*) as a control variable. Detailed variable definitions are provided in Appendix 2A.

2.4.3 Descriptive Statistics

Table 2.2 reports summary statistics of all variables used in my main regressions. All continuous variables are winsorized at 1% and 99%. On average, the total subsidy amount accounts for 0.4% of total assets.[6] The forecast error (absolute value of *Accuracy*) is 1.3% of the opening stock price. About 50% of the firms are state-owned enterprises (*SOE*) and approximately 12% of the firms report a negative operating profit (*Loss_OP*). The average forecast horizon (*Horizon_mean*) for all reports in each firm-year observation is about seven months.

[6] Unreported summary statistics show that subsidies account for 25.32% of net income over my sample period.

Table 2.2: Descriptive Statistics

Variable Name	N	Mean	S.D.	Min	Median	Max
Panel A: Dependent Variables						
Accuracy	11,943	-0.013	0.019	-0.122	-0.007	-0.000
Accuracy_Indi	89,524	-0.011	0.015	-0.093	-0.005	0.000
Panel B: Independent Variables						
TotalSubAsset	11,943	0.004	0.006	0.000	0.002	0.036
TotalSubR	11,943	0.010	0.016	0.000	0.004	0.092
TotalSubMVE	11,943	0.003	0.006	0.000	0.001	0.039
TaxSubAsset	11,943	0.001	0.003	0.000	0.000	0.022
NTaxSubAsset	11,943	0.003	0.005	0.000	0.002	0.027
Sub_Dummy	11,930	0.888	0.316	0.000	1.000	1.000
Panel C: Control Variables						
Size	11,943	22.068	1.241	19.729	21.892	25.879
Leverage	11,943	0.254	0.394	0.000	0.097	2.300
SD_CFO	11,943	0.039	0.029	0.004	0.032	0.165
SD_Rev	11,943	0.146	0.130	0.010	0.110	0.763
OperCycle	11,943	4.975	0.953	2.130	5.064	7.195
Loss_OP	11,943	0.123	0.328	0.000	0.000	1.000
Acc_Quality	11,943	0.070	0.080	0.001	0.045	0.468
Institution	11,943	0.051	0.051	0.000	0.037	0.219
SOE	11,943	0.509	0.500	0.000	1.000	1.000
Report_Coverage	11,943	1.974	0.872	0.693	1.946	3.738
Horizon_mean	11,943	6.749	2.452	0.567	6.744	12.617
Horizon_Ind	89,524	6.681	3.688	0.033	6.500	13.400
Panel D: IV and Cross-sectional Variables						
Geo_Connection	11,943	0.204	0.403	0.000	0.000	1.000
NegNews	11,943	0.504	0.500	0.000	1.000	1.000
Loss_OPLag	11,315	0.120	0.235	0.000	0.000	1.000
Fraud_Disclosure	11,642	0.117	0.321	0.000	0.000	1.000

This table presents the descriptive statistics for the variables used in the empirical analyses. Appendix 2A provides detailed variable definitions.

Table 2.3 reports the pairwise correlations between the variables appearing in the main regressions, with Pearson coefficients reported below the diagonal and Spearman coefficients above the diagonal. The subsidy measure is positively correlated with forecast accuracy and the coefficient is significant at the 1% level, lending initial support to the idea of government subsidies improving forecast accuracy. Besides, the correlation between subsidies and discretionary accruals (*Acc_Quality*) is negative and statistically significant, implying that subsidized firms have higher earnings quality.

Table 2.3: Correlation

	1	2	3	4	5	6	7	8	9	10	11	12	13
1 *Accuracy*		0.125*	-0.189*	-0.212*	-0.057*	-0.082*	0.116*	-0.273*	-0.066*	0.106*	-0.102*	0.048*	-0.314*
2 *TotalSubAsset*	0.069*		-0.140*	-0.121*	-0.059*	-0.078*	0.201*	0.058*	-0.036*	0.061*	-0.220*	0.032*	-0.035*
3 *Size*	-0.120*	-0.113*		0.491*	-0.122*	0.130*	-0.240*	0.007	-0.121*	-0.036*	0.340*	0.315*	0.073*
4 *Leverage*	-0.211*	-0.102*	0.421*		-0.147*	-0.079*	-0.140*	0.114*	-0.077*	-0.058*	0.267*	0.018	0.061*
5 *SD_cf*	-0.084*	-0.025*	-0.137*	-0.118*		0.283*	-0.067*	0.092*	0.123*	-0.050*	-0.014	-0.093*	0.003
6 *SD_rev*	-0.073*	-0.074*	0.105*	-0.104*	0.276*		-0.300*	-0.007	0.089*	0.080*	0.113*	0.145*	0.017
7 *OperCycle*	0.077*	0.128*	-0.217*	-0.142*	-0.032*	-0.303*		-0.002	0.042*	0.065*	-0.272*	-0.061*	-0.012
8 *Loss_OP*	-0.462*	0.105*	0.012	0.155*	0.101*	0.014	0.011		0.046*	-0.122*	0.064*	-0.238*	0.070*
9 *Acc_Quality*	-0.096*	-0.016	-0.142*	-0.055*	0.121*	0.068*	0.042*	0.037*		0.035*	-0.029*	-0.009	-0.010
10 *Institution*	0.117*	0.027*	-0.081*	-0.080*	-0.053*	0.053*	0.034*	-0.110*	0.020*		-0.051*	0.354*	-0.111*
11 *SOE*	-0.098*	-0.122*	0.347*	0.241*	-0.012	0.101*	-0.259*	0.064*	-0.043*	-0.032*		-0.022*	0.064*
12 *Report_Coverage*	0.150*	0.042*	0.326*	-0.014	-0.117*	0.094*	-0.065*	-0.237*	-0.021*	0.321*	-0.020*		-0.033*
13 *Horizon_mean*	-0.208*	-0.042*	0.056*	0.047*	0.004	0.006	-0.010	0.073*	-0.018	-0.102*	0.059*	-0.042*	

This table presents the correlation coe cients for the variables used in the main empirical analyses. Pearson coe cients are reported below the diagonal, while Spearman coe cients are reported above the diagonal. * denotes signi cance at the 10% level or better. Appendix 2A provides detailed variable de nitions.

2.5 Empirical Results

2.5.1 Main Results

Table 2.4 presents the results from testing my hypothesis. Column (1) presents the results without control variables. The coefficient on *TotalSubAsset* is positive and significant at the 1% level (0.120, s.e.=0.029). In Column (2), I add the control variables into the regression, and the coefficient of *TotalSubAsset* remains significant at the 1% level (0.189, s.e.=0.030). The standard errors are corrected for heteroskedasticity and clustered by firm. The economic significance of subsidies is also meaningful. Take Column (2) for example. A one-standard-deviation increase in *TotalSubAsset* increases forecast accuracy by 10.5% relative to its sample mean. These results collectively suggest that government subsidies improve analyst forecast performance, consistent with subsidies generally leading to more transparent information environments.

Regarding the effects of the control variables, I find that larger firms (*Size*), firms with a higher proportion of debt financing (*Leverage*), firms with a higher volatility of operating cash flow (*SD_CFO*), and loss-making firms (*Loss_OP*) tend to have less accurate forecasts, while a longer operating cycle (*OperCycle*) can improve forecast accuracy. Firms with more discretionary accruals (*Acc_Quality*) have less accurate analyst forecasts, because such firms are more likely to manipulate their earnings numbers, which is in line with previous studies (Chen *et al.*, 2010; Chaney *et al.*, 2011). The percentage of institutional shareholding (*Institution*) is positively related to forecast accuracy, suggesting a monitoring role played by institutional investors that improves firms' earnings quality. State-owned enterprises (*SOE*) have lower incentives to maneuver their earnings, so the forecast accuracy is higher for them than for their non-state-owned counterparts. Analyst following (*Report_Coverage*)

is positively associated with forecast accuracy. Finally, accuracy should be higher for reports issued closer to the reporting date, because reports issued later will take more information into consideration, and the average reporting horizon (*Horizon_mean*) has a negative association with accuracy. Overall, all these control variables are significant, with the expected signs.

Table 2.4: The Effect of Subsidy on Forecast Accuracy

		Accuracy	
	Predicted Sign	1	2
TotalSubAsset	?	0.120***	0.189***
		[0.029]	[0.030]
Size	-		-0.002***
			[0.000]
Leverage	-		-0.005***
			[0.001]
SD_CFO	-		-0.019***
			[0.007]
SD_Rev	-		-0.004**
			[0.002]
OperCycle	+		0.001**
			[0.000]
Loss_OP	-		-0.024***
			[0.001]
Acc_Quality	-		-0.024***
			[0.003]
Institution	+		0.008***
			[0.003]
SOE	+		0.001***
			[0.000]
Report_Coverage	+		0.001***
			[0.000]
Horizon_mean	-		-0.001***
			[0.000]
Constant		-0.014***	0.028***
		[0.001]	[0.004]
Year FE		Yes	Yes
Industry FE		Yes	Yes
Adj. R^2		0.052	0.324
No. of Observations		11,943	11,943

This table presents the regression results for the effect of government subsidies on analyst forecast accuracy. The independent variable (*TotalSubAsset*) is the amount of total subsidies deflated by total assets for the fiscal year. The dependent variable (*Accuracy*) is defined as the negative average value of firm's absolute analyst forecast errors. Appendix 2A provides detailed definitions for the variables. Robust standard errors in brackets are corrected for heteroskedasticity and clustered by firm. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate that the coefficients are statistically significant at the 0.1, 0.05, and 0.01 levels, respectively, using two-tailed tests.

2.5.2 Robustness Checks

As a robustness check, I use alternative measures of subsidies and analyst forecast accuracy and repeat my main regression. I first define two alternative proxies for subsidies, $TotalSubRev$ and $TotalSubMVE$. The former is calculated as the subsidy amount scaled by total operating revenue, while the latter is the subsidy amount divided by the market value of the firm. As can be seen in Columns (1) and (2) of Table 2.5, my main findings remain qualitatively unchanged.

In the main regression, my dependent variable measures the consensus analyst forecast accuracy. To provide robust evidence, I also estimate the effect of subsidies on forecast accuracy at the individual report level:

$$Accuracy\_Indi_{i;t} = \quad + \quad TotalSubAsset_{i;t} + \Sigma Controls + YearFE + IndFE + \tag{2.2}$$

To this end, I obtain data from the Chinese Research Data Services (CNRDS) database and construct a dataset of report-level observations.[7] The final sample for this analysis consists of 89,524 report-level observations from 2007-2016. $Accuracy\_Indi$ is the absolute difference between forecast and actual EPS for each analyst report, scaled by the stock price at the beginning of the year. I also replace the control variable $Horizon\_mean$ in the main regression with $Horizon\_individual$, which is the forecast horizon of each individual report. All other variables are defined as in the main regression. Column (3) of Table 2.5 shows that the coefficient on $TotalSubAsset$ is still positive and significant at the 1% level (0.072, s.e.=0.022), which indicates the robustness of my main finding.

[7] I also use CSMAR data to reconduct the report-level regression. Although the coverage of analyst forecast reports of CNRDS is different from that of CSMAR, the results remain qualitatively unchanged.

Table 2.5: Robustness Checks: Alternative Definitions

	Accuracy	*Accuracy*	*Accuracy_Indi*
	1	2	3
TotalSubAsset			0.072***
			[0.022]
TotalSubR	0.073***		
	[0.012]		
TotalSubMVE		0.140***	
		[0.039]	
Size	-0.002***	-0.002***	-0.001***
	[0.000]	[0.000]	[0.000]
Leverage	-0.005***	-0.005***	-0.004***
	[0.001]	[0.001]	[0.001]
SD_CFO	-0.018**	-0.019***	-0.020***
	[0.007]	[0.007]	[0.007]
SD_Rev	-0.003*	-0.004**	-0.004**
	[0.002]	[0.002]	[0.002]
OperCycle	0.000**	0.001***	0.001***
	[0.000]	[0.000]	[0.000]
Loss_OP	-0.024***	-0.024***	-0.019***
	[0.001]	[0.001]	[0.001]
Acc_Quality	-0.025***	-0.025***	-0.012***
	[0.003]	[0.003]	[0.002]
Institution	0.008**	0.008***	0.004
	[0.003]	[0.003]	[0.003]
SOE	0.001***	0.001***	0.000
	[0.000]	[0.000]	[0.000]
Report_Coverage	0.001***	0.001***	0.002***
	[0.000]	[0.000]	[0.000]
Horizon_mean	-0.001***	-0.001***	
	[0.000]	[0.000]	
Horizon_Indi			-0.001***
			[0.000]
Constant	0.029***	0.033***	0.012***
	[0.004]	[0.004]	[0.004]
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Adj. R^2	0.324	0.322	0.279
No. of Observations	11,943	11,943	89,524

This table presents the robustness checks for the effect of government subsidies on forecast accuracy. The independent variables (*TotalSubAsset*, *TotalSubR*, *TotalSubMVE*) are the amount of total subsidies deflated by closing total assets, total operating revenue, and the market value at fiscal year-end, respectively. The dependent variables (*Accuracy* and *Accuracy_Indi*) are defined as the negative average value of firm's absolute analyst forecast errors and the negative absolute error of each analyst forecast report, respectively. Appendix 2A provides detailed definitions for the variables. Robust standard errors in brackets are corrected for heteroskedasticity and clustered by firm. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate that the coefficients are statistically significant at the 0.1, 0.05, and 0.01 levels, respectively, using two-tailed tests.

2.5.3 Endogeneity Tests

Given the fact that government subsidies are not randomly assigned, my model may suffer from endogeneity problems, which could lead to biased and inconsistent estimates. To bolster confidence in my inference, I perform several robustness checks to mitigate the endogeneity concerns, including firm fixed effects, the IV approach, and PSM. The results are discussed in the following subsections.

A. Firm Fixed Effects

One source of endogeneity in my model could be omitted variable bias. There could be unobservable omitted variables that affect the amount of the received subsidies and analyst forecast accuracy simultaneously. I first include firm fixed effects to control for time-invariant omitted variables. Table 2.6 reports the results. In Column (1), where no control variables are included, the coefficient on *TotalSubAsset* is significantly positive (0.159, s.e.=0.046). In Column (2), where control variables are added, the coefficient on *TotalSubAsset* remains positive and significant at the 1% level (0.263, s.e.=0.050). In terms of economic significance, in Column (2), a one-standard-deviation increase in *TotalSubAsset* leads to a 0.17% increase in *Accuracy*, representing about 8% of the sample mean of *Accuracy*.[8]

[8] I also conduct a first-difference model and obtain qualitatively similar results. The results are untabulated but available upon request.

Table 2.6: Firm Fixed Effect Model

	Accuracy	
	1	2
TotalSubAsset	0.159***	0.263***
	[0.046]	[0.050]
Size		-0.001
		[0.001]
Leverage		-0.003**
		[0.001]
SD_CFO		-0.015
		[0.010]
SD_Rev		0.003
		[0.003]
OperCycle		0.000
		[0.001]
Loss_OP		-0.023***
		[0.001]
Acc_Quality		-0.021***
		[0.003]
Institution		0.012***
		[0.004]
SOE		0.002
		[0.002]
Report_Coverage		0.001***
		[0.000]
Horizon_mean		-0.001***
		[0.000]
Constant	-0.012***	0.015
	[0.001]	[0.014]
Year FE	Yes	Yes
Firm FE	Yes	Yes
Adj. R^2	0.214	0.389
No. of Observations	11,943	11,943

This table presents the results for the endogeneity test with year and firm fixed effect. The independent variable (*TotalSubAsset*) is the amount of total subsidies deflated by closing total assets for the fiscal year. The dependent variable (*Accuracy*) is the negative average value of firm's absolute analyst forecast errors. Appendix 2A provides detailed definitions for the variables. Robust standard errors in brackets are corrected for heteroskedasticity and clustered by firm. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate that the coefficients are statistically significant at the 0.1, 0.05, and 0.01 levels, respectively, using two-tailed tests.

B. Two-stage Least Squares Estimation

Firm fixed effects could eliminate the endogeneity with regard to time-invariant omitted variables. Nonetheless, there could still be some time-varying omitted variables that affect my inference. To mitigate this endogeneity concern, I use a 2SLS estimation. Following the rationale of Pappas *et al.* (2022) and Huang (2022), I use geographical coincidence between a firm and a political leader as my IV.[9] Prior literature suggests that such geographical coincidence would enable the connected firm to acquire more favorable treatment from the government (Cohen *et al.*, 2011). However, the IV reflects a coincidence between the firm and the political leader, making it unlikely to be associated with analyst forecast accuracy.[10] At the least, geographic coincidence should have no direct impact on analyst forecasts, except through the channel of subsidies. I define the geographical connection, *Geo_Connection*, as a dummy variable that equals 1 if the provincial leader has previously worked in the city where the firm is registered and 0 otherwise (Li *et al.*, 2021).

Table 2.7 reports the results for the 2SLS regression. In the first-stage, *Geo_Connection* shows a significantly positive relation with *TotalSubAsset*, which accords with my prediction that firms with geographical connections receive more subsidies (0.001, s.e.=0.000). Moreover, the Kleibergen–Paaprk *F*-statistic (12.64) is larger than the critical value proposed by Stock *et al.* (2002),[11] suggesting that my IV estimates do not suffer from a weak IV problem. The second-stage regression shows a significantly positive coefficient estimate for *TotalSubAsset* (1.837, s.e.=0.659). The results of the 2SLS bolster my main finding that subsidies can improve analyst forecast accuracy. Having

[9] Pappas *et al.* (2022) and Huang (2022) focus on the U.S. context and use the promotion of politicians from state to federal government as an IV for government subsidies.

[10] Since in China, the provincial leaders (shuji) are appointed by the central government rather than elected by the public, it is exogenous to firm and institutional characteristics, and the IV meets the exclusion assumption.

[11] According to Stock *et al.* (2002), when there is one instrument, the suggested critical *F*-value is 8.96 (Larcker & Rusticus, 2010).

said that, I do not claim that my IV is perfect for tackling the endogeneity concern. The analysis simply provides additional evidence that my results are unlikely to be driven by endogeneity.

Table 2.7: Instrumental Variable and Two-Stage Least Squares

	First Stage	Second Stage
	TotanSubAsset	*Accuracy*
Geo_Connection	0.001***	
	[0.000]	
TotalSubAsset		1.837***
		[0.659]
Size	-0.001***	-0.001
	[0.000]	[0.001]
Leverage	0.000	-0.004***
	[0.000]	[0.001]
SD_CFO	-0.001	-0.017**
	[0.003]	[0.009]
SD_Rev	0.000	-0.003
	[0.001]	[0.002]
OperCycle	0.000	0.000
	[0.000]	[0.000]
Loss_OP	0.002***	-0.028***
	[0.000]	[0.002]
Acc_Quality	-0.002**	-0.021***
	[0.001]	[0.003]
Institution	0.002	0.005
	[0.002]	[0.004]
SOE	0.000	0.000
	[0.000]	[0.001]
Report_Coverage	0.001***	0.000
	[0.000]	[0.001]
Horizon_mean	-0.000**	-0.001***
	[0.000]	[0.000]
Constant	0.016***	0.001
	[0.002]	[0.012]
Year FE	Yes	Yes
Industry FE	Yes	Yes
Adj. R^2	0.16	0.048
No. of Observations	11,943	11,943
F-statistics	12.644	

This table presents the empirical results using instrumental variable and two-stage least squares approach. In the first stage, *Geo_Connection* is an instrumental variable, defined as an indicator variable that equals 1 if the firm *i* is located in the city where the provincial leader (*shuji*) has worked and 0 otherwise. In the second stage, the independent variable (*TotalSubAsset*) is the amount of total subsidies dedicated by closing total assets for the fiscal year, while the dependent variable (*Accuracy*) is defined as the negative average value of firm's absolute analyst forecast errors. Appendix 2A provides detailed definitions for the variables. Robust standard errors in brackets are corrected for heteroskedasticity and clustered by firm. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate that the coefficients are statistically significant at the 0.1, 0.05, and 0.01 levels, respectively, using two-tailed tests. The F-statistics (12.644) provides evidence for rejecting the null hypothesis that the instrumental variable is weak.

C. Propensity Score Matching

In a further attempt to control for observable characteristics between subsidized and unsubsidized firms, I use PSM and repeat my main regression using the matched sample. I first create a new variable, *Sub_Dummy*, which takes the value 1 if the firm *i* receives a subsidy in fiscal year *t*, and 0 otherwise. Specifically, the treatment group is the firm-year observations who receive subsidies, while the control group is those who does not receive subsidies. I use a logit model to regress *Sub_Dummy* on the control variables and fixed effects used in the main regression. Following Li *et al.* (2021), I match observations using the caliper technique (without replacement), with a radius of 0.05. Panel A of Appendix 2B presents the first-stage regression results.

The above matching procedure ensures that the treatment (subsidized) and control (unsubsidized) observations are largely indistinguishable along a set of firm-level characteristics (i.e., the matching variables). Panels B and C of Appendix 2B present the results of univariate tests between the two groups before and after the matching. The results show that the differences in the covariates between the two groups vanish following the matching, indicating desirable matching performance. I then use the matched sample to re-run the main regression. Table 2.8 presents the results. My findings are insensitive to this alternative identification.

Table 2.8: Propensity-Score Matching

	Accuracy	
	1	2
TotalSubAsset	0.558**	0.352*
	[0.221]	[0.200]
Size		-0.002***
		[0.001]
Leverage		-0.002
		[0.002]
SD_CFO		-0.035
		[0.024]
SD_Rev		-0.005
		[0.005]
OperCycle		0.000
		[0.001]
Loss_OP		-0.031***
		[0.004]
Acc_Quality		-0.033***
		[0.010]
Institution		0.004
		[0.009]
SOE		0.002
		[0.001]
Report_Coverage		0.001
		[0.001]
Horizon_mean		-0.001***
		[0.000]
Constant	-0.013***	0.035***
	[0.002]	[0.012]
Year FE	Yes	Yes
Industry FE	Yes	Yes
Adj. R^2	0.056	0.343
No. of Observations	952	952

This table presents the results for the effect of government subsidies on forecast accuracy using propensity score matching (PSM) sample. *TotalSubAsset* is the amount of total subsidies deflated by total assets for the fiscal year, while *Accuracy* is defined as the negative average value of firm's absolute analyst forecast errors. Appendix 2A provides detailed definitions for the variables. The results for the statistical test for the PSM are presented in Appendix 2B. Robust standard errors in brackets are corrected for heteroskedasticity and clustered by firm. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate that the coefficients are statistically significant at the 0.1, 0.05, and 0.01 levels, respectively, using two-tailed tests.

2.5.4 Cross-sectional Variation Tests

I argue that subsidized firms are associated with higher political costs because they are essentially being propped up by taxpayers' money at the cost of public investment. Therefore, such firms may want to be more transparent to pre-empt any public outcry or scrutiny. To test this channel, I use media coverage to proxy for political costs. Prior literature (e.g., Chen *et al.*, 2009) shows that firms with high media coverage, especially negative coverage, often incur high political costs. As such, I expect the positive relationship between subsidies and forecast accuracy to be more pronounced for firms facing greater negative media attention. The variable *NegNews* is a dummy variable that equals 1 if the number of negative news items about the firm is above the sample median in year t 1. In Column (1) of Table 2.9, the coefficient on *NegNews* is significantly negative, suggesting that firms with more negative media coverage are associated with lower information transparency. However, consistent with the political cost explanation, the coefficient on the interaction term, *TotalSubAsset* *NegNews*, is significantly positive (0.169, s.e.=0.047).

In addition, my hypothesis suggests that subsidies improve analyst forecast accuracy via improved transparency. According to this line of reasoning, I would expect the positive relation between subsidies and analyst forecast accuracy to be stronger for firms with less transparent information environments, because the positive effect of subsidies on information transparency will be incrementally larger for such firms.

To test this conjecture, I use two proxies for information opacity. *Loss_OP Lag* is a dummy variable that equals 1 if the firm reports a negative operating profit in year t 1. It is well documented that loss-making firms exhibit a lower level of information transparency than financially healthy firms (e.g., Chen *et al.*, 2009). To exclude the effect of subsidies on net profit, I measure a firm's loss-making status based on operating profit. In Column (2) of Table

2.9, the coefficient on $Loss\_OPLag$ shows that, on average, the forecast accuracy is lower for loss-making firms (-0.005, s.e.=0.001). The coefficient on the interaction term, $TotalSubAsset \quad Loss\_OPLag$, is positive and significant at the 1% level (0.541, s.e.=0.084).

Next, I use $Fraud\_Disclosure$, a dummy variable for whether a firm is under enforcement action for violation disclosure behavior in year t, to measure the information transparency of the firm. The results, reported in Column (3), reveal that the coefficient on $Fraud\_Disclosure$ is significantly negative at the 1% level (-0.002, s.e.=0.001). The coefficient on the interaction term, $TotalSubAsset \quad Fraud\_Disclosure$, is positive and significant at the 5% level (0.211, s.e.=0.087). Taken together, the above results provide robust evidence that the positive effect of subsidies on analyst forecast outcomes is diminished among firms with higher political costs and poorer information environments.

Table 2.9: Cross-sectional Tests

	Accuracy		
	1	2	3
TotabSubAsset	0.107***	0.086***	0.171***
	[0.029]	[0.028]	[0.030]
NegNews	-0.001***		
	[0.000]		
TotalSubAsset *NegNews*	0.169***		
	[0.047]		
Loss_OPLag		-0.005***	
		[0.001]	
TotabSubAsset *Loss_OPLag*		0.541***	
		[0.084]	
Fraud_Disclosure			-0.002***
			[0.001]
TotabSubAsset *Fraud_Disclosure*			0.211**
			[0.087]
Controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Adj. R^2	0.325	0.338	0.328
No. of Observations	11,943	11,315	11,642

This table presents the regression results for the role of media coverage and information transparency in the subsidy-accuracy relation. The independent variable (*TotalSubAsset*) is the total subsidy amount de ated by closing total assets for the scal year. The dependent variable (*Accuracy*) is de ned as the negative average value of a rm's absolute analyst forecast errors. Appendix 2A provides detailed de nitions for the variables. Robust standard errors in brackets are corrected for heteroskedasticity and clustered by rm. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate that the coe cients are statistically signi cant at the 0.1, 0.05, and 0.01 levels, respectively, using two-tailed tests.

2.5.5 Information Content of Subsidies as an Alternative Explanation

As discussed above, subsidized firms exhibit a higher level of financial reporting quality due to their lessened motive for earnings manipulation. However, an alternative explanation for the observed relation is that a subsidy is a piece of value-relevant information, such that analysts can make more precise forecasts on the basis of the information content of received subsidies. This line of reasoning predicts that the positive effect of subsidies on forecast accuracy will be stronger when the awarded subsidies have a higher level of informativeness. Lee *et al.* (2014) show that tax-related subsidies are more value relevant than non-tax-related subsidies in the Chinese market. This is primarily because the provision of non-tax-related subsidies relies more on politicians' individual preferences and they are therefore more discretionary and subjective than tax-related subsidies. Following Lee *et al.*'s (2014) classification, I decompose subsidies into tax-related and non-tax-related components, and predict that the subsidy-forecast-accuracy relation will be stronger when subsidies are granted through the tax-related channels. Tax-related subsidies comprise rebates or reductions of VAT, corporate income tax, and export tax, while non-tax-related subsidies are often granted in the form of direct cash payments, loan guarantees, and debt forgiveness. The results, reported in Table 2.10, show that the coefficient on tax-related subsidies ($TaxSubAsset$) is positive but insignificant, whereas the coefficient on non-tax subsidies ($NTaxSubAsset$) is significantly positive. These results sharply oppose the alternative explanation concerning the informativeness of subsidies.

Overall, the results in Table 2.10 could help rule out the alternative explanation that the information content of the subsidy itself is the main contributor to the improvement in analyst forecast performance. It is worth noting that these results further reinforce my argument that the observed relation between

subsidies and forecast accuracy is driven by the reduced motivation to engage in earnings management, due to subsidization. Previous research (e.g., Lee *et al.*, 2017; Li *et al.*, 2021; Pappas *et al.*, 2022) suggests that discretionary subsidies are associated with higher political costs. As a result, firms have stronger incentives to improve their information transparency to signal their innocence to the public and shield themselves and politicians related to them from public scrutiny.

Table 2.10: Detailed Classification of Subsidies

	Accuracy		
	1	2	3
TaxSubAsset	0.039		0.023
	[0.041]		[0.041]
NTaxSubAsset		0.298***	0.297***
		[0.041]	[0.041]
Controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Adj. R^2	0.321	0.326	0.326
No. of Observations	11,943	11,943	11,943
Di erence (F-statistics)			22.85
p-value			0.000

This table presents the regression results for the e ect of di erent types of government subsidies on forecast accuracy. The independent variable (*TaxSubAsset*, *NTaxSubAsset*) is the amount of tax-related and non-tax-related subsidies de ated by closing total assets for the scal year, respectively. The dependent variable (*Accuracy*) is de ned as the negative average value of rm's absolute analyst forecast errors. Appendix 2A provides detailed de nitions for the variables. Robust standard errors in brackets are corrected for heteroskedasticity and clustered by rm. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate that the coe cients are statistically signi cant at the 0.1, 0.05, and 0.01 levels, respectively, using two-tailed tests.

2.6 Conclusion

I examine the effect of government subsidies on analyst forecast accuracy. Using a large sample of Chinese listed firms, I find that government subsidies are associated with a higher degree of analyst forecast accuracy. My results are robust to a battery of sensitivity tests. The effect is more pronounced among firms with greater political costs and weaker information environments. My results suggest that subsidies improve forecast accuracy through the restraint of managers' earnings management incentives.

This study contributes to the literature on analyst forecasts and government subsidies. Besides, I expect my results to be of interest to various groups of stakeholders, including investors, practitioners, and policymakers. Investors can rely more on the information in the annual report and the equity research reports in the case of firms with higher levels of subsidies, since they imply a better information environment and more accurate forecasts. Analysts can consider the receipt and disclosure of subsidies as a positive sign of corporate information quality. Moreover, I expect my findings to inform the setting of financial reporting standards, which are supposed to consider how government subsidies should be disclosed and how corporate insiders can be prohibited from trading on inside knowledge of such subsidies.

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Appendix 2A: Variable Definition

Variable Name	Definition
Panel A: Dependent Variables	
$Accuracy_{i;t}$	The negative average value of firm i's absolute analyst forecast errors in fiscal year t. The absolute analyst forecast error for analyst j is the absolute difference between forecast and actual EPS, scaled by the stock price at the beginning of the year (Dhaliwal *et al.*, 2012).
$Accuracy\_Indi_{i;t}$	The negative absolute value of the difference between the forecast EPS of each analyst report j and actual EPS for each firm i, scaled by the stock price at the beginning of fiscal year t.
Panel B: Independent Variables	
$TotalSubAsset_{i;t}$	The total amount of subsidies deflated by the book value of total assets in year t.
$TotalSubR_{i;t}$	The total amount of subsidies deflated by total operating revenue in year t.
$TotalSubMVE_{i;t}$	The total amount of subsidies deflated by the market value at the end of year t.
$SubDummy_{i;t}$	An indicator variable that takes the value of 1 if the firm i receives subsidies in fiscal year t; and 0 otherwise.
$TaxSubAsset_{i;t}$	The total amount of tax-related subsidies deflated by the book value of closing total assets in year t.
$NTaxSubAsset_{i;t}$	The total amount of non-tax-related subsidies deflated by the book value of closing total assets in year t.
Panel C: Control Variables	
$Size_{i;t}$	The log of total assets at the beginning of the year t.
$Leverage_{i;t}$	The ratio of non-current liabilities to shareholder equity at the beginning of the year t.
$SD\_CFO_{i;t}$	The standard deviation of a firm's rolling 5-year cash flow from operations, deflated by the average of opening and closing total assets for the year t.
$SD\_Rev_{i;t}$	The standard deviation of a firm's rolling 5-year sales revenue, deflated by the average of opening and closing total assets for the year t.
$OperCycle_{i;t}$	The log of the sum of a firm's days of accounts receivable and days of inventory turnover.
$Loss\_OP_{i;t}$	An indicator variable that equals 1 if the operating profit for the year t is negative; and 0 otherwise.
$Acc\_Quality_{i;t}$	The residuals taken from time-series cross-sectional estimations of fitted values that regress total current accruals on reciprocal of opening assets, changes in sales, net fixed assets, and industry and time dummies.

$Institution_{i;t}$	The ownership percentage of the top 10 shareholders that are institutional investors (including mutual funds, foreign investors, brokerage firms, insurance companies, pension funds, investment trusts, banks, other financial companies, and non-financial public firms).
$SOE_{i;t}$	An indicator variable that equals 1 if the firm i is a state-owned enterprise; and 0 otherwise.
$Report\_Coverage_{i;t}$	The log of one plus the total number of analysts who follow firm i in year t.
$Horizon\_mean_{i;t}$	The average forecast horizon of all analysts following firm i in year t. The horizon for each analyst is defined as the length of period between the forecast date and the fiscal year-end, in months.
$Horizon\_Indi_{j;i;t}$	The forecast horizon of each individual analyst forecast j following firm i in year t. The horizon for each analyst is defined as the length of period between the forecast date and the fiscal year-end, in months.
Panel D: Instrumental Variable	
$Geo\_Connection_{i;t}$	An indicator variable that equals 1 if the firm i is located in the city where the provincial leader has worked; and 0 otherwise.
Panel E: Cross-sectional Variables	
$NegNew_{i;t}$	An indicator variable that equals 1 if the firm has relatively higher ratio of negative news coverage in year t; and 0 otherwise. The ratio of negative news is the difference between negative news and positive news divided by total amount of news. The relative level is classified within each industry-year cluster.
$Loss\_OPLag_{i;t}$	An indicator variable that equals 1 if the operating profit for the year t 1 is negative; and 0 otherwise.
$Fraud\_Disclosure_{i;t}$	A dummy that equals 1 if the firm i is recognized to have fraud disclosure in year t; and 0 otherwise.
Panel F: Determinants of subsidies	
$TotalSubAssetLag_{i;t}$	The total amount of subsidies deflated by the book value of closing total assets in year t 1.
$Employee_{i;t}$	The log of the total number of employees in year t.
$PSROA_{i;t}$	The net profit minus subsidies deflated by total assets in year t.
$Sales\_Growth_{i;t}$	The growth rate of operating revenue from year t 1 to year t.
$BM_{i;t}$	The book-to market ratio at the beginning of year t.
$RnD_{i;t}$	The amount of capitalized research and development expense for the year in year t.
$Tangibility_{i;t}$	The sum of fixed asset and inventories deflated by total assets in year t.

Appendix 2B: Determinants of Subsidies and PSM Covariate Balance Tests

Panel A: Determinants of Government Subsidy		
	Dependent: Sub_Dummy	
		s.e.
TotalSubAssetLag	4.620***	[0.378]
Size	-0.045***	[0.007]
Leverage	0.004	[0.013]
Employee	0.027***	[0.006]
BM	0.113***	[0.027]
PSROA	-0.164	[0.103]
Sales_Growth	0.001	[0.006]
RnD	0.001**	[0.000]
Loss_OP	-0.029**	[0.011]
Geo_Connection	0.002	[0.010]
SOE	0.006	[0.009]
Tangibility	-0.005	[0.027]
Fixed Effects	Year FE and Industry FE	
Adj. R^2	0.171	
No. of Observations	11,303	

Panel B: Covariate Balance Test of Full Sample				
	Unsubsidized Firm	Subsidized Firm	Difference	*t*-statistics
TotalSubAssetLag	0.001	0.005	-0.004***	-20.749
Size	22.250	22.070	0.180***	4.538
Leverage	0.342	0.246	0.096***	7.674
Employee	7.879	7.954	-0.075*	-1.899
BM	0.604	0.519	0.085***	10.363
PSROA	0.045	0.036	0.009***	5.375
Sales_Growth	-0.201	-0.207	0.006	0.416
RnD	1.592	3.676	-2.085***	-9.725
Loss_OP	0.128	0.127	0.001	0.108
Geo_Connection	0.195	0.207	-0.011	-0.884
SOE	0.677	0.477	0.200***	12.649
Tangibility	0.437	0.392	0.045***	8.039

Panel C: Covariate Balance Test of PSM Sample				
	Unsubsidized Firm	Subsidized Firm	Difference	*t*-statistics
TotalSubAssetLag	0.001	0.001	0.000	1.363
Size	22.281	22.312	-0.032	-0.368
Leverage	0.363	0.331	0.031	1.022
Employee	7.978	8.020	-0.042	-0.487
BM	0.642	0.645	-0.002	-0.140
PSROA	0.041	0.042	-0.000	-0.154
Sales_Growth	-0.186	-0.181	-0.005	-0.175
RnD	1.333	1.555	-0.222	-0.735
Loss_OP	0.107	0.111	-0.004	-0.208
Geo_Connection	0.204	0.195	0.008	0.324
SOE	0.714	0.697	0.017	0.569

Tangibility	0.441	0.442	-0.001	-0.061

This table presents the detailed results of the propensity score matching method. Panel A shows the determinants of subsidies, using *TotalSubAsset* as dependent variable. Panel B shows the covariate balance test of the full sample, while Panel C shows that of the PSM sample. Variable definitions are provided in Appendix 2A. *, **, and *** indicate that the coefficients are statistically significant at the 0.1, 0.05, and 0.01 levels, respectively, using two-tailed tests. Robust standard errors are clustered by firm and shown in parentheses.

Chapter 3

Socio-Political Scrutiny and Voluntary Subsidy Disclosure

Abstract

This paper examines how socio-political scrutiny affects firms' voluntary disclosure of subsidy information. In 2015, China enforced a regulation to crack down on "zombie firms", which rely heavily on government subsidies to survive, within the subsequent five years. This aroused widespread socio-political scrutiny of the provision of subsidies. Using a difference-in-differences analysis, I find that the treatment group (i.e., zombie firms) significantly reduces its voluntary disclosure of subsidies received after the regulatory shock. Cross-sectional analyses show that the effect is stronger for firms with more public attention, firms whose performance is more vulnerable to subsidies, and politically connected firms. Overall, these findings suggest that subsidy recipients tend to withhold subsidy information to mitigate socio-political scrutiny.

Keywords: Socio-Political Scrutiny, Government Subsidies, Voluntary Disclosure, Zombie Firms

3.1 Introduction

Globally, governments provide huge amounts of subsidies every year as a tool to offset market inefficiency (e.g., Schwartz & Clements, 1999). For instance, in the first quarter of 2022 alone, the US federal government provided USD147 billion in subsidies.[1] However, the provision of government subsidies arouses criticism both in academia[2] and from external stakeholders. As stakeholders place great emphasis on the effectiveness of subsidies, they expect subsidized firms to behave themselves, maintain their public image, and create social value. However, in some circumstances, the government provides subsidies to poorly performing enterprises or corruption-related businesses (e.g., Fang *et al.*, 2018; Chang *et al.*, 2021; Wang & Zhang, 2020), and such government intervention also leads to an increasing number of "zombie firms" (Chang *et al.*, 2021). The ongoing Covid-19[3] and the trade war between the US and China[4] have brought subsidies under the spotlight again and provoked a great deal of controversy.

As controversial elements, subsidies receive socio-political scrutiny from stakeholders. The stakeholder theory requires firms to consider a series of relationships between themselves and stakeholders such as communities, employees, and financiers and, in order to maintain their reputations among stakeholders, firms need to weigh up the benefits and potential risks of their behavior

[1] For details about the subsidy provision, please refer to https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=3&isuri=1&1921=survey&1903=86.

[2] For example, Desai & Hines (2008) nd that subsidies improve the pro tability of exporters, which triggers unfair trade. Boeing (2016) argues that the provision of subsidies crowds out businesses' R&D investment.

[3] Anecdotal evidence from the Wall Street Journal refers to Covid-19 programs supporting small businesses in the US. Although there is about USD5 billion remaining, small businesses have objected about the rerouting of the unspent aid. Please refer to media articles at https://www.wsj.com/articles/small-businesses-object-to-clawback-of-covid-19-aid-11650274203 for more information.

[4] One media report on the trade war implies that the Biden administration has criticised Beijing's widespread use of industrial subsidies and is planning an investigation. For more details, please refer to https://www.wsj.com/articles/biden-administration-takes-aim-at-chinas-industrial-subsidies-11631295257.

(Freeman *et al.*, 2010). In the specific case of subsidies, political stakeholders have conflicting interests. The central government is against wide provision of subsidies,[5] while local government relies on firms within their jurisdiction to maintain employment and economic growth, and they have incentives to attract firms by providing subsidies. As taxpayers, the social stakeholders (i.e., the public) expect the government to be able to properly use tax revenue for trustworthy purposes, and require more transparency in subsidy information.[6] However, subsidy disclosure is less examined in the literature. Therefore, analyzing how scrutiny affects firms' disclosure incentives regarding subsidy information can provide more insight into this consequential issue.

China provides a fitting setting for analyzing the effect of socio-political scrutiny on subsidy information disclosure. Firstly, subsidies play an important role in China, with a total observed amount of over USD30 billion in 2020,[7] and an average listed firm reporting subsidies as making up 14% of total profit. The subsidy, as an important form of government intervention, is one of the main causes of zombie firms in China (Chang *et al.*, 2021), and the prevalence of shadow banking also provides opportunities for poorly performing firms to acquire subsidized credit (Allen *et al.*, 2019). Secondly, apart from the mandatory disclosure of the amounts of subsidies received and their categories, Chinese listed firms also voluntarily disclose other subsidy-related information, such as project names, sources, and policy basis, which allows for a deep investigation into the disclosure incentives.[8] Specifically, project names can

[5] In 2014, the central government of China issued an official document to regulate the provision of subsidies, but this encountered strong resistance from the local governments, and was withdrawn in 2015. More information is available at http://www.gov.cn/zhengce/content/2014-12/09/content_9295.htm.

[6] Some organizations are working to improve the transparency of subsidies. For example, Subsidystories.eu claims that they "intend to increase the transparency of EU-Funds by unravelling how the European Structural Investment Funds are spent".

[7] The total amount of subsidies only includes the observable part listed in the annual reports of public firms.

[8] By contrast, in the US, it is the government rather than the firm that is required to disclose details of corporate subsidies, and only a limited number of firms disclose material subsidies in the Management Discussion and Analysis part of their annual reports. There-

tell stakeholders the nature and purpose of the programs,[9] while the source and policy basis can help stakeholders trace programs back to the institutes and possibly politicians who provided the subsidies.[10]

Under socio-political scrutiny, firms need to trade off the costs and benefits when disclosing subsidy-related information. On the one hand, higher scrutiny increases the risks that stakeholders may observe the firms' subsidized status, and those which rely heavily on subsidies to survive do not want to expose their non-performing status to public attention. Also, since firms can acquire subsidies through political connection (Jin & Zhang, 2019), they have incentives to protect the politicians through whom they may acquire subsidies, and thus suppress negative information to protect their reputations (e.g., Piotroski *et al.*, 2015; Li *et al.*, 2021a). A cost-effective way to mitigate the scrutiny costs is to reduce voluntary disclosure of subsidies. On the other hand, subsidized firms can also benefit from increased transparency. Huang (2022) finds that firms receiving subsidies disclose more general information and more subsidy-goal-related information, so that the increased transparency will reduce the agency cost between taxpayers and shareholders. Such increases in disclosure also benefit politicians and improve their reputations. Marquis *et al.* (2016) finds that, when firms are exposed to more scrutiny, they engage in less selective disclosure to mitigate criticism. Based on the mixed evidence, whether socio-political scrutiny changes the subsidy disclosure pattern is an open empirical question.

To test this question, I construct a sample of Chinese listed firms over the period between 2013 and 2016, and use the difference-in-differences (DID)

fore, China is a more appropriate setting for analyzing the voluntary disclosure incentives of rms.

[9] For example, one can tell from project names whether subsidies are provided in the form of tax reduction, whether they are related to technology, R&D, or environmental protection, etc., and whether they are recurring or not.

[10] For example, Li *et al.* (2021a) nd that politically connected rms disclose less subsidy-related information to protect the politicians through whom they have acquired subsidies.

regression model, with a regulatory shock in 2015, when the Prime Minister of China proposed a reform and stated the government's aim of solving the problem of "zombie firms" in China for the first time.[11] After the central government conferences,[12] the local governments set out detailed follow-up plans to root out zombie firms within their jurisdictions within five years. As is implied by the significant rise in the number of searches for "zombie firms" in the Baidu Search Index after the proposal was introduced, the enforcement action of cracking down on zombie firms also put them under scrutiny from social stakeholders. Therefore, I use this "anti-zombie" regulation as a shock that increases socio-political scrutiny, which in turn exerts pressure on the zombie firms. I define zombie firms in 2014 (i.e., one year before the shock) as the treatment group and non-zombies as the control group. The dependent variable, subsidy disclosure, is comprised of three components: subsidy source, policy basis, and project name, following Li *et al.* (2021a). I also include control variables affecting firms' voluntary disclosure behavior, year fixed effects, and firm fixed effects in the regression model.

The empirical results show that, after the regulatory shock, the treated firms disclose significantly less about the subsidies they receive, relative to the control firms. The finding is not only statistically significant but also economically meaningful. Zombie firms reduce voluntary subsidy disclosure by 4.7%, representing 21.8% (8.6%) of the standard deviation (mean). Overall, these findings imply that, when firms are subject to high socio-political scrutiny, they tend to reduce disclosure to mitigate the potential risks.

To test the robustness of my finding, I perform a number of robustness checks, including parallel trend analysis, a placebo test, using alternative measures for the key variables, and using entropy balancing approach. Firstly, the

[11] Please refer to http://www.gov.cn/zhengce/2015-11/05/content_2961087.htm for more information.

[12] In late 2015, the key word \zombie rms" appeared at least three times in the government conferences, signalling the government's emphasis on this issue.

basic assumption of the DID model is that the difference in disclosure between the treated group (i.e., zombie firms) and the control group (i.e., non-zombie firms) is largely negligible before the regulation takes effect. The empirical results support this assumption. Secondly, in order to rule out the potential confounding effect of other shocks during the period, I conduct a placebo test. The randomly assigned treatment and control groups do not show significant differences in their disclosure patterns. Thirdly, I use pre-adjusted measures for the three voluntary disclosure components (i.e., the absolute percentages of subsidies for which firms disclose the source, policy basis, and project name), and I also use different definitions of zombie firms based on prior literature (e.g., Fukuda & Nakamura, 2011). The significant results suggest that my finding is not sensitive to these alternative measures. Finally, I use the entropy-balancing method to alleviate the potential systematic differences between the treatment and control groups. After the entropy-balancing, the characteristics are more comparable between the groups, and the results remain unaffected.

In order to better analyze the intensity of the scrutiny of subsidy disclosure and help build a stronger causal relation, I then conduct several cross-sectional tests. Firstly, when firms receive more public attention, they face greater scrutiny risks, and therefore have higher incentives to hide information to reduce the potential risks of public monitoring. Indeed, I find that firms with more public attention (measured by analyst following and negative media coverage) tend to reduce subsidy disclosure to a larger extent. Secondly, since firms that rely more on government subsidies may receive more criticism when they come under scrutiny,[13] I predict that the effect of scrutiny is stronger for heavily subsidized firms. The results show that the treatment effect is more

[13]Government subsidies are commonly criticized in the media. For example, the media claim that the heavy subsidies given to motor vehicle manufacturers do harm to the development of the industry. Please see https://auto.huanqiu.com/article/9CaKrnJVyLP for more details. Also, some high-tech firms rely too much on subsidies, even if they should have the capability to make a profit. Please see example at http://epaper.bjnews.com.cn/html/2015-05/11/content_575995.htm.

pronounced for firms relying more on subsidies to survive. Thirdly, zombie firms with political connections are more likely to be attacked if they receive government subsidies (Piotroski *et al.*, 2015; Li *et al.*, 2021a). As such, those firms are expected to have greater incentives to hide subsidy information. Consistent with this prediction, I find that the treatment effect is stronger for firms with political connections.

There are potential concerns, which may undermine my finding. The first is that the reduction of subsidy disclosure may partly be caused by a change in the amounts of subsidies provided. When politicians face higher scrutiny, they are less likely to provide subsidies to low-quality applicants, and my finding may thus only be a consequence of the reduced subsidy amount. Therefore, I test the effect of the regulatory shock on the amounts of subsidies, and the results suggest that firms do not receive less in subsidies when scrutiny increases. This finding rules out this potential explanation. Another concern is that, when zombie firms face higher scrutiny, their general disclosure may decrease, and the decrease in subsidy disclosure could just reflect the reduction in general information disclosure. I use the frequency of management earnings forecasts as a proxy, and the results show that the increase in socio-political scrutiny does not have any significant impact on general information disclosure.

Overall, this paper makes contributions to three areas of research. Firstly, it contributes to subsidy disclosure literature. Prior literature mainly focuses on the economic outcomes of government subsidies (e.g., Schwartz & Clements, 1999; Karhunen & Huovari, 2015; Groh *et al.*, 2016; Wang & Zhang, 2020). There are only a few studies from the accounting perspective, which find that subsidized firms disclose more general information, more subsidy-goal-related information, and more corporate social responsibility reports (e.g., Lee *et al.*, 2017; Huang, 2022), while they are also more likely to smooth their earnings and engage in corporate fraud (e.g., Raghunandan, 2021; Pappas *et al.*, 2022).

To the best of my knowledge, the only papers studying subsidy disclosure are Li *et al.* (2021a), which finds that politically connected firms disclose fewer details about the subsidies they receive, and Li *et al.* (2021b), which shows that firms disclose less when facing international anti-subsidy actions. This study adds to this part of the literature by analyzing the effect of scrutiny on subsidy disclosure.

Secondly, this paper contributes to the effect of socio-political scrutiny. Prior literature has some findings about the effect of scrutiny on corporate disclosure. For example, Marquis *et al.* (2016) finds that socio-political scrutiny reduces the incentives for greenwashing and encourages less selective disclosure about environmental performance. Reid & Toffel (2009) finds that shareholder actions and government regulations can increase the propensity for firms to follow the regulations and disclose more about their strategies for climate change. Patten & Trompeter (2003) finds that political scrutiny increases the political costs, and firms, therefore, have more incentives to manipulate their earnings. However, studies mainly focus on environmental performance and earnings numbers, whereas little is known about the effect on the disclosure of other financial items. This paper fills the gap.

Finally, this paper contributes to the zombie firm literature. Prior studies have analyzed the determinants of zombie firms (e.g., Caballero *et al.*, 2008; Banerjee & Hofmann, 2018; He *et al.*, 2018; Andrews & Petroulakis, 2019), poor performance, and the spill-over effect onto industry peers (e.g., Caballero *et al.*, 2008; Gopinath *et al.*, 2017; Adalet McGowan *et al.*, 2018; Acharya *et al.*, 2019; Schmidt *et al.*, 2019). In spite of the exploration of the determinants and negative externalities worldwide, little is known about the disclosure patterns of zombie firms. Therefore, studying their disclosure incentives could shed more light on the identification strategies of zombie firms.

The paper is organized as follows. Section 3.2 introduces the institutional

background of government subsidies in China and disclosure by Chinese firms, as well as the regulatory shock to zombie firms in 2015. Section 3.3 develops the hypotheses. Section 3.4 describes the methodology and variable definitions of the model. Section 3.5 presents the empirical results, and Section 3.6 concludes.

3.2 Institutional Background

3.2.1 Government Subsidies and Disclosure in China

Defined as free monetary or non-monetary assets obtained from the government, subsidies work as an important economic tool for correcting market failures, improving economies of scale, and facilitating social target achievement. According to the annual reports of listed firms in China, the total amount of government subsidies reached over CNY200 billion (approximately USD30 billion) in 2020. For an average listed firm, government subsidies represent about 14% of total profit during my sample period. Subsidies can be granted in various forms, including direct cash payments, reduction or repayment of tax liabilities, free or low-cost loans, provision of goods and services at below-market prices, and purchases of goods and services at above-market prices. As is mentioned by Li *et al.* (2021a), the government can also provide support to certain firms in other forms, such as increasing the market entry barriers in certain industries to facilitate current participants' profit-making, but it is difficult to know to what extent these policies benefit firms. Therefore, the observable subsidies in corporate annual reports comprise only a fraction of the full government support, and this paper looks only at that observable part.

In China, the provision of subsidies is partly inside the black box. The government sets a general goal or plan every five years, for which the relevant

information for supporting industries is available to all market participants, but it does not necessarily disclose information on each subsidy project in detail. At the beginning of each fiscal year, the planned subsidy projects are open for applications from all eligible firms.[14] After applications have been received, the government will establish an inspection team and arrange corporate visits to the applicants, based on which they will pick those with the most potential and offer subsidies to them. As implied by prior literature, the team is usually made up of government officials, rather than peer reviewers or expert panels (e.g., Fang *et al.*, 2018; Li *et al.*, 2021a). Some local governments may also provide discretionary subsidies to attract enterprises that set up new branches within their jurisdiction, or to avoid listed firms reporting losses and being delisted.[15] The provision of subsidies has aroused bitter controversy in the media. For example, the intense growth of subsidies in the motor vehicle manufacturing industry is blamed for "destroying the market", such that firms can earn a profit even if they are not competitive.[16]

According to the *Chinese Accounting Principle No. 16: Government Subsidies*, Chinese listed firms must disclose subsidy-related information in the notes of financial reports. The mandatory disclosure includes (1) the category and amount of the subsidies, (2) the amount recognized as current profit or loss, and (3) refunds of subsidies and reasons for them. The China Securities Regulatory Commission (CSRC) also provides a project-by-project template

[14] The projects differ in terms of their nature (i.e., some may involve building up non-current assets while others provide compensation for incurred expenses), duration (i.e., some may last for years, others just one year), funding source (i.e., some are provided only by the central or only by the local government, while others come from different tiers of government organizations), and policy basis (i.e., some are general and apply to all firms meeting certain criteria, while others require a selection to be made from the applicants). For instance, tax-related subsidies are usually provided by the central government, based on a general policy and applied to all firms meeting fixed criteria. However, many technology-related subsidies require the government to make a choice between candidates within a certain jurisdiction.

[15] Please refer to anecdotal evidence at https://www.szse.cn/aboutus/research/securities/documents/t20040106_530788.html.

[16] Please refer to https://auto.huanqiu.com/article/9CaKrnJVyLP for some anecdotal evidence.

for firms' disclosure of detailed subsidy information. Apart from the mandatory disclosure, Chinese listed firms also voluntarily disclose other information related to subsidies in their annual reports. They may disclose (1) the project name, (2) the source, (3) the policy basis, (4) the reasons for the subsidy, (5) the nature of the project, (6) the profit impact, (7) any speciality, and (8) the subsidized entity.[17] Some firms also disclose subsidies receivable[18] and the cash flow effect related to operating, investing, or financing activities, respectively. Appendix 3B provides a more detailed description of the disclosure requirements.

Of all the voluntary disclosure items, the project name, source, and policy basis are the most commonly disclosed and contain sufficient information about the subsidy programs in which the firms are engaged. Based on these three key informative items, the stakeholders can analyze the reliability and rationality of the programs, and also trace the origins of the subsidies from the government's website. By contrast, some subsidy-related items in the notes of financial statements do not have a clear definition or criteria, such as the speciality and the nature, while others can be inferred from the project's name, source, and policy basis, such as the profit impact and cash flow effect. Therefore, I choose to use the source, policy basis, and project name as the research objects. [19]

3.2.2 Zombie Firms and the "Anti-Zombie" Regulatory Shock in 2015

Globally, zombie firms have received increasing attention in recent years. Research has identified their poor performance and the negative externality

[17] Firms can choose not to use the voluntary disclosure template.

[18] In reality, due to the use of cash basis in government accounting and strict government planning, rarely is there any situation in which rms have subsidies receivable.

[19] Prior literature including Li *et al.* (2021b) and Li *et al.* (2021a) uses the source and policy basis, whereas the project name is a more absolute measure, because it only answers a yes-no question of voluntary subsidy disclosure.

of crowding out the employment, investment opportunities, and productivity of healthy industry peers (e.g., Caballero *et al.*, 2008; Acharya *et al.*, 2019). Unlike the institutional environments in Japan (e.g., Caballero *et al.*, 2008; Fukuda & Nakamura, 2011), European countries (e.g., Adalet McGowan *et al.*, 2018; Acharya *et al.*, 2019), and the United States,[20] in China, the government plays an important role in the formation of zombie firms. Chang *et al.* (2021) finds that government intervention, in the form of subsidies, resource support, financial support, and taxation, increases the zombie prevalence in China. The financial difficulties of local governments can also lead to a higher level of zombie firms (Cai *et al.*, 2022). Zombie prevalence caused by subsidies has aroused a series of criticisms from socio-political stakeholders.

In 2015, Keqiang Li, the Prime Minister of China, announced a plan to solve the problem of "zombie firms" in China.[21] During the conference, a series of supporting actions were proposed to diminish the negative shock to society caused by zombie firms (e.g., bank bad debt, unemployment, etc.). Afterwards, local governments followed the instructions of the central government and set out their own plans in late 2015 and early 2016. Many of the government documents involved a short-term plan to crack down on non-operating enterprises by 2017 or 2018, and a longer-term plan to completely solve the zombie problem by 2020.[22] Based on the proposed actions in the con-

[20] In Japan, banks are the first blamed for providing low-quality borrowers with evergreening loans, and the prevalence of zombie congestion impairs profitability, investment, employment, and productivity (Caballero *et al.*, 2008). Similarly, in Europe, Acharya *et al.* (2019) finds that weakly capitalized banks build cash reserves and renew zombie loans to non-creditworthy borrowers. Using a multinational sample with 14 countries (namely, Australia, Belgium, Canada, Denmark, France, Germany, Italy, Japan, the Netherlands, Spain, Sweden, Switzerland, the United Kingdom, and the United States), Banerjee & Hofmann (2018) claims that reduced financial pressure, reflected by decreasing interest rates, is the main reason for zombie prevalence. Apart from banks and the monetary policy, De Martiis & Peter (2021) also demonstrates the positive effect of decreased inflation and a lower state of the business cycle on the rise of zombie firms.

[21] Please refer to http://www.gov.cn/zhengce/2015-11/05/content_2961087.htm for more information.

[22] Most of the local (provincial) governments disclose their plans and results regarding the clearing of zombie firms on their websites (e.g., Guangdong Province https://www.ndrc.gov.cn/xwdt/ztzl/gdqjcbzc/guangdong/201801/t20180119_1209

ference, firms still having business value would be encouraged to restructure, while those meeting the conditions for bankruptcy and liquidation were to be resolutely liquidated. Although the policy focused more on extreme zombie firms, most of which had no active productivity, listed firms also treated it as a negative signal.[23]

The regulation introduced in 2015, aimed at solving the "zombie firm" problem in China, exposed them to socio-political scrutiny. The government set out a series of rules for detecting and cracking down on zombie firms and, following the regulation, social stakeholders began paying more attention to the issue. Figure 3.1 presents the Baidu Search Index for zombie firms, showing a significant peak in late 2015, which indicates that the policy drew attention and increased socio-political scrutiny. After 2016, the search dropped to a more stable level, but remained higher than before the shock. Overall, following the introduction of the "anti-zombie" regulation, public scrutiny of zombie firms increased.

680.html?code=&state=123; Shanghai https://www.shanghai.gov.cn/nw18454/20200820/0001-18454_1257299.html; etc.).

[23] As mentioned during the conference, zombie rms are those which reports negative earnings in three consecutive years. However, according to the delisting requirement made by the CSRC in 2011, a listed rm shall be delisted if it reports a loss for three years, and in 2012, the CSRC added more criteria related to the net assets, operating revenue, and stock price. Therefore, rms that remain listed are unlikely to be absolute "zombies", in spite of the fact that some rms manipulate earnings or information to hide their actual performance.

Figure 3.1: Baidu Index of Zombie Firm Search

This figure shows the Baidu Search Index of the key word "zombie firms". After late 2015 when the Prime Minister of China announced to solve the issue of "zombie firms", there was a significant increase in searching topics related with "zombie firms", implying a rise in socio-political scrutiny.

3.3 Hypotheses Development

Disclosure reduces the information asymmetries between the firm and capital market participants, and firms can benefit from the information transparency. For example, Healy & Palepu (2001) states that increased transparency can reduce firms' costs of capital. However, increased transparency also brings about higher costs, such as the proprietary cost (e.g., Ellis *et al.*, 2012) and the reputational cost (e.g., Dye, 2001; Chakravarthy *et al.*, 2014). Therefore, firms need to trade off the benefits and costs when making disclosure decisions so as to optimize their disclosure choices. In the context of this study, how firms respond to the "anti-zombie" regulation depends on their evaluation of the subsequent outcomes: disclosing subsidy information can improve the quality of their annual reports and signal their innocence, while such disclosure can also increase the possibility of being observed and blamed for taking taxpayers' money. In this section, I use stakeholder theory to illustrate the cost-benefit trade-off of corporate disclosure choices.

The stakeholder theory requires managers to think about their management and strategy so as to maintain their relationships with and reputation among stakeholders including communities, employees, financiers, etc. (Freeman *et al.*, 2010). In this paper, I define socio-political scrutiny as increased attention from political stakeholders and public stakeholders (i.e., general interest parties). When external socio-political scrutiny increases, the stakeholders are more aware of the situations of these zombie firms under the "anti-zombie" regulation, and the exposure of the subsidy acquirement channel is likely to attract blame from the public, causing reputation losses for both the firms and the politicians who awarded the subsidies. In this sense, the regulatory shock reduces "reputation capital"[24] and brings about lower expectations of prof-

[24] Karpo (2012) identi es reputation capital as \the present value of the improvement in net cash ow and lower cost of capital that arises when a rm's counterparties trust that the rm will uphold its explicit and implicit contracts, and will not act opportunistically to

itability and future cash flow. Therefore, firms have incentives to reduce disclosure to avoid being censured when they receive high socio-political scrutiny. Since firms rely on politicians to acquire subsidies (e.g., Faccio, 2006; Grimmelikhuijsen, 2009), they may also choose to protect the politicians through whom they acquire the subsidies, by hiding information on subsidy sources, and preventing their subsidy program from being observed by withholding the project name and policy basis. Based on the above discussion, I propose the following hypothesis:

H1: When the regulation increases socio-political scrutiny, the treated firms decrease their voluntary disclosure of government subsidies.

The impact of the "anti-zombie" regulation on subsidy disclosure may vary cross-sectionally. First, when a firm receives more public attention, the risk of scrutiny tends to escalate. As such, zombie firms facing higher scrutiny risk are more likely to hide their subsidy information. Second, zombie firms that rely heavily on subsidies to survive are more likely to receive criticism. Before the public is aware of the non-performers and their inefficiency, firms can struggle to survive with the support from the government, but when the regulation increases socio-political scrutiny, such firms might be blamed for taking up resources that should have been allocated to healthy counterparts. Therefore, zombie firms relying more on subsidies tend to hide subsidy information. Third, since the firms consider the effects on politicians when they disclose information, I predict that the treatment effect is stronger for firms with political connections. Li *et al.* (2021a) finds that politically connected firms disclose less subsidy information. Therefore, when the regulatory shock increases socio-political scrutiny, firms have incentives to hide subsidies, in order to avoid exposure of the connections through which they acquired them, and to protect the politicians from whom they acquired them. Based on the

their detriment". In other words, reputation is an o -balance-sheet intangible asset.

above discussion, I propose the following hypotheses:

H2: The treatment effect is stronger for firms that receive more public attention.

H3: The treatment effect is stronger for firms that rely more on subsidies.

H4: The treatment effect is stronger for firms with political connections.

It is possible, however, that the results will not be as predicted. Firstly, zombie firms can also benefit from increased subsidy disclosure. Guedhami *et al.* (2014) find that politically connected firms have stronger incentives to signal their innocence and information transparency. Huang (2022) finds that subsidized firms disclose more general information and subsidy-goal-related information so as to reduce public skepticism and prevent further investigation. The provision of additional information allows the public to observe the use of subsidies and thereby ensure that the taxpayers' money is being reasonably allocated. Even for zombie firms, if their subsidies are obtained reasonably, the central government and the public may blame them less. Increasing subsidy disclosure, including the sources, policy basis, and project names, can also benefit the politicians, who avoid being accused of misusing government funds. Marquis *et al.* (2016) finds that, when firms are under external scrutiny, they are less likely to engage in selective disclosure, and instead increase information quality. Therefore, when firms face increased scrutiny, they have incentives to increase their subsidy disclosure and so prove their innocence. Secondly, the regulatory shock's effect on disclosure might be the result of an impact on the subsidy amount, which in turn changes the disclosure pattern. When socio-political scrutiny increases, politicians might be more cautious and provide less in discretionary subsidies. Thirdly, the reduction of subsidy disclosure may only reflect part of the entire change to the voluntary disclosure level, and firms under scrutiny may change their overall disclosure as well. They may reduce their general information disclosure to avoid scrutiny costs, or

increase other related information to signal their innocence.

3.4 Research Design

3.4.1 Data and Sample Selection

The sample starts with all Chinese listed firms covered by the China Stock Market and Accounting Research Database (CSMAR) from 2013 to 2016.[25] In order to test the effect on subsidy disclosure, I keep only those observations for which subsidies were received over the four-year sample period, and I manually collect detailed subsidy disclosure information from annual reports. Other variables related to firm financial performance, corporate governance, analyst following, stock market performance, etc. are obtained from CSMAR. To rule out the possible impact of state-owned enterprise (SOE) revolution happening during the period, I keep only those firms that do not experience changes of controlling ownership. I also drop observations with missing values of any variable used in the model and require the sample to be completely balanced over the years. The final sample contains 6,784 firm-year observations, which represent 1,696 unique firms over four years.

3.4.2 Model Specification

I use a DID research design to test the effect of socio-political scrutiny on firms' subsidy disclosure:

$$Disclosure_{i;t} = \ _{i;t} + \ Treat \ \ Post_{i;t} + \ \Sigma Controls_{i;t} + FirmFE + YearFE + \ _{i;t} \tag{3.1}$$

[25] I choose this sample period to keep the subsidy disclosure requirement strictly consistent. Although the *Explanatory Announcement about Information Disclosure* in 2013 and the *Accounting Principle No.16* in 2017 do not have much direct impact on the dependent variable(s), they could change the incentives for rm disclosure.

where i indexes the firm and t the year. The variable of interest, $Treat \times Post$, reflects the treatment effect on the treated group. The treatment group, for which $Treat$ equals 1, includes firms that are defined as zombie firms one year before the shock (i.e., in 2014). Zombie firms ($ZombieSI$) are defined as those whose earnings before non-recurring items are negative for three consecutive years. $Post$ is a dummy equal to 1 for years after the shock (i.e., 2015 and 2016), and 0 before the shock (i.e., 2013 and 2014). I include firm and year fixed effects in the model to control for time-invariant firm characteristics and year-specific factors, and therefore neither $Treat$ nor $Post$ needs to be included. The standard errors are clustered by firm to correct for heteroscedasticity.

The dependent variable, $Disclosure$, is the average disclosure score of three components: $Source$, $Policy$, and $Project$. Using the disclosure in the annual reports, I first calculate (i) the percentage of subsidies for which the source is disclosed ($SourceSub$), (ii) the percentage of subsidies for which the policy basis is disclosed ($PolicySub$), and (iii) the percentage of subsidies for which the project name is disclosed ($ProjectSub$).[26] Following Li *et al.* (2021a), I then sort $SourceSub$, $PolicySub$, and $ProjectSub$ into five quintiles and code the value 0.2 for the lowest quintile and 1 for the highest. For more than 20% of the observations, $SourceSub$ and $PolicySub$ are concentrated at 0, so I code 0 as the lowest quintile, equally split the remaining observations into quartiles, and code the first (second, third, fourth) quartile as the second (third, fourth, fifth) quintile of the full sample. As for $ProjectSub$, more than 20% of observations take the value 1, so I code 1 as the highest quintile and equally split the remaining observations into quartiles.

I further control for a series of factors related to corporate disclosure, fol-

[26] I follow Li *et al.* (2021a) to calculate the first two components. For the third, since there is not full disclosure of the subsidy projects on the government's website, I treat the project name as "undisclosed" if the firm only uses the name "subsidy", "grants", or "other subsidy", etc., to diminish possible measurement error.

lowing prior literature (e.g., Ellis *et al.*, 2012; Li *et al.*, 2021a,b). The control variables include firm size (*Size*), leverage ratio (*Leverage*), number of employees (*Employee*), market-to-book ratio (*MTB*), return on assets (*ROA*), an operating loss dummy (*OPLoss*), export-to-sales ratio (*ForeignSales*), number of analysts following (*AnalystFollowing*), institutional shareholding (*Institution*), annual stock return (*Return*), return volatility over the previous three years (*Return*), financing demand (*FinancingDemand*), seasoned equity offering in the subsequent year (*SEO*), industry Hirschman-Herfindahl Index (*HHI*), and the industry-level abnormal profit persistence (*AbProfitPersistent*). Finally, I also control for the amount of subsidy (*LnSub*), since the subsidy disclosure increases with the subsidy amount (Li *et al.*, 2021a). Appendix 3A provides detailed variable definitions.

3.5 Empirical Results

3.5.1 Summary Statistics

Table 3.1 presents the zombie distribution over the sample period and industry. Overall, zombie firms account for about 8% of all listed firms, and there is no great variation among the years of the period. The zombie proportion is similar to that in prior literature analyzing zombie phenomena among listed firms in China and other countries. The agricultural industry and the manufacturing industry are the two main industries in which zombies operate, with 13% and 10% zombie firms respectively. Untabulated results indicate that the zombies are mainly concentrated in the farm product processing, textile, paper-making, metals, equipment manufacturing, and water transportation industries. These industries used to be heavily subsidized due to their important position in the emerging economy. Following prior literature, I do not include financial industries in the sample due to their different operating pattern.

Table 3.1: Sample Distribution

Panel A: Zombie distribution over the sample period						
Year	N	Mean	S.D.	Min	Median	Max
2013	1,696	0.060	0.237	0.000	0.000	1.000
2014	1,696	0.083	0.276	0.000	0.000	1.000
2015	1,696	0.090	0.287	0.000	0.000	1.000
2016	1,696	0.090	0.286	0.000	0.000	1.000
Total	6,784	0.081	0.272	0.000	0.000	1.000
Panel B: Pre-Shock (2014) zombie distribution by industry						
Industry (CSRC 2012)	N	Mean	S.D.	Min	Median	Max
A (Agriculture)	122	0.131	0.339	0.000	0.000	1.000
B (Mining)	185	0.032	0.178	0.000	0.000	1.000
C (Manufacturing)	4,500	0.100	0.300	0.000	0.000	1.000
D (Production and Supply of Electric Power, Thermal Power, Gas and Water)	264	0.053	0.225	0.000	0.000	1.000
E (Construction)	214	0.037	0.190	0.000	0.000	1.000
F (Wholesale and Retail Trade)	387	0.070	0.255	0.000	0.000	1.000
G (Transportation, Warehousing and Post)	224	0.054	0.226	0.000	0.000	1.000
H (Hotels and Catering Industry)	16	0.000	0.000	0.000	0.000	1.000
I (Information Transmission, Software and IT Services)	331	0.051	0.221	0.000	0.000	1.000
K (Real Estate)	227	0.053	0.224	0.000	0.000	1.000
L (Leasing and Business Service)	68	0.015	0.121	0.000	0.000	1.000
M (Scientific Research and Technological Service)	28	0.000	0.000	0.000	0.000	1.000
N (Water Conservancy, Environment and Public Facilities Management)	70	0.000	0.000	0.000	0.000	1.000
P (Education)	4	0.000	0.000	0.000	0.000	1.000
Q (Sanitation and Social Work)	13	0.000	0.000	0.000	0.000	1.000
R (Culture, Sports and Entertainment)	70	0.000	0.000	0.000	0.000	1.000
S (Conglomerates)	61	0.033	0.180	0.000	0.000	1.000
Total	6,784	0.083	0.276	0.000	0.000	1.000

This table presents the zombie firm distribution among years and industries. Zombie firms are defined as firms whose earnings before non-recurring items is less than interest expenses in three consecutive years.

Table 3.2 provides the descriptive statistics of the variables used in the main regression. All continuous variables are winsorized at the 1^{st} and 99^{th} percentiles to alleviate the potential impact of outliers. The average disclosure score is 0.523, implying a relatively balanced distribution of the disclosure measurement. An average firm discloses 35.5% of the sources, 15.0% of the policy bases, and 81.0% of the project names of the subsidies received. The adjusted scores of the components (*Source*, *Policy* and *Project*) have a more balanced distribution, with mean values of 0.558, 0.345, and 0.666, respectively. In the main regression analysis, 8% of listed firms are zombies. The average zombie firm proportion differs depending on the definition,[27] but all of them are within a feasible range.

[27] Appendix 3.6 provide detailed definitions for the zombie definitions.

Table 3.2: Descriptive Statistics

Variable Name	N	Mean	S.D.	Min	Median	Max
Panel A: Dependent Variables						
Disclosure	6,784	0.523	0.206	0.200	0.467	1.000
Source	6,784	0.558	0.294	0.200	0.600	1.000
Policy	6,784	0.345	0.257	0.200	0.200	1.000
Project	6,784	0.666	0.298	0.200	0.600	1.000
SourceSub	6,784	0.355	0.390	0.000	0.159	1.000
PolicySub	6,784	0.150	0.300	0.000	0.000	1.000
ProjectSub	6,784	0.810	0.293	0.000	0.971	1.000
Panel B: Independent Variables						
ZombieSI	6,784	0.081	0.272	0.000	0.000	1.000
ZombieSISUB	6,784	0.085	0.279	0.000	0.000	1.000
ZombieFN	6,784	0.120	0.325	0.000	0.000	1.000
Panel C: Control Variables						
Size	6,784	22.334	1.254	20.089	22.139	26.059
Leverage	6,784	0.445	0.209	0.055	0.435	0.892
Employee	6,784	7.892	1.213	5.187	7.815	11.228
MTB	6,784	3.844	3.005	0.605	2.960	18.695
ROA	6,784	0.036	0.048	-0.143	0.031	0.180
OPLoss	6,784	0.157	0.364	0.000	0.000	1.000
ForeignSales	6,784	0.183	0.315	0.000	0.015	1.509
AnalystFollowing	6,784	2.398	1.213	0.000	2.565	4.369
Institution	6,784	45.906	23.793	0.435	48.893	90.679
Return	6,784	0.388	0.751	-0.544	0.140	3.276
Return	6,784	0.724	0.512	0.062	0.623	3.112
FinancingDemand	6,784	0.204	2.064	-8.857	-0.012	10.345
SEO	6,784	0.184	0.388	0.000	0.000	1.000
HHI	6,784	0.100	0.100	0.017	0.066	0.611
AbProfitPersistent	6,784	0.573	0.368	0.013	0.718	1.130
SOE	6,784	0.436	0.496	0.000	0.000	1.000
LnSub	6,784	16.490	1.652	11.798	16.494	20.620

This table presents the summary statistics of the variables used in the main regression. Appendix 3A provides detailed definitions of the variables.

3.5.2 Baseline Results

Table 3.3 presents the results of the hypothesis H1 based on Equation 3.1, where all columns include firm and year fixed effects. Column (1) displays the results for the overall disclosure score, showing that the coefficient estimate of *Treat* *Post* is significant at the 1% level. The coefficient (-0.047) suggests that zombie firms' subsidy disclosure decreases by 21.8% (8.6%) of the standard deviation (mean) of overall subsidy disclosure. The results show that the regulatory shock in 2015 reduces firm disclosure of subsidy information, suggesting firms have incentives to hide subsidy information when facing higher socio-political scrutiny.

In order to understand which part of disclosure is affected, I then regress each individual disclosure component on the right-hand variables, and present the results in Columns (2), (3), and (4). All three components (*Source*, *Policy*, and *Project*) significantly decrease after the shock, by 0.055, 0.034, and 0.046 respectively. The results are economically significant as well. The decrease in *Source* (*Policy*, *Project*) accounts for 19.4% (14.0%, 16.4%) of the standard deviation (=-0.057/0.294, =-0.036/0.257, =-0.049/0.298).

With firm and year fixed effects in the model, most control variables are insignificant, which is consistent with prior studies (e.g., Li *et al.*, 2021a,b), and the table only shows the R-squared within the model. Leverage (*Leverage*) and the market-to-book ratio (*MTB*) have positive effects on subsidy information disclosure, while institutional shareholding (*Institution*) and stock return volatility (*Return*) have negative impacts. What worth mentioning is that the amount of the subsidies has a positive and significant effect on subsidy disclosure, which indicates that firms' dependence on subsidies has an effect on disclosure behavior.[28]

[28] The result for cross-sectional test on subsidy dependence is shown in Section 3.5.4.

Table 3.3: Main Regression Results

Dependent	*Disclosure*	*Source*	*Policy*	*Project*
	(1)	(2)	(3)	(4)
Treat Post	-0.047***	-0.057**	-0.036*	-0.049**
	[0.015]	[0.022]	[0.020]	[0.023]
Size	-0.010	0.015	-0.013	-0.037**
	[0.012]	[0.019]	[0.014]	[0.018]
Leverage	0.074**	0.05	0.074	0.093*
	[0.037]	[0.056]	[0.046]	[0.053]
Employee	-0.003	0.006	-0.003	-0.012
	[0.010]	[0.015]	[0.012]	[0.016]
MTB	0.005***	0.011***	0.001	0.004*
	[0.002]	[0.003]	[0.002]	[0.002]
ROA	0.049	0.017	0.061	0.069
	[0.084]	[0.131]	[0.110]	[0.115]
OPLoss	0.000	0.004	0.015	0.005
	[0.009]	[0.015]	[0.012]	[0.013]
ForeignSales	0.020	0.040	0.015	0.005
	[0.016]	[0.025]	[0.020]	[0.021]
AnalystFollowing	0.008	0.013*	0.002	0.010
	[0.005]	[0.008]	[0.007]	[0.008]
Institution	-0.001***	-0.001**	0.000	-0.001***
	[0.000]	[0.001]	[0.000]	[0.000]
Return	-0.003	-0.001	-0.011**	0.003
	[0.004]	[0.007]	[0.006]	[0.006]
Return	-0.008	-0.024**	0.001	-0.002
	[0.007]	[0.011]	[0.009]	[0.011]
FinancingDemand	0.001	0.002	0.000	-0.001
	[0.001]	[0.002]	[0.001]	[0.002]
SEO	-0.012**	-0.015	-0.005	-0.016**
	[0.006]	[0.009]	[0.008]	[0.008]
HHI	-0.083	-0.097	-0.081	-0.071
	[0.081]	[0.125]	[0.098]	[0.109]
AbProfitPersistent	0.038	0.038	0.020	0.056
	[0.033]	[0.046]	[0.039]	[0.046]
LnSub	0.010***	0.014***	0.010***	0.004
	[0.003]	[0.006]	[0.004]	[0.005]
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
R^2 within model	0.021	0.025	0.026	0,021
No. of Observations	6,784	6,784	6,784	6,784

This table presents the baseline results for the effect of socio-political scrutiny on subsidy information disclosure. *Disclosure* is defined as the average score across three subsidy disclosure measures: *Source*, *Policy*, and *Project*, which represent the scores of the percentage of subsidies for which the source, policy basis, and project name are disclosed, respectively. *Treat Post* is the treatment effect on the treated group (i.e., firms classified as zombie firms in 2014). The robust standard errors are clustered by firm to correct for heteroscedasticity and reported in brackets. *, ** and *** indicate significance at 10%, 5% and 1% levels, respectively.

3.5.3 Robustness Checks

A. Parallel Trend Analysis

The DID methodology relies on the parallel trend assumption regarding the treated and control groups, and therefore I further examine the dynamic effect on subsidy disclosure following the method of Bertrand & Mullainathan (2003). Specifically, I set 2013 as the benchmark year, 2014 as $Year^{-1}$, 2015 as $Year^{0}$, and 2016 as $Year^{+1}$, and regress these variables on the disclosure variables using the following model:

$$Disclosure_{i,t} = {}_{i,t} + \Sigma Treat \quad Year^{j}_{i,t} + \Sigma Controls_{i,t} + FirmFE + YearFE + {}_{i,t} \tag{3.2}$$

where j indexes the year -1, year 0, and year 1. The coefficient estimates of $Treat \quad Year^{-1}$, $Treat \quad Year^{0}$, and $Treat \quad Year^{+1}$ show the treatment effects on the treated firms, before and after the shock. Table 3.4 presents the results of the parallel trend analysis. Column (1) shows that there is no significant change before the regulatory shock, since the coefficient estimate of $Treat \quad Year^{-1}$ is not significant. The significantly negative coefficients of $Treat \quad Year^{0}$ and $Treat \quad Year^{+1}$ show that firms decrease their subsidy information disclosure from 2015, and there is no significant difference between $Treat \quad Year^{0}$ and $Treat \quad Year^{+1}$, thus proving the parallel trend assumption. This pattern indicates that the results are not driven by reverse causality.[29]

[29] I further test the trend for individual disclosure components. The source of the subsidies received (*Source*) shows the same pattern as the overall disclosure score, implying that the e ect is persistent after the regulation is introduced.

Table 3.4: Parallel Trend Analysis

Dependent	*Disclosure*	*Source*	*Policy*	*Project*
	(1)	(2)	(3)	(4)
Treat *Year* $^{-1}$	-0.019	-0.028	-0.025	-0.004
	[0.020]	[0.028]	[0.029]	[0.023]
Treat *Year*^{0}	-0.060**	-0.081**	-0.064**	-0.035
	[0.022]	[0.032]	[0.029]	[0.028]
Treat *Year*$^{+1}$	-0.054**	-0.061*	-0.032	-0.069**
	[0.024]	[0.033]	[0.032]	[0.031]
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
R^2 within model	0.021	0.025	0.027	0.021
No. of Observations	6,784	6,784	6,784	6,784

This table presents results for the parallel trend analysis. *Disclosure* is defined as the average score across three subsidy disclosure measures: *Source*, *Policy*, and *Project*. *Source*, *Policy*, and *Project* represent the scores of the percentage of subsidies for which the source, policy basis, and project name are disclosed, respectively. *Treat* *Year* $^{-1}$, *Treat* *Year*^{0}, and *Treat* *Year*$^{+1}$ are the treatment effect on the treated group (i.e., firms classified as zombie firms in 2014) in 2014, 2015 and 2016. The robust standard errors are clustered by firm to correct for heteroscedasticity and reported in brackets. *, ** and *** indicate significance at 10%, 5% and 1% levels, respectively.

B. Placebo tests

In order to rule out the possibility that the effect is due to unobserved shocks, I conduct placebo test using randomly assigned pseudo-treated and pseudo-control groups. I randomly assign 141 firms, in accordance with the actual number of treated firms, into the treatment group and regress using Equation 3.1 to get the t-value of the coefficient estimates on $Treat \quad Post$. I repeat this process 1,000 times, and Figure 3.2 presents the density of the 1,000 t-values. The distribution suggests that random assignment of the treatment and control groups, on average, does not present significant results, which rules out the potential effect of unobserved confounding shocks.

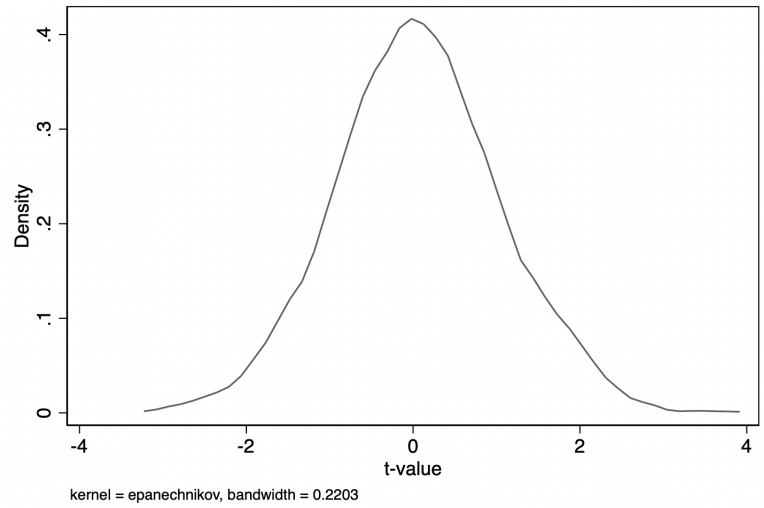

Figure 3.2: The Kernel Density Estimate

This figure shows results of the placebo test. I randomly sample 141 firms, in accordance with the actual number of treatment firms, into the treatment group and regress with Equation 3.1 to get the t-value of the coefficient estimates on $Treat \quad Post$. I repeat this process for 1,000 times, and this figure presents the density of the 1,000 t-values.

C. Alternative Measures

In order to test whether the results are dominated by measurement error in the disclosure score, I first regress the original percentages of subsidies for which the source, policy basis, and project name are disclosed (*SourceSub*, *PolicySub*, and *ProjectSub*, respectively) on the right-hand variables. Panel A of Table 3.5 presents the results. The effects on *SourceSub* and *ProjectSub* are negative and significant at the 1% level (-0.083 and -0.057, respectively), whereas the negative effect on *PolicySub* is no longer significant. The result implies that firms may not emphasize policy basis disclosure to the same extent as disclosure of source and project name.[30]

I then test whether different zombie firm definitions have any effect on the findings. The first, *ZombieSISUB*, defines zombies as firms whose earnings before non-recurring items and recurring subsidies are negative for three consecutive years, and the second, *ZombieFN*, uses the method of Fukuda & Nakamura (2011) as an adjustment to the Caballero *et al.* (2008) definition.[31] As is shown in Panel B of Table 3.5, the results remain significantly negative under the two alternative zombie definitions.

[30] The insignificant result for *PolicySub* may also be driven by the distribution pattern, since the template provided by CSRC does not include columns for policy basis.

[31] Caballero *et al.* (2008) defines zombies as firms receiving subsidized credit (i.e., whose actual interest payments are lower than the theoretically lowest interest payment). However, this method can cause a misclassification of zombie firms: high-quality firms for whom banks are willing to provide low-cost loans would be classified as zombies, while firms with heavy financial burdens and high costs of debt would not be classified as zombies. Thus, Fukuda & Nakamura (2011) adds more criteria to this definition: (1) firms whose EBIT is positive are not defined as zombies and (2) firms with negative EBIT, high leverage ratio, and higher-than-last-year debt are defined as zombies. I use earnings before interest, tax, and subsidies as a replacement for EBIT, to rule out the effect of subsidies.

Table 3.5: Robustness Checks: Alternative Measures

Panel A: The effect on *SourceSub*, *PolicySub*, and *ProjectSub*			
Dependent	*SourceSub*	*PolicySub*	*ProjectSub*
	(1)	(2)	(3)
Treat *Post*	-0.083***	-0.034	-0.057***
	[0.028]	[0.025]	[0.022]
Controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
R^2 within model	0.025	0.027	0.015
No. of Observations	6,784	6,784	6,784
Panel B: Alternative zombie measures			
Dependent		*Disclosure*	*Disclosure*
		(1)	(2)
Treat *Post*, where *Treat*=*ZombieSISUB*		-0.042***	
		[0.015]	
Treat *Post*, where *Treat*=*ZombieFN*			-0.034**
			[0.015]
Controls		Yes	Yes
Year FE		Yes	Yes
Firm FE		Yes	Yes
R^2 within model		0.020	0.020
No. of Observations		6,784	6,784

This table presents the results for the robustness checks for alternative measures. *Disclosure* is defined as the average score across three subsidy disclosure measures: *Source*, *Policy*, and *Project*. *SourceSub*, *PolicySub*, and *ProjectSub* represent the percentage of subsidies for which the source, policy basis, and project name are disclosed, respectively. *Treat* *Post* is the treatment effect on the treated group (i.e., firms classified as zombie firms in 2014). The robust standard errors are clustered by firm to correct for heteroscedasticity and reported in brackets. *, ** and *** indicate significance at 10%, 5% and 1% levels, respectively.

D. Entropy-balancing Method

In order to alleviate the concern that systematic differences in the characteristics of the treatment and control group may drive the results, I then use entropy-balancing methods. Compared with propensity score matching, entropy-balancing weights the sample observations to achieve covariate balance (e.g., Huang, 2022). Panels A and B of Table 3.6 present the difference between the treatment and control groups before and after matching. Before the entropy-balancing matching, the control variables are significantly different between the treatment and control groups while, after matching, the two groups are more comparable. Panel C of Table 3.6 presents the regression results using the entropy matching method. The overall disclosure score (*Disclosure*) decreases for zombie firms after the regulatory shock, and the coefficient is significant.

Table 3.6: Robustness Checks: Entropy Balancing

Panel A: Before Entropy-Balancing

	Treatment Group			Control Group		
	Mean	Variance	Skewness	Mean	Variance	Skewness
Size	22.260	1.702	0.559	22.340	1.562	0.717
Leverage	0.596	0.047	-0.524	0.431	0.041	0.137
Employee	7.915	1.256	0.334	7.890	1.491	0.355
MTB	5.002	21.490	1.786	3.739	7.773	2.296
ROA	-0.014	0.003	-0.768	0.041	0.002	-0.012
OPLoss	0.688	0.215	-0.811	0.109	0.097	2.509
ForeignSales	0.193	0.079	2.140	0.182	0.101	2.268
AnalystFollowing	1.248	1.089	0.262	2.503	1.375	-0.576
Institution	45.590	425.800	-0.039	45.930	578.900	-0.289
Return	0.394	0.671	1.461	0.387	0.554	1.520
Return	0.780	0.286	1.301	0.717	0.260	1.977
FinancingDemand	0.252	3.535	1.656	0.200	4.324	0.961
SEO	0.193	0.156	1.554	0.183	0.150	1.637
HHI	0.094	0.008	2.881	0.100	0.010	2.769
AbProfitPersistenct	0.593	0.142	-0.388	0.571	0.135	-0.362
LnSub	16.730	2.931	-0.359	16.470	2.706	-0.088

Panel B: After Entropy-Balancing

	Treatment Group			Control Group		
	Mean	Variance	Skewness	Mean	Variance	Skewness
Size	22.260	1.702	0.559	22.260	1.551	0.505
Leverage	0.596	0.047	-0.524	0.596	0.036	-0.594
Employee	7.915	1.256	0.334	7.915	1.462	0.278
MTB	5.002	21.490	1.786	5.002	20.410	1.618
ROA	-0.014	0.003	-0.768	0.014	0.003	-0.631
OPLoss	0.688	0.215	-0.811	0.688	0.215	-0.811
ForeignSales	0.193	0.079	2.140	0.193	0.107	2.239
AnalystFollowing	1.248	1.089	0.262	1.248	1.390	-0.617
Institution	45.590	425.800	-0.039	45.590	411.000	-0.325
Return	0.394	0.671	1.461	0.394	0.660	1.533
Return	0.780	0.286	1.301	0.780	0.264	1.524
FinancingDemand	0.252	3.535	1.656	0.252	3.205	2.634
SEO	0.193	0.156	1.554	0.193	0.156	1.554
HHI	0.094	0.008	2.881	0.094	0.008	2.616
AbProfitPersistenct	0.593	0.142	-0.388	0.593	0.131	-0.482
LnSub	16.730	2.931	-0.359	16.730	3.192	-0.320

Panel C: Regression Results

Dependent	*Disclosure*
Treat Post	-0.046**
	[0.023]
Controls	Yes
Year FE	Yes
Firm FE	Yes
Adjusted R^2	0.491
No. of Observations	6,784

This table presents the results for entropy balancing methodology. Panel A and B display the difference between control variables before and after entropy-balancing method, and Panel C presents the regression results with the weighting. The robust standard errors are clustered by firm to correct for heteroscedasticity and reported in brackets. *, ** and *** indicate significance at 10%, 5% and 1% levels, respectively.

3.5.4 Cross-sectional Tests

A. The Effect of Public Attention

I first use two proxies for public attention to test H2. First, financial analysts play an important role in the use and decoding of financial reports, and they can acquire more details through conference calls or corporate visits, so analyst following can reflect the extent to which firms attract attention. I include a dummy variable, $HighAnalystFollow$ as a proxy for whether a firm receives greater (i.e., above industry-year median) coverage from analysts, and its interaction term with $Treat \quad Post$ in the model. Next, when the media speaks more negatively about a firm, it will have a stronger incentive to decrease unnecessary disclosure, so I include $NegMediaReport$, a dummy equal to one if the firm receives above-median negative media coverage in the previous year. If my prediction is correct, I should find a significant coefficient for both $Treat \quad Post \quad HighAnalystFollow$ and $Treat \quad Post \quad NegMediaReport$.

The results are presented in Table 3.7. The coefficient of $Treat \quad Post \quad HighAnalystFollow$ in Column (1) is negative and significant (-0.071), and Column (2) of Table 3.7 also shows a negative interaction term (-0.067) which is significant at the 10% level, proving that, when firms receive more attention from analysts or a greater amount of negative media coverage, they disclose less detail about the subsidies they receive.

Table 3.7: The Effect of Public Attention

Dependent	*Disclosure*	
	(1)	(2)
Treat *Post*	-0.033*	-0.032*
	[0.017]	[0.019]
Treat *Post* *HighAnalystFollow*	-0.071*	
	[0.040]	
Treat *Post* *NegMediaReport*		-0.067*
		[0.040]
Controls	Yes	Yes
Year FE	Yes	Yes
Firm FE	Yes	Yes
R^2 within model	0.022	0.022
No. of Observations	6,784	6,784

This table presents the results for the effect of public attention on the scrutiny-disclosure relation (H2). *Disclosure* is defined as the average score across three subsidy disclosure measures: *Source*, *Policy*, and *Project*. *Treat* *Post* is the treatment effect on the treated group (i.e., firms classified as zombie firms in 2014). *HighAnalystFollow* and *NegMediaReport* represent whether the firm attracts relatively more analyst following and negative media coverage in their industry-year group. The robust standard errors are clustered by firm to correct for heteroscedasticity and reported in brackets. *, ** and *** indicate significance at 10%, 5% and 1% levels, respectively.

B. The Effect of Subsidy Dependence

As for H3, I first calculate the ratio of subsidies to operating revenue, with a higher ratio indicating that the subsidies are more material, and that the firm relies more heavily on them. I then include a dummy variable, *HighSubsidy*, which equals 1 if the subsidy-to-revenue ratio is above the industry-year median and 0 otherwise, and its interaction term with *Treat* *Post*, in the model. If my prediction is correct, I should find a significant coefficient for *Treat* *Post* *HighSubsidy*.

Table 3.8 shows the results of testing H3. The significantly negative coefficient of *Treat* *Post* *HighSubsidy* (coeff. = -0.058) indicates that the reduction of subsidy disclosure is stronger for firms relying more on subsidies. This suggests that firms for whom the subsidies are more material are more likely to receive criticism and have stronger incentives to hide the details of their subsidies when they face higher socio-political scrutiny.

Table 3.8: The Effect of Firm Dependence on Subsidies

Dependent	*Disclosure*
Treat *Post*	-0.013
	[0.023]
Treat *Post* *HighSubsidy*	-0.058*
	[0.031]
Controls	Yes
Year FE	Yes
Firm FE	Yes
R^2 within model	0.021
No. of Observations	6,784

This table presents the results for the effect of firm dependence on subsidies on the scrutiny-disclosure relation (H3). *Disclosure* is defined as the average score across three subsidy disclosure measures: *Source*, *Policy*, and *Project*. *Source*, *Policy*, and *Project* represents the scores of the percentage of subsidies for which the source, policy basis, and project name are disclosed, respectively. *Treat* *Post* is the treatment effect on the treated group (i.e., firms classified as zombie firms in 2014). The robust standard errors are clustered by firm to correct for heteroscedasticity and reported in brackets. *, ** and *** indicate significance at 10%, 5% and 1% levels, respectively.

C. The Effect of Political Connection

To test H4, I use a dummy variable, $PCNow$, to reflect whether at least one of the directors and managers is working in a government institution in the focal year. This variable is a proxy for a strong political connection and a stronger incentive to hide detailed subsidy information when the firm faces socio-political scrutiny. If my prediction is correct, the coefficient estimate of the interaction term, $Treat \quad Post \quad PCNow$, should be significant in the same direction as $Treat \quad Post$.

Table 3.9 presents the results of testing H4. The coefficient of $Treat$ $Post \quad PCNow$ is negative and significant at the 5% level, indicating that firms with current political connections disclose less information about subsidies, and the reduced disclosure protects the politicians through which the firms acquire subsidies.

Table 3.9: The Effect of Political Connection

Dependent	*Disclosure*
Treat × *Post*	-0.037**
	[0.017]
Treat × *Post* × *PCNow*	-0.104**
	[0.042]
Controls	Yes
Year FE	Yes
Firm FE	Yes
R^2 within model	0.022
No. of Observations	6,784

This table presents the results for the effect of political connection on the scrutiny-disclosure relation (H4). *Disclosure* is defined as the average score across three subsidy disclosure measures: *Source*, *Policy*, and *Project*. *Treat* × *Post* is the treatment effect on the treated group (i.e., firms classified as zombie firms in 2014). *PCNow* is a dummy variables proxy for whether one or more managers/directors work in government institutions. The robust standard errors are clustered by firm to correct for heteroscedasticity and reported in brackets. *, ** and *** indicate significance at 10%, 5% and 1% levels, respectively.

3.5.5 Further Tests

A. The Effect on Subsidy Amount

As discussed in Section 3.3, the effect might be driven by a change in the subsidy amount. If politicians are under the pressure of scrutiny, they may provide fewer subsidies. Therefore, in order to understand whether the effect on subsidy disclosure is driven by the effect on the subsidy amount, I follow Li *et al.* (2021a) and regress the amount of the subsidies received (*LnSub*) on all other right-hand variables in the main regression model. Panel A of Table 3.10 shows that the coefficient of *Treat* *Post* is not significant, implying that the regulatory shock in 2015 does not have an effect on the amount of the subsidies received, and that the change in the disclosure score is not caused by the change in the amount of the subsidies received.

B. The Effect on General Disclosure

I next address the concern that my finding might be caused by an overall reduction in general information disclosure, and regress a proxy for general disclosure on the right-hand variables in Equation 3.1. Following Li *et al.* (2021a) and Huang (2022), I use the natural logarithm of one plus the frequency of management earnings forecasts (*LnFreq*) as a proxy for general information disclosure. The results reported in Panel B of Table 3.10 indicate that the increased socio-political scrutiny does not have a significant impact on the disclosure of general information. Thus, it is unlikely that the results in Table 3.3 are due to lower disclosure incentives in general.

Table 3.10: The Effect on Subsidy Amount and General Information Disclosure

Panel A: The effect on subsidy amount	
Dependent	*LnSub*
Treat *Post*	-0.109
	[0.089]
Controls	Yes
Year FE	Yes
Firm FE	Yes
R^2 within model	0.160
No. of Observations	6,784
Panel B: The effect on general information disclosure	
Dependent	*LnFreq*
Treat *Post*	0.044
	[0.031]
Controls	Yes
Year FE	Yes
Firm FE	Yes
R^2 within model	0.021
No. of Observations	6,784

This table presents the results for the effect of socio-political scrutiny on subsidy amount and general information disclosure. *LnSub* is the natural logarithm of one plus the amount of subsidies received. *LnFreq* is the natural logarithm of one plus the frequency of management earnings forecast, representing the general information disclosure in the fiscal year. *Treat* *Post* is the treatment effect on the treated group (i.e., firms classified as zombie firms in 2014). The robust standard errors are clustered by firm to correct for heteroscedasticity and reported in brackets. *, ** and *** indicate significance at 10%, 5% and 1% levels, respectively.

3.6 Conclusion

This paper examines the effect of socio-political scrutiny on firms' subsidy information disclosure using a sample of Chinese listed firms. Using a regulatory shock in 2015, which increases socio-political scrutiny of zombie firms, I hypothesize that, when firms are under higher scrutiny, their disclosure incentives change and they reconsider the related costs and benefits. Empirical results show that socio-political scrutiny decreases voluntary disclosure of firms' subsidies, suggesting an increase in disclosure costs that outweighs the benefits, and the results are robust to a series of sensitivity tests. Cross-sectional tests show that the negative effect of socio-political scrutiny is stronger for firms that are more likely to attract public attention, firms that rely more on subsidies, and firms with political connections, indicating that firms have incentives to reduce their disclosure to protect politicians and their own reputations. Further tests suggest that this finding is not driven by the effect on the subsidy amount, and there is no significant change in the overall disclosure of general information.

Overall, this paper makes contributions to the literature on government subsidy disclosure, the effect of socio-political scrutiny, and the disclosure incentives of zombie firms. It also provides insights for practitioners with respect to the potential impact of scrutiny on firms' disclosure incentives, and for policy makers with respect to improving the subsidy disclosure requirement.

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Appendix 3A: Variable Definitions

Variable Name	Definition
Panel A: Dependent Variables	
$Disclosure_{i;t}$	The average score of three subsidy disclosure measures: *Source*, *Policy*, and *Project*.
$Source_{i;t}$	The adjusted disclosure score of the source of subsidy.
$Policy_{i;t}$	The adjusted disclosure score of the policy basis of subsidy.
$Project_{i;t}$	The adjusted disclosure score of the project name of subsidy.
$SourceSub_{i;t}$	The percentage of subsidies for which the source is disclosed.
$PolicySub_{i;t}$	The percentage of subsidies for which the policy basis is disclosed.
$ProjectSub_{i;t}$	The percentage of subsidies for which the project name is disclosed.
Panel B: Independent Variables	
Treat	A dummy variable equal to 1 if the firm is defined as a zombie firm in the year before the shock, and 0 otherwise.
Post	A dummy variable equal to 1 for years after the shock (i.e., 2015 and 2016), and 0 before the shock (i.e., 2013 and 2014).
$ZombieSI_{i;t}$	A dummy variable equal to 1 if the profit before non-recurring items is negative for 3 consecutive years (year *t*, year *t-1*, year *t-2*), and 0 otherwise.
$ZombieSISUB_{i;t}$	A dummy variable equal to 1 if the profit before non-recurring items and recurring subsidies is negative for 3 consecutive years (year *t*, year *t-1*, year *t-2*), and 0 otherwise.
$ZombieFN_{i;t}$	A dummy variable equal to 1 if the interest expense is lower than the hypothetical risk-free interest payments, and the zombie status is further modified based on two more criteria (Fukuda & Nakamura, 2011): 1) the firm is not defined as a zombie if the earnings before interest, tax, and subsidies are positive; and 2) the firm is defined as a zombie if the earnings before interest, tax and subsidies is negative, the leverage ratio is more than 50%, and the total liabilities increase in year *t*; and 0 otherwise.
Panel C: Control Variables	
$Size_{i;t}$	The natural logarithm of total assets in year *t*.
$Leverage_{i;t}$	Total liabilities over total assets in year *t*.
$Employee_{i;t}$	The natural logarithm of the number of employees in year *t*.
$MTB_{i;t}$	The market-to-book ratio in year *t*.
$ROA_{i;t}$	Operating profits over total assets in year *t*.
$OPLoss_{i;t}$	A dummy variable equal to 1 if the firm has a negative operating profit in year *t*, and 0 otherwise.
$ForeignSales_{i;t}$	Foreign revenue over total operating revenue.

$AnalystFollowing_{i;t}$	The natural logarithm of the number of analysts following firm i in year t.
$Institution_{i;t}$	The percentage of shareholding held by institutional investors.
$Return_{i;t}$	Buy-and-hold return over the 12 months prior to April 30, the deadline of annual report publication in China.
$Return_{i;t}$	The standard deviation of a firm's annual stock returns over a rolling 36-month window.
$FinancingDemand_{i;t}$	Investment expenditures in year t minus cash flows from operating activities in year t-1.
$SEO_{i;t}$	A dummy variable that equals one if the firm issues a seasoned equity offering in year t+1, and 0 otherwise.
$HHI_{i;t}$	The sum of squares of market shares (based on sales) in an industry based on 3-digit CSRC 2012 code.
$AbProfitPersistent_{i;t}$	The partial correlation coefficient resulting from a pooled time series regression of current abnormal profits on lagged abnormal profits in an industry based on 3-digit CSRC 2012 code, calculated following Ellis *et al.* (2012).
$SOE_{i;t}$	A dummy variable equal to 1 if the firm is a state-owned enterprise in year t.
$LnSub_{i;t}$	The natural logarithm of the amount of subsidies in year t
$LnFreq_{i;t}$	The natural logarithm of one plus the frequency of management earnings forecasts issued during a fiscal year t.
Panel D: Cross-sectional Variables	
$HighAnalystFollow_{i;t}$	A dummy variable equal to 1 if the firm has relatively higher analyst following in year t.
$NegMediaReport_{i;t}$	A dummy variable equal to 1 if the firm has relatively higher proportion of negative media reports in year t-1.
$HighSubsidy_{i;t}$	A dummy variable equal to 1 if the firm has relatively higher proportion of negative media reports in year t.
$PCNow_{i;t}$	A dummy variable equal to 1 if at least one of the firms' directors works in an government institution in year t.
$PCPast_{i;t}$	A dummy variable equal to 1 if at least one of the firms' directors works in an government institution before year t but not in year t.

Appendix 3B: Subsidy Disclosure Requirement in China

Dating back to 1984, the International Accounting Standards Committee issued the International Accounting Standard (IAS) 20, *Accounting for Government Grants and Disclosure of Government Assistance*, which defines government grants (also named as subsidies, subventions, or premiums) as a form of government assistance.[32] According to IAS 20, government assistance is defined as "action by government designed to provide an economic benefit specific to an entity or range of entities qualifying under certain criteria", and government grants are "assistance by government in the form of transfers of resources to an entity in return for past or future compliance with certain conditions relating to the operating activities of the entity". The IAS 20 also classifies grants into two categories: (1) grants related to assets, presented in the statement of financial position as liability, and (2) grants related to income, presented in the income statement as revenue. In the financial statements, IAS 20 requires mandatory disclosure of: (1) the accounting policy adopted, (2) the nature and extent recognised, as well as "an indication of other forms of government assistance from which the entity has directly benefited", and (3) unfulfilled conditions and other contingencies. Since the receipt of asset-related subsidies can cause "major movements" in the corporate cash flow, the IAS 20 also encourages disclosure of the amount of subsidies received as cash in the statement of cash flow.

Following IAS 20, China Accounting Standards Committee issued a consultation version of financial reporting principle for government assistance and government grants in 2002, which is basically a translation of IAS 20. Afterwards, the first official principle, *Chinese Accounting Principle No. 16: Government Subsidies*, was introduced and took effect in 2007.[33] The principle defines subsidies, provides criteria for classification, and explains the accounting treatment for subsidies received. According to the 2007 principle, asset-related subsidies shall be accounted in deferred income and amortized within the economic life of the related assets. Income-related subsidies shall either (1) be accounted as deferred income and transferred to income in the relative period, if the subsidies are provided to compensate future expenses or loss; or (2) be accounted as income immediately, if the subsidies are provided to compensate current expenses or loss. However, the classification criteria only gives a vague standard, since the only classification standard in the principle is whether the subsidies are related to assets or income. Theoretically, firms can only disclose two single items under non-operating income: subsidies related to assets and subsidies related to income, while in reality (i.e., according to what we can observe in the annual reports), most firms choose to provide a detailed table about the subsidy projects they are involved in. For financial reporting, it requires firms to disclose (1) the category and amount of subsidies, (2) the amount recognized as current profit or loss, and (3) the refund of subsidies and reasons.

In 2013, China Securities Regulatory Commission (CSRC) issued *Explanatory Announcement about Information Disclosure of Listed Firms No. 2: Disclosure of Information Related to Government Subsidies in Financial Statement Notes*, and provided a template for subsidy information disclosure.[34] The explanatory announcement suggests firms (1) to provide an project-by-project

[32] Please refer to IAS 20 on https://www.ifrs.org/issued-standards/list-of-standards/ias-20-accounting-for-government-grants-and-disclosure-of-government-assistance/#standard for more details.

[33] Please refer to https://www.casc.org.cn/2018/0815/202795.shtml for more information.

[34] Please refer to http://www.csrc.gov.cn/csrc/c101864/c1024626/content.shtml for more information.

detailed disclosure for each subsidy project they are involved in, and (2) to distinguish between recurring and non-recurring subsidies and to explain reasons for classification. Then in 2017, a new accounting principle about subsidy was issued, which provides a more detailed explanation about the accounting treatment.[35] The main change about reporting is an additional mandatory disclosure requirement about the accounts that subsidies are put into, since it starts to ask for judgement about whether subsidies in the income statement are related to operating activities or not. Subsidies related to operating activities are put into other operating income, while those not related to operating activities are still under non-operating income.

[35] Please refer to https://www.casc.org.cn/2018/0815/202796.shtml for more information.

Chapter 4

Black Sheep or Scapegoats: The Financing Effect of Zombie Firms in Business Groups

Abstract

This paper examines the effect of zombie firms on the cost of debt of other firms within the same business group. Using a large sample of European firms during 2004-2011, I find that the presence of zombie subsidiaries in business groups increases the cost of debt of non-zombies. The effect is more pronounced when the non-zombie firms have more pledgeable income, face less financial constraint, and have closer relationships with the zombies. Moreover, the effect is stronger for business groups with greater business complexity. My results are robust to a battery of sensitivity tests. Overall, this paper sheds light on a negative spill-over impact of zombie firms in the context of business groups.

Keywords: Zombie Firm, Business Group, Spillover Effect, Cost of Debt

4.1 Introduction

Zombie firms are those that consecutively have problems paying interest expenses with their earnings but keep renewing their loans and staying in the market (Caballero *et al.*, 2008). In recent years, zombie firms have aroused increasing attention from media and financial institutions worldwide. In 2020, Isabel Schnabel, a member of the Executive Board of the ECB (i.e., European Central Bank), claimed that zombie congestion had been rising in many European countries due to the expansionary monetary policy.[1] The ongoing Covid-19 issues are also pushing governments into providing more support for the market in the form of loan guarantees and moratoria, while such support is leading the governments into "bottlenecks in their insolvency regimes".[2]

In academia, this phenomenon was first analyzed in Japan. The substantial declines in stock and land markets in the early 1990s brought about serious problems in the fragile bank system there, and the leaving of these problems unsolved encouraged banks to evergreen their non-performing loans in order to avoid writing off these low-quality assets. A series of subsequent studies use the Japanese setting to analyze the consequences of zombie firms (e.g., Hoshi, 2006; Caballero *et al.*, 2008; Fukuda & Nakamura, 2011; Giannetti & Simonov, 2013). Since the 2008 global financial crisis, more studies have shifted their attention to OECD countries and Europe (e.g., Gopinath *et al.*, 2017; Adalet McGowan *et al.*, 2018; Gouveia & Osterhold, 2018; Acharya *et al.*, 2019), largely showing underperformance of zombie firms and negative spill-overs onto industry peers. For example, Caballero *et al.* (2008) find that zombie congestion decreases the

[1] For more details about the speech, please refer to: https://www.ecb.europa.eu/press/key/date/2020/html/ecb.sp200211_1~b439a2f4a0.en.html

[2] Despite some voices claiming that temporarily keeping zombie firms alive can maintain employment and allow the government to catch a breath, the opponents of zombie firms argue that keeping them alive can inhibit real economic growth and productivity gains. Some anecdotal evidence from online media can be accessed through https://www.ft.com/content/c843dd94-91f7-444d-a3c7-5e0d7dd160d5, https://www.ft.com/content/ac2828ad-7930-43ef-a227-1cbd8ff8c018, and https://www.ft.com/content/55d06941-52b2-37be-a8ff-174728d158fc.

development opportunities, profitability, productivity, and employment growth of non-zombies in the same industry. In contrast, prior literature also indicates some bright-side outcomes of zombie firms, and identifies their association with lower firm defaults, firm markups, and product prices, as well as higher aggregate sales (Acharya *et al.*, 2020). In this study, I seek to understand the effect of zombie firms in business groups. Specifically, I investigate whether and how zombie congestion spills over onto the cost of debt of other member firms within the same business group.

It is established that lenders charge higher interest rates to borrowing firms with higher default risk or information risk (e.g., Sengupta, 1998). Due to economic connections between business group affiliates, bailing out zombie firms might increase the default risk of other members of the same group. The internal market in business groups allows for resource transfer within the group, and therefore leads to risk spreading among member firms (e.g., Khanna & Yafeh, 2005; Belenzon & Berkovitz, 2010; Jia *et al.*, 2013; Larrain *et al.*, 2019; Faccio & O'Brien, 2020). Also, since group members share reputation gains and losses with each other (Bae *et al.*, 2008; Hsueh, 2016; Joe & Oh, 2017), the possible default of zombie firms might tarnish the reputations of the others. Besides, when resources are stranded in zombie firms, the funding opportunities of other affiliates could be crowded out, inhibiting their own development opportunities and profitability, and leading to an increase in default risk.

In addition, the complex governance structure in business groups results in an agency issue among the shareholders of member firms. The ultimate controller can allocate resources to affiliates from which they can gain more benefits, which tunnels the interests of non-controlling shareholders (e.g., Baek *et al.*, 2006; Lin *et al.*, 2011). Group members also have incentives to hide their transactions with zombies when requesting debt financing, which impairs information quality. If lenders perceive such uncertainty related to borrowing

firms, they may charge higher interest rates to compensate for the information risk (e.g., Mansi *et al.*, 2011). Based on the above arguments, I predict that zombie firms increase the cost of debt of non-zombies in the same business groups. To test this prediction, I construct a data set of group-affiliated firms in Europe during 2004-2011. Following Shroff *et al.* (2014), I acquire the information for all the ultimate owners, and their subsidiaries at four different levels, in which the ultimate owners have controlling rights. The final data set contains 281,795 firm-year observations. To identify zombie firms, I follow prior literature (e.g., Adalet McGowan *et al.*, 2018; De Martiis *et al.*, 2021) and define zombie firms as those aged 10 years or older, and whose interest coverage ratios remain below one for three consecutive years. Further, inspired by the approach of Caballero *et al.* (2008), I define the zombie fraction as the percentage of group assets stranded in zombie affiliates.

After controlling for country, industry, and business group by year fixed effects, I find that the zombie fraction in business groups has a positive effect on the cost of debt of non-zombie affiliates, and the effect is significant at the 1% level. As for the economic significance, a one-standard-deviation increase in the zombie fraction elevates the interest rates of non-zombie peers by 12%, representing 25% of the sample mean interest rate. Although non-zombie firms have a lower cost of debt than zombies, the difference vanishes when the business group is dominated by zombie firms (i.e., when assets in zombie firms make up over 60% of the total assets of the whole group). Considering the overall percentage of zombie firms in the business groups,[3] this makes a great impact, suggesting that the underperforming of one firm can affect the default risk of other affiliates through coinsurance, and that lenders can also perceive

[3]On average, about 7% of observations in my sample are zombie rms, and there is no signi cant di erence among years, countries, and industries, which is consistent with previous studies about European zombie rms. However, the proportion of assets stranded in zombie rms is up to 16.2%, which implies that the zombie rms in business groups are larger and more powerful than expected.

such associations. I also use interest payment rates and finance expense rates as dependent variables to mitigate the measurement error in interest expense rates, and the results are robust to these alternative measures.

In order to better understand how coinsurance takes effect within a business group and how a business group affects external information perception, I perform several cross-sectional variation tests. First, firms with more pledgeable income and less financial constraints are able to provide more support and thus suffer more from zombie congestion.[4] To test this prediction, I use relative profitability and relative size as proxies for pledgeable income, and industry-adjusted net debt and leverage as proxies for financial constraints. The results show that the spill-over effect of zombie firms is stronger for firms in better health, indicating that the coinsurance preferentially comes from better-performing affiliates in the group.

Second, I test whether the spill-over effect of zombie firms varies with the relationship between the zombie firms and non-zombie affiliates. Firms that are closer to zombie firms are expected to suffer more from zombie congestion. In line with this prediction, I find that the negative externality of zombie congestion is stronger for the zombies' direct parents and subsidiaries, suggesting that such firms are more likely to be observed by external lenders.

Third, when a business group is more complex, lenders face higher information uncertainty when considering debt applications of affiliates from the group. In small and simple business groups, lenders can easily access the information and evaluate the effect of zombie firms on non-zombies. However, in complex business groups, lenders can only know that the borrower is related to zombie firms, but it is hard to evaluate to what extent the borrower is affected, so they may charge higher cost of debt to compensate for the information un-

[4] For those standalone firms, less profitable and more financially constrained firms are more vulnerable to external shocks. However, the internal market within business groups allow affiliates to provide coinsurance for each other, so I predict that the coinsurance effect plays a major role in this setting.

certainty. Consistent with this prediction, my results show that the spill-over effect is more pronounced for firms in larger and diversified groups.

I further conduct a series of supplemental analyses to clarify the channels and rule out some alternative explanations. First, I argue in the main analysis that zombie firms have a negative spill-over effect on non-zombie affiliates by increasing the latter's default risk. I find that zombie congestion decreases the profitability and asset growth of non-zombies in the group, consistent with zombie congestion in business groups inhibiting the development of non-zombies and increasing their default risk. I then test the effect of zombie firms on the performance of the ultimate owners of the business groups to assess the potential motivation of these ultimate controllers. The results show that zombie congestion increases the cost of debt, suppresses the employment growth, and decreases the profitability of the ultimate parent firms, which rules out an alternative explanation that zombie firms are strategic outcomes of these ultimate owners. Considering that my sample period covers the 2008 global financial crisis, I further split the sample into three different periods, pre-crisis, during-crisis and post-crisis, to analyze whether the effects are different before and after the crisis. Although there is a slight increase in the overall zombie percentage after the 2008 financial crisis, I do not find any significant difference between the spill-overs of zombie congestion in the three different periods.

This paper makes contributions from two aspects. First, it contributes to the zombie firm literature. Prior studies mostly analyze the causes and consequences of zombie firms in Japan (e.g., Hoshi, 2006; Caballero *et al.*, 2008; Fukuda & Nakamura, 2011; Giannetti & Simonov, 2013; Gopinath *et al.*, 2017; Adalet McGowan *et al.*, 2018; Gouveia & Osterhold, 2018; Acharya *et al.*, 2019). Despite the exploration of the determinants of zombie firms and their spill-over effect on their industry peers worldwide (e.g., Caballero *et al.*, 2008;

Gopinath *et al.*, 2017; Adalet McGowan *et al.*, 2018; Banerjee & Hofmann, 2018; He *et al.*, 2018; Andrews & Petroulakis, 2019; Schmidt *et al.*, 2019), little is known about whether and how zombie subsidiaries have an impact on non-zombie firms within the same business group. My study therefore fills this gap and demonstrates that zombie congestion in business groups can also inhibit the development of other firms by increasing their cost of debt financing.

This study also adds to the business group literature. Prior literature has studied the unique characteristics, functions, and internal mechanism of business groups, as a critically important form of business entity. Holmes *et al.* (2018) conclude that there are three defining features of business groups, an internal market, complicated governance structure, and diversification, and several prior studies have identified the coinsurance effect within business groups through these three features (e.g., Bae *et al.*, 2008; Belenzon & Berkovitz, 2010; Jia *et al.*, 2013; Joe & Oh, 2017; Beaver *et al.*, 2019; Larrain *et al.*, 2019). My finding complements prior literature, suggesting that business groups support zombie affiliates in order to prevent greater damage to the group caused by the bankruptcy of zombies, and that business groups complicate the information environment for external lenders. It also provides more evidence on how the coinsurance takes effect, via direct evidence on how business groups reallocate resources to support zombie firms, suggesting that healthier firms and closer firms bear the brunt of supporting underperforming peers.

The rest of this paper is organized as follows: Section 4.2 reviews related literature and develops my hypotheses. Section 4.3 describes the research design and sample characteristics. Section 4.4 presents the empirical results, and Section 4.5 concludes.

4.2 Literature and Hypotheses

4.2.1 Literature on Zombie Firms

Prior research has identified various factors resulting in the prevalence of zombie firms: banks, the government, and the macro-economic trend. First, since banks need to meet the international standards governing their minimum capital level, writing off bad debt caused by zombie firms (i.e., loans given to zombies) means that they must write down their existing capital and face the fear of falling below the standard. Therefore, banks, especially small banks, have incentives to continuously provide advantageous interest rates or renew loans for these low-quality borrowers, expecting them to recover in the future (e.g., Caballero *et al.*, 2008; Giannetti & Simonov, 2013; Schivardi *et al.*, 2017; Storz *et al.*, 2017; Andrews & Petroulakis, 2019). Second, the government has a responsibility to maintain employment and stabilize the society, while cracking down on zombie firms will cause public grievances. He *et al.* (2018) find that connected firms are more likely to become zombies, especially when government intervention is strong. Qu (2019) also documents that local officials can force small banks to lend to zombie firms, and that zombie lending increases during the officials' appointment cycle. Third, a downward trend in interest rates reduces the pressure on lenders to clean up their financial statements and lessens their funding costs, making them more willing to renew loans to non-performing borrowers (Borio & Hofmann, 2017; Banerjee & Hofmann, 2018).

Some other studies focus on the outcomes of zombie congestion. Unsurprisingly, zombie firms are documented to have lower profitability, make fewer investments, and have poorer environmental performance (e.g., Han *et al.*, 2019). Zombie congestion takes up resources that should have been allocated to well-performing peers in the market, and therefore firms operating in high-zombie industries suffer significantly from credit misallocation, which slowing

economic recovery (Caballero *et al.*, 2008; Gopinath *et al.*, 2017; Adalet McGowan *et al.*, 2018; Acharya *et al.*, 2019). Schmidt *et al.* (2019) document that zombie lending also inhibits competition and innovation. The zombie firms formed due to political connections also have a negative spill-over onto healthy firms without political connections (He *et al.*, 2018). In terms of financial reporting consequences, zombie lending reduces information transparency for the whole market, and non-zombies report higher discretionary accruals (Lin, 2014).

Prior literature also identifies some positive sides of zombie firms. Acharya *et al.* (2020) find that a higher zombie fraction is associated with lower firm defaults, firm markups, and product prices, as well as higher aggregate sales. Schivardi *et al.* (2017) document that the overall effect of zombie firms on the market is relatively modest, as such resource misallocation to zombie firms can help them recover and mitigate adverse aggregate demand during recession. Zombie firms are also able to recover after financial crisis through employee strength reduction, fixed-asset disposal, and structural changes (Fukuda & Nakamura, 2011).

4.2.2 Literature on Business Groups

Business groups are entities that contain more than one business. Holmes *et al.* (2018) identify three features of business groups: an internal market, complicated governance structure, and diversification. Firstly, business groups have an internal capital and labor market, which is beneficial for resource flow among members. Groups can use approaches such as intragroup loans or related party transactions to transfer cash to financially weaker firms and reduce their financial constraints (Gopalan *et al.*, 2007; Jian & Wong, 2010; Jia *et al.*, 2013). The internal capital market can be more efficient than external financing, especially when the external financial market is less developed (Carney

et al., 2011; Belenzon *et al.*, 2012). Besides, the internal labor market of business groups can reduce employment fluctuation and provide more promotion opportunities (Faccio & O'Brien, 2020). The internal market provides a channel for firms to improve innovation (Belenzon & Berkovitz, 2010), translate institutional improvements to R&D (Choi *et al.*, 2014), and increase investment levels (Larrain *et al.*, 2019) with the support of other group members.

Secondly, the corporate governance structures of group-affiliated firms are more complicated than those of their stand-alone counterparts. The ultimate owner takes control of all subsidiaries in the business group, and each subsidiary may have its own shareholders, other than the ultimate owner, so that they face competing interests from different shareholders. Under these circumstances, the controlling shareholders may sacrifice minority shareholders for their own benefits, and this tunnelling effect can result in higher agency issues and lower the firms' financial performance (e.g., Baek *et al.*, 2006). The divergence of the ultimate owner's control rights and cash-flow rights can increase firms' borrowing costs (Lin *et al.*, 2011). The information environment in which the subsidiaries are located also affects the efficiency of their communication with their parents and therefore their responsiveness to investment opportunities (Shroff *et al.*, 2014). Group members also have incentives to improve external monitoring by hiring top auditors to reduce the agency issue and to signal that they have high information quality (Fang *et al.*, 2017).

Thirdly, members of a business group can focus on their own competitive advantage to maximize the overall benefits of the group, so most business groups are diversified. Such diversification can come in different forms, such as product market segmentation and international operations (e.g., Kim *et al.*, 2015). Khanna & Yafeh (2005) use a global sample and find that group affiliation can facilitate risk sharing among members with diversified operations. However, diversified operation based on specification may also inhibit the in-

novativeness of member firms (Chang *et al.*, 2006).

The unique features of business groups allow member firms to provide coinsurance for each other. In other words, the support from peer firms provides an off-balance-sheet asset for the receiving firm and an off-balance-sheet liability for the supporting firm. Therefore, the performance of one firm can spill over onto others. Bae *et al.* (2008) find that the announcement of increased (decreased) earnings by one firm can lead to an increase (decrease) in affiliated firms' market value. Similarly, Joe & Oh (2017) find the same effect on others' credit ratings. Beaver *et al.* (2019) document that group information can be used to predict parent and subsidiary default, and unconsolidated statements of each member firm can provide additional information to group-level consolidated statements.

4.2.3 Hypothesis Development

When borrowing firms have higher default risk, lenders tend to charge higher interest rates to compensate for those risks (e.g., Sengupta, 1998). In the context of business groups, the internal market and diversified operations allow the group members to provide financial support for each other, and better-performing firms in the group are expected to transfer benefits to worse-performing affiliates (e.g., Gedajlovic & Shapiro, 2002; Jia *et al.*, 2013; Larrain *et al.*, 2019; Faccio & O'Brien, 2020). However, such support given to zombie firms comes at the cost of the non-zombies' benefits, as these healthy affiliates sacrifice their own profits and development opportunities to rescue the zombie affiliates in their group.

Also, similarly to how zombie firms crowd out the opportunities of non-zombie industrial peers and affect their performance (e.g., Caballero *et al.*, 2008; Adalet McGowan *et al.*, 2018; Acharya *et al.*, 2019), zombies in the group might also take up resources that should have been delivered to non-

zombie affiliates. When the ration of resources in the internal market is limited and part of it is stranded in zombie firms, the non-zombies in the group receive weaker coinsurance because they cannot derive as much support. Therefore, with more benefits transferred to zombies and less support from the business group, non-zombies suffer a higher default risk. I formulate the following hypothesis based on the above discussion:

H1: Zombie firms increase the cost of debt of non-zombies in the group.

Since the effect in H1 works through the coinsurance in the group and the perceptions of lenders, I next examine several firm and business group characteristics that may impact how the coinsurance takes effect in the groups, and how external lenders perceive the information in the group. Firstly, since business groups support zombie firms using resources from healthy firms, I predict that the effect should be stronger for firms with higher health levels. Byun *et al.* (2013) find that firms with lower pledgeable income and higher future uncertainty can benefit more from the coinsurance of business groups, and it is reasonable to assume that such benefits are obtained at the cost of firms with higher pledgeable income and lower uncertainty. Larrain *et al.* (2019) suggest that firms with relatively higher profitability and lower leverage indicate the presence of capital misallocation within business groups, implying zombie firms may push the group to reallocate resources from over-supported peers to the non-performing members. Therefore, I put forward the following hypothesis:

H2: The spill-over effect of the zombie fraction is more pronounced for healthier firms.

Secondly, I expect firms closer to the zombie firms to be more prone to zombie congestion in the group. Since affiliates in business groups can share reputation gains or losses through the coinsurance effect (Hsueh, 2016), the bankruptcy of one firm in the group can tarnish the reputations of related

firms and imply that their corporate competency is relatively lower (Joe & Oh, 2017). Beaver *et al.* (2019) find that the default risk of a firm in a business group exhibits predictive power for the defaults of its parents and subsidiaries. Since lenders can directly recognize the relationships between zombie firms and their parents/subsidiaries,[5] firms closer to these fragile zombies are more likely to suffer reputation losses. Also, in order to avoid strong shocks from the bankruptcies of related zombies, direct parents or subsidiaries need to provide more resources to support the zombies' survival, which inhibits their own development, and eventually leads to a higher cost of debt. The above discussions lead to the following hypothesis:

H3: The spill-over effect of the zombie fraction is more pronounced for firms closer to zombies.

Thirdly, I expect that the complexity of business groups can influence the effect of zombie firms on their peers. Firms in business groups can have various shareholders apart from the ultimate controller, which results in tunneling and agency issues (Baek *et al.*, 2006; Lin *et al.*, 2011), and such agency costs are higher for larger and diversified business groups with more complex corporate governance structures. The agency issue can also lead to a higher cost for firms in transferring resources within the group, and increases the information uncertainty for external lenders, who charge higher interest rates to compensate for the opaque information environment. Therefore, I formulate the following hypothesis:

H4: The spill-over effect of the zombie fraction is more pronounced for firms in more complex business groups.

It is plausible that the complex business group structure inhibits lenders' ability to perceive the links between zombie and non-zombie firms. If this were

[5] Banks often require borrowing firms to submit the financial statements of related firms, but the criteria for being related are not clear, and different countries have different rules.

the case, I might not observe a significant impact on non-zombies' cost of debt.[6] Therefore, the effect of zombie firms on the cost of debt of their non-zombie peers in the same business group appears to be an empirical question.

4.3 Research Design

4.3.1 Sample Selection

The database Amadeus, assembled by Bureau van Dijk (BvD), provides financial and ownership information for all European firms. Following Shroff *et al.* (2014), I first obtain the ownership information from the BvD Amadeus 2014 compact disk (CD) and identify the business groups, as illustrated in Appendix 4A.[7] In brief, I first acquire the information for all the ultimate owners (i.e., the shareholder with the highest shareholding in a firm where the shareholder with the highest shareholding is an individual or the highest corporate shareholding is no more than 25%).[8] Then, I use the subsidiary information provided to link the subsidiaries (Level 1) to these ultimate owners, and to link the subsidiaries (Levels 2, 3, 4) to their direct parent (Levels 1, 2, 3, respectively). This procedure ensures that both the direct subsidiaries (subsidiary Level 1) of the ultimate owners and the indirect subsidiaries (subsidiary Level 2, 3, and 4) are included in the sample. In order to make sure that the parent has controlling rights over the subsidiaries, I exclude all subsidiaries whose

[6] Another potential concern is that, since I cannot observe within-group loans, I assume that all the debt comes from external lenders. Theoretically, group a liates would not provide loans to rms within the same business group at higher interest rates than are charged by external lenders, since the internal market reduces information costs within the group. Therefore, the part of the debt from related a liates should be biased against my ndings.

[7] As mentioned by Shro *et al.* (2014), one of the potential weaknesses of BvD Amadeus is that it only contains ownership information for the current year. Since the ultimate owners should change relatively infrequently, the stale information will not have much of an impact on my results.

[8] If the the highest corporate shareholding of a rm is no more than 25%, BvD does not treat it as an ultimate owner.

parent's direct shareholding or total shareholding through observable entities is not more than 25%.[9] For subsidiaries that appear on different ownership levels, I keep the highest effective level.[10] Appendix 4A provides a more detailed explanation and one example from my original data collection process. Thanks to the wide coverage of the database, I obtain 698,483 parent-subsidiary pairs at this stage.[11]

I then obtain the financial information of the firms from the 2011-2014 BvD Amadeus CDs, which contain accounting numbers from 2002 to 2013. In order to balance the sample distribution among years, I drop observations in 2013 because more than 90% of firms had not disclosed financial information by the time the 2014 CD was issued. Since I require data for the past three years to calculate the independent variable and one-year-ahead data for the dependent variable, my final sample period is 2004-2011, and all financial variables are transformed into their values in euros at the end of each financial reporting period.[12]

To test my hypotheses, I construct a sample with firm-year observations and impose the following constraints. First, I exclude all firms without industry SIC codes, firms operating in the financial industry, and firms without unconsolidated financial statements. I then exclude observations lacking suffi-

[9] BvD Amadeus provides both direct shareholding and indirect shareholding information. Because the indirect shareholding contains shareholding through unobservable and unprovided channels, I only use the direct shareholding information for reliability following Shro *et al.* (2014). Also, I exclude observations without direct shareholding information.

[10] \E ective" means the shareholding by the ultimate owner is more than 25% on this level. This is also based on Shro *et al.* (2014) and the guidance in the ORBIS manual.

[11] Theoretically, I should have 5,587,864 parent-subsidiary-year observations within my eight-year sample period. Since I keep the subsidiaries in the group with the highest shareholding, this is also the theoretical number of rm-year observations.

[12] Due to the di erences in nancial reporting requirements among countries, subsidiaries in some countries are under-represented because the available nancial data for the rms is insu cient. For example, in Russia, Switzerland, and Ukraine, private rms are not required to disclose nancial information. In some other countries, such as Austria, private rms only need to disclose a few basic items. The disclosure requirements for rms of di erent sizes are also di erent. Since it is very likely that zombie subsidiaries vary in size, I do not impose a requirement on rm size (including total assets, turnover, or number of employees) on my observations.

cient financial information for the calculation of my independent, dependent, and control variables. Finally, since my study concerns the spill-over effect of firms within business groups, I require at least two observations in each group-year cluster. These restrictions leave me 281,795 firm-year observations, and Table 4.1 presents the sample selection process.

Table 4.1: Sample Selection

	Observations Dropped	No. of Firm-Year Observations
Original sample		5,587,864
1. Exclude observations with missing industry code or operating in financial industry	1,484,776	4,103,088
2. Exclude observations without unconsolidated statements	415,776	3,684,312
3. Exclude observations without sufficient financial information	3,209,672	477,640
4. Exclude group-years with only one observation	195,845	281,795
Final sample		281,795

This table presents the sample selection process. Appendix 4A provides a more detailed explanation of how we get the original sample.

4.3.2 Model Specification

A. Baseline Model

Since this is the first paper to study zombies' spill-over effect on other affiliates in the same group, I borrow a model from previous studies analyzing their spill-over effect on industry peers (e.g., Caballero *et al.*, 2008; Adalet McGowan *et al.*, 2018; Acharya *et al.*, 2019), as follows:

$$y_{t+1} = {}_1 NonZ_t + {}_2 Frac + {}_3 NonZ \quad Frac + \quad X + FE + \tag{4.1}$$

where the dependent variable y ($Interest\_Rate$) is the proxy for the cost of debt, defined as the ratio of interest expense to average debt for the year (Kim *et al.*, 2011). Following Adalet McGowan *et al.* (2018), a firm is defined as a $Zombie$ if its interest coverage ratio is less than 1 for three consecutive years and its age is no less than 10 years, and $NonZ$ is a dummy equal 1 if the firm is not a zombie firm; $Frac$ is the percentage of group assets residing in zombie firms. I use these income- and debt-related variables since they are the main characteristics distinguishing zombies and non-zombies in Europe (De Martiis *et al.*, 2021).[13] The variable of interest is the interaction term, $NonZ \quad Frac$, which explains the effect of the zombie fraction on non-zombie firms. A positive $_3$ would mean zombie firms increase the cost of debt of non-zombies, while a negative $_3$ would mean zombie firms reduce healthy firms' cost of debt.

Following Kim *et al.* (2011) and Byun *et al.* (2013), I control for other firm

[13] Another criterion used widely in the literature is whether the rm receives subsidized credit (e.g., Caballero *et al.*, 2008). Banerjee & Hofmann (2018) mention three limitations of this identi cation methodology: it is di cult to precisely identify such credit; banks may grant subsidized credit for other reasons, such as a long-term relationship; subsidized credit has to be close to zero or even negative when the macro interest rates are very low for a long time. Brie y speaking, this alternative criterion is more suitable in the Japanese and Korean settings than in Europe.

characteristics (X in Equation 4.1). Larger firms tend to have a lower cost of debt, so I include $Size$ among my control variables, defined as the logarithm of 1 plus total assets for the year. Higher leverage implies a higher default risk and thus that lenders will charge higher expense, so I include $Leverage$, measured as the ratio of total debt to total assets. Bharath *et al.* (2008) find that higher tangible asset ownership reduces the cost of debt, so I include $Tangibility$, defined as the ratio of tangible fixed assets to total assets. As lenders usually charge lower interest rates to firms with higher profitability and growth potential, I include $OROA$, defined as the ratio of operating income (EBIT) to total assets, and $Sales_Growth$, measuring the growth potential of the firm. $NegEquity$ is a dummy equal to 1 if the equity of the firm is negative and 0 otherwise, since the credit risk of firms with negative equity is extremely high. With older firms tending to have better reputations and experience with lenders, they have a lower cost of debt (Diamond, 1989), and thus I also include $LnAge$ among the control variables. Appendix 4B provides a detailed explanation of the variable definitions.

I also include fixed effects in my model. In order to analyze the spill-over effect within the business groups, I put group dummies in the regression. I also include country, industry, and year dummies in my baseline regression model to control for country-, industry-, and year-specific characteristics. Like firms' reactions to changes of industry conditions, as mentioned by Caballero *et al.* (2008), group features and situations may change over time and members of the group will react differently to such changes; thus, I further replace the combination of group dummies and year dummies with group-year dummies.

B. Cross-sectional Tests

To test the other hypotheses (H2, H3, H4), I use different proxies for firm characteristics and business group characteristics and include interaction terms

with all the independent variables and with the control variables. The model is as follows:

$$y_{t+1} = (\ _1 NonZ_t + \ _2 Frac + \ _3 NonZ \quad Frac + \ X) \quad _1(1+VAR) + \ _2 VAR + FE + \tag{4.2}$$

The VAR is a set of variables reflecting different characteristics following Carney *et al.* (2011), Byun *et al.* (2013) and Gaur *et al.* (2019). To be more specific, I first analyze firm health based on two different aspects: pledgeable income and financial constraints. I use relative operating profit and relative total assets as proxies for whether the firm has relatively more pledgeable income within each group-year cluster, with the dummy variable $RelOROA$ ($RelSize$) equaling 1 if the firm has above-median EBIT (total assets). If the spill-over effect of zombie firms are stronger for non-zombies with higher pledgeable income, I should find significantly positive coefficients for $_3$ $_1$. Similarly, relative net debt ($RelDebt$) and relative leverage ($RelLev$) are dummies that are proxies for the relative financial constraints of the firm within each group-year cluster. If the spill-over effect of zombie firms are stronger for non-zombies with a lower amount of financial constraints, I should find significantly negative coefficients for $_3$ $_1$.

Second, since private firms in European business groups are not required to disclose information about related party transactions, the only feasible measure of their relationships with zombie firms comes from the ownership structure data. I use a dummy variable, $Closeness$, that equals 1 if the firm is a direct parent or subsidiary of a zombie firm. Direct parents and subsidiaries have stronger motives to support zombies in order to avoid reputation losses, and they are more observable by external lenders, so I predict a significantly positive coefficient for $_3$ $_1$.

Third, the scale and scope of business groups can make it more difficult for lenders to perceive information and they will thus charge a higher cost of debt as a risk premium, while it is also likely that larger and more diversified groups can provide stronger coinsurance. I use four measures of group scale (size): the number of firms in the group, the total assets of all group members, the total sales of all group members, and the total number of employees of all group members. As for the group scope (diversification), I use the number of three-digit industries of all group members, and unrelated diversification, following Byun *et al.* (2013). The dummy variables, *GNum*, *GAsset*, *GSales*, *GEmp*, *GInd*, and *Divers*, equal 1 if the business group has more firms, higher total assets, higher total sales, more employees, more operating industries or above-median unrelated diversification.

4.3.3 Sample Distribution and Descriptive Statistics

Table 4.2 presents my sample distribution by year, country, and industry. The distribution by year is basically well balanced, despite the smaller number of observations early in the sample period due to the reduced coverage of the Amadeus database. I can observe an upward trend in zombie prevalence, especially after the financial crisis, when about 1 out of 10 firms is a zombie firm on average. In terms of distribution by country, it is similar to that in previous papers using the Amadeus database (e.g., Larrain *et al.*, 2019). The difference can be expected due to country size and disclosure requirements. France accounts for the largest share of observations, followed by Spain, Italy, and Portugal. The average percentage of zombie firms does not differ hugely among countries. The highest is in Portugal, where 11.4% firms on average are zombies. Finally, the industry distribution does not show a significant clustering pattern either. SIC 5 (wholesale and retail trade) accounts for the largest share of observations, but it is only about 25% of the whole sample.

The industry with the highest zombie percentage is SIC 1 (agriculture, forestry, and fishing), with just above 10%, while the percentage for all other industries is less than 10%. I exclude financial firms (SIC 6) from my sample because the criteria for being a zombie in financial industries are different.

Table 4.2: Sample Distribution

Panel A: Zombie Firm Distribution by Year			
	No. Of Observations	Zombie Mean	Zombie S.D.
2004	16,713	0.060	0.237
2005	29,433	0.038	0.191
2006	29,577	0.062	0.241
2007	33,342	0.062	0.241
2008	40,276	0.066	0.249
2009	42,849	0.075	0.264
2010	45,483	0.086	0.280
2011	44,122	0.093	0.290
Total	281,795	0.071	0.256
Panel B: Zombie Firm Distribution by Country			
	No. Of Observations	Zombie Mean	Zombie S.D.
Austria	710	0.068	0.251
Bosnia and Herzegovina	360	0.081	0.273
Belgium	14,590	0.096	0.294
Bulgaria	1,473	0.050	0.217
Switzerland	241	0.066	0.249
Czechia	7,257	0.033	0.177
Germany	5,184	0.059	0.236
Estonia	1,994	0.000	0.000
Spain	58,326	0.084	0.278
Finland	2,933	0.089	0.285
France	78,307	0.061	0.240
United Kingdom	9,957	0.081	0.273
Greece	1,725	0.080	0.271
Croatia	2,151	0.000	0.000
Hungary	421	0.055	0.228
Ireland	381	0.084	0.278
Iceland	43	0.000	0.000
Italy	37,793	0.078	0.267
Lithuania	473	0.000	0.000
Luxembourg	161	0.031	0.174
Latvia	499	0.044	0.205
Moldova, Rep. of	266	0.000	0.000
Montenegro	10	0.000	0.000
Malta	19	0.000	0.000
Netherlands	211	0.000	0.000
Norway	8,088	0.038	0.191
Poland	3,463	0.051	0.220
Portugal	16,592	0.114	0.317
Romania	288	0.049	0.215
Serbia	1,828	0.088	0.283
Russian Federation	11,923	0.041	0.199
Sweden	4,853	0.067	0.249
Slovenia	1,807	0.054	0.227
Slovakia	941	0.024	0.154
Turkey	53	0.075	0.267
Ukraine	6,474	0.063	0.243
Total	281,795	0.071	0.256

Table 4.2: Sample Distribution (cont'd)

Panel C: Zombie Firm Distribution by Industry (1-digit SIC code)			
	No. Of Observations	Zombie Mean	Zombie S.D.
Agriculture, Forestry and Fishing	9,172	0.105	0.306
Mining and Construction	36,520	0.054	0.227
Manufacturing	32,258	0.082	0.274
Manufacturing	39,770	0.069	0.254
Transportation, Communications, Electric, Gas and Sanitary service	33,404	0.066	0.248
Wholesale and Retail Trade	72,900	0.069	0.253
Services	35,327	0.086	0.280
Services	22,305	0.059	0.237
Public Administration and Other	139	0.086	0.282
Total	281,795	0.071	0.256

This table presents the sample distribution of zombie firms in business groups by year, country and industry. A firm is defined as a zombie firm (i.e., $Zombie$=1) if the firm is aged 10 years or older and it had an interest coverage ratio less than one for three consecutive years.

Table 4.3 presents the descriptive statistics of the variables. On average, 7.1% of firms are zombie firms, but they have a bigger impact since the assets locked in zombie firms (*Frac*) comprise about 16.2% of total asset for all group affiliates in an average group-year cluster, which also implies zombie firms are relatively larger. The median interest rate is about 5.3%, while the interest payment rate and the finance expense rate show the same pattern.[14] The average firm age is about 15 years. Panels B and C present the descriptive statistics of the zombie and non-zombie firms. On average, zombie firms have a higher cost of debt (*Interest_Rate*) and leverage (*Leverage*), while their asset growth rate (*Asset_Growth*), sales growth rate (*Sales_Growth*), employment growth rate (*Emp_Growth*), and profitability (*OROA*) are negative. They are also larger in size (*Size*) and older in age (*LnAge*).[15]

[14] The average cost of debt (Interest_Rate) is about 45.6%, which looks a bit abnormal, but actually more than 90% of observations do not hit such a high level. This is highly likely to be caused by my winsorization strategy and the data availability of interest rates. Since the Amadeus database does not provide interest expense data, I calculate the interest expense using the interest coverage ratio disclosed. The interest rates are then calculated using interest expense over total debt. To further check the robustness, I also use the interest payment and nance expense provided directly by Amadeus to calculate the dependent variable. In untabulated results, my nding is robust to trimming the sample at 95%.

[15] I understand that the observed larger size and older age may result from survivorship bias, because young and small zombies are more likely to go bankrupt. However, this bias in the sample should not have a great impact on my research question, as the exclusion of the non-survivors leads to bias against my nding.

Table 4.3: Descriptive Statistics

Panel A: Descriptive Statistics of Full Sample						
	N	Mean	S.D.	Min	Median	Max
Zombie	281,795	0.071	0.256	0.000	0.000	1.000
NonZ	281,795	0.929	0.256	0.000	1.000	1.000
Frac	281,795	0.162	0.217	0.000	0.065	0.911
Interest_Rate	281,795	0.456	2.211	0.000	0.053	18.898
Interest_Payment	257,168	0.538	2.587	0.000	0.059	22.000
Finance_Expense	275,565	0.937	4.719	0.000	0.065	40.222
Asset_Growth	281,743	0.036	0.279	-0.915	0.017	1.087
Emp_Growth	196,527	-0.000	0.257	-1.099	0.000	0.993
Size	281,795	1.999	1.429	0.074	1.727	6.590
Leverage	281,795	0.240	0.250	0.000	0.163	1.167
Tangibility	281,795	0.251	0.261	0.000	0.152	0.951
OROA	281,795	0.044	0.133	-0.526	0.039	0.453
Sales_Growth	281,795	0.048	0.446	-1.786	0.041	1.984
NegEquity	281,795	0.083	0.275	0.000	0.000	1.000
LnAge	281,795	2.708	0.743	1.099	2.773	4.394
Panel B: Descriptive Statistics of Zombie Firms						
	N	Mean	S.D.	Min	Median	Max
Interest_Rate	19,907	0.586	2.592	0.000	0.059	18.898
Interest_Payment	19,688	0.642	2.925	0.000	0.060	22.000
Finance_Expense	19,852	0.999	4.975	0.000	0.067	40.222
Asset_Growth	19,901	-0.018	0.276	-0.915	-0.020	1.087
Emp_Growth	14,324	-0.054	0.281	-1.099	0.000	0.993
Size	19,907	2.307	1.516	0.074	2.034	6.590
Leverage	19,907	0.348	0.300	0.000	0.283	1.167
Tangibility	19,907	0.307	0.286	0.000	0.219	0.951
OROA	19,907	-0.070	0.117	-0.526	-0.029	0.453
Sales_Growth	19,907	-0.034	0.476	-1.786	0.000	1.984
NegEquity	19,907	0.216	0.412	0.000	0.000	1.000
LnAge	19,907	3.122	0.507	2.398	3.045	4.394
Panel C: Descriptive Statistics of Non-Zombie Firms						
	N	Mean	S.D.	Min	Median	Max
Interest_Rate	261,888	0.446	2.180	0.000	0.053	18.898
Interest_Payment	237,480	0.530	2.556	0.000	0.058	22.000
Finance_Expense	255,713	0.932	4.698	0.000	0.064	40.222
Asset_Growth	261,842	0.040	0.279	-0.915	0.021	1.087
Emp_Growth	182,203	0.004	0.255	-1.099	0.000	0.993
Size	261,888	1.976	1.419	0.074	1.705	6.590
Leverage	261,888	0.231	0.244	0.000	0.155	1.167
Tangibility	261,888	0.247	0.259	0.000	0.147	0.951
OROA	261,888	0.053	0.130	-0.526	0.045	0.453
Sales_Growth	261,888	0.054	0.443	-1.786	0.044	1.984
NegEquity	261,888	0.073	0.259	0.000	0.000	1.000
LnAge	261,888	2.676	0.748	1.099	2.708	4.394

This table presents descriptive statistics. All continuous variables are winsorized at 1% and 99%. Detailed variable definitions are shown in Appendix 4B.

4.4 Empirical Results

4.4.1 Spill-over Effect of Zombie Firms onto Non-zombies in the Group (H1)

I first examine the difference between the cost of debt of zombies and that of non-zombies in the group, and the results are presented in Columns 1 and 2 of Table 4.4. The univariate test with country, industry, year, and group fixed effects shows that non-zombies have a lower cost of debt (coeff. = -0.124, t-stat = -4.403), and the coefficient is significant at the 1% level. I then add control variables to the model, and the coefficient estimate remains significantly negative (coeff. = -0.182, t-stat = -6.681), which suggests that the lenders can perceive the performance of firms, differentiate between zombies and non-zombies, and charge higher interest rates to zombie firms.

I then test the spill-over effect of the zombie fraction on non-zombies in the business groups, using Equation 4.1 and including country, industry, group, and year fixed effects. Column 3 shows that, without control variables, the coefficient of the interaction term, $NonZ \quad Frac$, is positive and significant at the 1% level (coeff. = 0.430, t-stat = 4.493), which suggests that the zombie fraction in business groups increases the cost of debt of non-zombie firms. The result is still significant when I include other control variables (coeff. = 0.460, t-stat = 4.968). The magnitude of this coefficient is economically significant as well. A one-standard-deviation increase in the zombie fraction increases the interest rate of non-zombie firms by about 10% (0.217 0.460), representing about 22% of the average interest rate. The coefficient estimates for the other control variables are generally consistent with previous literature. Specifically, firms with lower profitability, negative equity, and a younger age have a higher cost of debt.

Due to the potential endogeneity issue from group-level omitted variables

and selection bias, where some group features may affect resource reallocation and the existence/tolerance of zombie firms (Caballero *et al.*, 2008), I replace the group and year fixed effects with group by year fixed effects to eliminate the endogeneity issue. The positive estimated coefficient of the interaction term $NonZ \quad Frac$ remains significant at 1% (coeff. = 0.548, t-stat = 4.639). As for the economic significance, the coefficient indicates that a one-standard-deviation increase in the zombie fraction increases the interest rate of non-zombie firms by about 12%, representing 25% of the average interest rate. When zombie firms take up more than 60% of assets in the business group, the cost of the debt financing of the non-zombies will be no different from that of the zombies.

Table 4.4: The Effect of Zombie Firms on Non-Zombies' Cost of Debt

	Interest_Rate				
	1	2	3	4	5
NonZ	-0.124	-0.182	-0.239	-0.310	-0.341
	[-4.403]	[-6.681]	[-5.536]	[-7.402]	[-6.635]
Frac			-0.388	-0.445	
			[-4.425]	[-5.275]	
NonZ Frac			0.430	0.460	0.548
			[4.493]	[4.968]	[4.639]
Size		0.095		0.099	0.099
		[10.845]		[11.108]	[9.619]
Leverage		-1.739		-1.738	-1.801
		[-48.731]		[-48.755]	[-42.110]
Tangibility		-0.052		-0.054	-0.053
		[-1.679]		[-1.740]	[-1.445]
OROA		-0.313		-0.303	-0.361
		[-5.819]		[-5.630]	[-5.357]
Sales_Growth		0.008		0.008	0.010
		[0.690]		[0.678]	[0.716]
NegEquity		0.589		0.586	0.608
		[19.445]		[19.376]	[16.675]
LnAge		-0.082		-0.084	-0.085
		[-6.410]		[-6.495]	[-5.801]
Country FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Group FE	Yes	Yes	Yes	Yes	
Year FE	Yes	Yes	Yes	Yes	
Group Year FE					Yes
Adjusted R^2	0.102	0.126	0.102	0.126	0.031
N	281,795	281,795	281,795	281,795	281,795

This table presents the results for the effect of zombie firms on the cost of debt of other affiliated firms in the same business group. The key variable of interest, *NonZ Frac*, is the interaction term of *NonZ* and *Frac*. *NonZ* is a dummy equal to 1 if the firm is not defined as a zombie firm and 0 otherwise. *Frac* is the percentage of assets locked in zombie firms over those of all the firms in the group-year. The dependent variable, *Interest_Rate*, is the ratio of interest expense over total debt. Appendix 4B displays a detailed explanation of variable definitions. All continuous variables are winsorized at 1% and 99%. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

4.4.2 The Moderating Effect of Firm and Business Group Characteristics (H2, H3, H4)

Columns 1-4 of Table 4.5 reports the cross-sectional test results analyzing the moderating effect of firm health. The positive coefficient estimates of *NonZ Frac RelOROA* (coeff. = 0.456, t-stat = 2.004 in Column 1) and *NonZ Frac RelSize* (coeff. = 0.470, t-stat = 2.007 in Column 2) show that firms with higher profitability and larger firms suffer more from zombie congestion, indicating that the effect in H1 is stronger for firms with higher pledgeable income. The negative coefficient estimates of *NonZ Frac RelDebt* (coeff. = -0.446, t-stat = -2.028 in Column 3) and *NonZ Frac RelLev* (coeff. = -1.522, t-stat = -7.012 in Column 4) show that firms with higher leverage and net debt are less likely to be affected by zombies in the group, indicating that firms under less financial constraint suffer more from zombie firms. All results are significant at the 5% level or better.[16] Overall, the results indicate that firms in business groups follow a certain order in providing coinsurance for affiliates, and those with higher health levels are more likely to suffer, which further demonstrates the function of the internal market.

Column 5 of Table 4.5 reports the results of testing H3. In line with my prediction, the coefficient estimates of *NonZ Frac Closeness* is positive and significant at the 5% level (coeff. = 1.556, t-stat = 2.267). The result suggests that the spill-over effect of zombie congestion in business groups is stronger for direct parents and subsidiaries of zombie firms.

[16] I also split the sample into two groups based on the dummy variables. The results remain qualitatively the same.

Table 4.5: Cross-sectional Tests on Firm Characteristics

	Dependent Variable: *Interest_Rate*				
	1	2	3	4	5
VAR	*RelOROA*	*RelSize*	*RelDebt*	*RelLev*	*Closeness*
NonZ	-0.331	-0.290	-0.583	-0.804	-0.287
	[-6.206]	[-4.988]	[-6.150]	[-7.950]	[-5.814]
VAR	0.145	0.286	-0.558	-1.451	0.837
	[1.013]	[2.258]	[-4.581]	[-12.116]	[1.941]
NonZ *Frac*	0.473	0.359	0.773	1.275	0.412
	[3.395]	[2.213]	[3.933]	[6.166]	[3.415]
NonZ VAR	-0.223	-0.109	0.401	0.829	-0.842
	[-1.739]	[-1.071]	[3.888]	[8.162]	[-2.213]
Frac VAR	-0.392	-0.178	0.355	1.118	-1.175
	[-1.969]	[-0.931]	[1.903]	[5.977]	[-1.880]
NonZ *Frac* VAR	0.456	0.470	-0.446	-1.522	1.556
	[2.004]	[2.007]	[-2.028]	[-7.012]	[2.267]
Controls	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Group Year FE	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.031	0.032	0.042	0.068	0.031
N	281,795	281,795	281,795	281,795	281,795

This table presents the results for the cross-sectional tests for firm characteristics. *NonZ* is a dummy equal to 1 if the firm is not defined as a zombie firm and 0 otherwise. *Frac* is defined as the percentage of assets locked in zombie firms over those of all the firms in the group-year. The dependent variable, *Interest_Rate*, is the ratio of interest expense over total debt. We use 5 different variables (VAR) to proxy for different characteristics: *RelOROA*, *RelSize*, *RelDebt*, *RelLev*, and *Closeness*. The first four are dummy variables equal to 1 if the firm has relatively higher (above industry-year median) *OROA*, *Size*, net debt and *Leverage* in the group-year and 0 otherwise; *Closeness* equals 1 if the direct parent or at least one of its direct subsidiaries is a zombie firm and 0 otherwise. Appendix 4B displays detailed variable definitions. All continuous variables are winsorized at 1% and 99%. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

Table 4.6 presents the results of testing the moderating effect of business group characteristics posted in H4. In Columns 1 through Column 6, the coefficient estimates on the interaction term of $NonZ \quad Frac$ and the six cross-sectional dummy variables are all significantly positive, suggesting that firms in business groups with more firms, more assets, higher sales, more employees, more industrial sectors, and higher unrelated diversification are more prone to zombie congestion. The results indicate that the complex information environment in larger and more diversified business groups increases information uncertainty, and lenders charge a higher cost of debt to compensate for the risk. Collectively, the results in Tables 4.5 and 4.6 shed light on the way coinsurance takes effect in business groups and how group characteristics complicate information perception for external lenders.

Table 4.6: Cross-sectional Tests on Business Group Characteristics

	Dependent Variable: *Interest_Rate*					
	1	2	3	4	5	6
VAR	*GNum*	*GAsset*	*GSales*	*GEmp*	*GInd*	*Divers*
NonZ	-	-	-	-0.112	-0.02	-
	0.145	0.201	0.151			0.126
	[-2.598]	[-4.109]	[-3.429]	[-2.470]	[-0.273]	[-2.680]
NonZ *Frac*	0.137	0.216	0.11	0.043	0.033	0.12
	[1.292]	[2.097]	[1.149]	[0.433]	[0.208]	[1.194]
NonZ VAR	-	-0.187	-	-	-	-
	0.228		0.271	0.333	0.355	0.286
	[-2.751]	[-2.237]	[-3.263]	[-3.959]	[-3.815]	[-3.450]
NonZ	0.500	0.466	0.686	0.768	0.557	0.585
Frac VAR						
	[2.380]	[2.170]	[3.126]	[3.540]	[2.656]	[2.527]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Group Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.033	0.034	0.035	0.034	0.031	0.033
N	281,795	281,795	281,795	281,795	281,795	281,795

This table presents the results for the cross-sectional tests for business group characteristics. *NonZ* is a dummy equal to 1 if the firm is not defined as a zombie firm and 0 otherwise. *Frac* is defined as the percentage of assets locked in zombie firms over those of all the firms in the group-year. The dependent variable, *Interest_Rate*, is the ratio of interest expense over total debt. We use 5 different variables (VAR) to proxy for group characteristics: *GNum*, *GAsset*, *GSales*, *GEmp*, *GInd* and *Divers*, which are dummy variables equal to 1 if the group is relatively larger in terms of number of firms, total assets of all firms, total sales of all firms, total employment of all firms, number of industries and unrelated diversification index, and 0 otherwise. Appendix 4B displays detailed variable definitions. All continuous variables are winsorized at 1% and 99%. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

4.4.3 Robustness Checks

One of the limitations of the Amadeus database is that the interest expense data is not directly provided, so I use interest coverage data to calculate the interest expense and then the interest rate used in the main regression. To test the robustness of my measures of the cost of debt, I further use two other proxies: interest payment and finance expense. The alternative dependent variables, *Interest_Payment* and *Finance_Expense* are deflated by total debt. As is reported in Table 4.7, the coefficient estimates of *NonZ Frac* are positive and significant at 1% in all columns, whether I control for group and year fixed effects or group by year fixed effects, indicating that my results are not sensitive to the cost of debt measure.

Table 4.7: Robustness Checks

Dependent:	*Interest_Payment*		*Finance_Expense*	
	1	2	3	4
NonZ	-0.328	-0.361	-0.509	-0.584
	[-6.801]	[-6.064]	[-6.168]	[-5.717]
Frac	-0.461		-0.698	
	[-4.776]		[-4.191]	
NonZ Frac	0.493	0.581	0.949	1.099
	[4.606]	[4.213]	[5.107]	[4.611]
Size	0.108	0.107	0.286	0.292
	[9.750]	[8.352]	[14.167]	[12.490]
Leverage	-2.149	-2.233	-3.552	-3.713
	[-47.871]	[-41.090]	[-48.491]	[-41.869]
Tangibility	-0.097	-0.093	-0.369	-0.369
	[-2.466]	[-2.003]	[-5.653]	[-4.794]
OROA	-0.372	-0.445	-0.328	-0.414
	[-5.249]	[-4.929]	[-2.768]	[-2.734]
Sales_Growth	0.002	0.002	-0.008	-0.001
	[0.119]	[0.135]	[-0.308]	[-0.031]
NegEquity	0.686	0.717	1.044	1.086
	[18.310]	[15.636]	[17.215]	[14.728]
LnAge	-0.103	-0.105	-0.154	-0.161
	[-6.517]	[-5.763]	[-5.570]	[-5.074]
Country FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Group FE	Yes		Yes	
Year FE	Yes		Yes	
Group Year FE		Yes		Yes
Adjusted R^2	0.129	0.032	0.127	0.026
N	256,812	252,415	275,464	274,366

This table presents the results for the robustness check of alternative measures. *NonZ* is a dummy equal to 1 if the firm is not defined as a zombie firm and 0 otherwise. *Frac* is the percentage of assets locked in zombie firms over those of all the firms in the group-year. *Interest_Payment* is the ratio of interest payment over total debt. *Finance_Expense* is the ratio of finance expense over total debt. Appendix 4B displays detailed variable definitions. All continuous variables are winsorized at 1% and 99%. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

4.4.4 The Effect of Zombie Firms on Non-zombies' Default Risk

Zombie firms can spill over onto non-zombies in the group through the internal market and the coinsurance effect, but I still need to verify whether zombie congestion has a real effect on their peers' performance and default risk. I use several proxies for the focal firms' default risk, including profitability (*OROA*), asset growth (*Asset_Growth*), and employment growth (*Emp_Growth*), and regress these default risk proxies on the right-hand variables in Equation 4.1. I expect that firms with higher profitability and asset growth have lower default risk, and therefore lenders will charge lower cost of debt. Table 4.8 presents the results. The coefficient estimates of *NonZ Frac* in Columns 1 and 3 are negative and significant at 1% level (coeff. = -0.015, t-stat = -3.863; coeff. = -0.023, t-stat = -2.578, respectively), while the result for profitability remains significant when I control for business group by year fixed effects. These results suggest that when the zombie fraction is higher in business groups it reduces the profitability and development opportunities of non-zombies, raising their default risk. Also, although non-zombies have higher employment growth rates than zombies, I find no significant result for a spill-over effect of zombie congestion.

Table 4.8: The Effect of Zombie Firms on Non-Zombies' Default Risk

Dependent:	*OROA*		*Asset_Growth*		*Emp_Growth*	
	1	2	3	4	5	6
NonZ	0.022	0.021	0.019	0.018	0.019	0.020
	[13.750]	[11.919]	[5.247]	[4.520]	[4.406]	[4.394]
Frac	0.031		0.001		0.000	
	[8.444]		[0.099]		[0.040]	
NonZ Frac	-0.015	-0.017	-0.023	-0.013	-0.003	-0.007
	[-3.863]	[-3.930]	[-2.578]	[-1.266]	[-0.287]	[-0.541]
Size	0.001	0.001	-0.018	-0.013	0.000	0.000
	[5.659]	[5.595]	[-28.627]	[-18.893]	[0.097]	[0.550]
Leverage	0.001	0.000	-0.077	-0.065	-0.013	-0.007
	[0.359]	[-0.139]	[-21.811]	[-17.168]	[-3.565]	[-1.708]
Tangibility	-0.001	0.001	0.020	0.011	0.017	0.015
	[-0.463]	[0.644]	[6.239]	[3.318]	[4.627]	[3.889]
OROA	0.546	0.600	0.107	0.103	0.118	0.104
	[129.459]	[135.617]	[15.438]	[13.759]	[16.695]	[13.426]
Sales_Growth	-0.004	-0.005	0.016	0.025	0.066	0.076
	[-6.652]	[-6.682]	[9.265]	[12.403]	[22.216]	[23.993]
NegEquity	-0.005	-0.006	0.007	0.003	-0.017	-0.018
	[-3.348]	[-3.995]	[2.227]	[0.890]	[-4.876]	[-4.935]
LnAge	0.003	0.002	-0.005	-0.005	-0.020	-0.019
	[7.897]	[5.879]	[-5.495]	[-4.772]	[-18.412]	[-15.670]
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Group FE	Yes		Yes		Yes	
Year FE	Yes		Yes		Yes	
Group Year FE		Yes		Yes		Yes
Adjusted R^2	0.426	0.453	0.069	0.124	0.067	0.107
N	281,747	281,735	281,740	281,728	195,652	184,807

This table presents the results for the channel tests. *NonZ* is a dummy equal to 1 if the firm is not defined as a zombie firm and 0 otherwise. *Frac* is defined as the percentage of assets locked in zombie firms over those of all the firms in the group-year. *OROA* is the ratio of operating profit before interest and tax (EBIT) over total assets. *Asset_Growth* is the difference between the firm's logarithm of assets and its lag. *Emp_Growth* is the difference between the firm's logarithm of total number of employees and its lag. Appendix 4B displays detailed variable definitions. All continuous variables are winsorized at 1% and 99%. *, **, *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

4.4.5 Further Tests

A. Parent Firm Motivation

Although my main research question concerns the spill-over effect of zombie firms, one may still suspect that parent firms are motivated to develop zombies to achieve certain benefits, and that my result might be driven by group heterogeneity. Therefore, I construct a new sample with 89,362 ultimate owner-year observations to analyze the effect on the ultimate owners. The zombie congestion variable (ZombieFraction) and all control variables are defined as in Equation 4.1, and the model is as follows:

$$y_{t+1} = \quad + \quad Frac + \quad X + FE + \tag{4.3}$$

The outcome variables include the cost of debt ($Interest\_Rate$), profitability ($OROA$), investment ($Asset\_Growth$), and employment growth (Emp_Growth). I control for country, industry, and year fixed effects. As shown in Table 4.9, zombie congestion increases the cost of debt of the ultimate owners, decreases their profitability, and inhibits their employment growth.[17] The results are economically significant as well. Overall, the parent firms have no positive real outcomes from having zombie firms in the group, so I can rule out the potential concern that parent firms might incubate zombies.

[17] In Columns 1 through 4, the numbers of observations are different due to the data availability of different dependent variables. The results are qualitatively the same when I add the zombie status of the ultimate owner to the model as a control variable.

Table 4.9: The Effect of Zombies on Ultimate Owners

Dependent:	*Interest_Rate*	*OROA*	*Asset_Growth*	*Emp_Growth*
	1	2	3	4
Frac	0.035	-0.007	0.001	-0.012
	[2.278]	[-4.771]	[0.239]	[-1.816]
Size	0.017	-0.001	-0.012	0.000
	[6.073]	[-3.124]	[-13.660]	[0.047]
Leverage	-0.470	0.000	-0.066	-0.024
	[-34.345]	[-0.100]	[-14.220]	[-4.052]
Tangibility	-0.076	0.003	0.026	0.005
	[-7.071]	[2.066]	[6.144]	[0.840]
OROA	-0.061	0.562	0.255	0.181
	[-2.148]	[90.171]	[19.680]	[12.166]
Sales_Growth	0.001	-0.003	0.022	0.044
	[0.376]	[-5.183]	[9.932]	[13.034]
NegEquity	0.157	0.002	0.028	-0.007
	[9.244]	[0.667]	[4.159]	[-0.868]
LnAge	-0.015	-0.001	-0.026	-0.025
	[-3.639]	[-1.442]	[-18.139]	[-13.227]
Country FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.05	0.348	0.056	0.029
N	89,362	89,346	89,346	63,872

This table presents the results for the effect of zombie firms on the performance of their ultimate owners. *Frac* is the percentage of assets locked in zombie firms over those of all the firms in the group-year. *Interest_Rate* is the ratio of interest expense over total debt. *OROA* is the ratio of operating profit before interest and tax (EBIT) over total assets. *Asset_Growth* is the difference between the firm's logarithm of assets and its lag. *Emp_Growth* is the difference between the firm's logarithm of total number of employees and its lag. Appendix 4B displays detailed variable definitions. All continuous variables are winsorized at 1% and 99%. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

B. The Effect of Financial Crisis

Because my sample covers the 2008 global financial crisis period, and the financial crisis increases the possibility of firms becoming zombie firms, it is necessary to analyze whether my findings are driven by the global financial crisis. I split the sample into the pre-crisis period (i.e., years 2004, 2005, and 2006), during-crisis period (i.e., years 2007, 2008, and 2009), and post-crisis period (i.e., years 2010 and 2011). I then perform the regression analysis on the three subsamples, and the results are shown in Table 4.10. The coefficient estimates of $NonZ\quad Frac$ in all three periods are positive and significant at the 5% level or better, whether I control for group and year fixed effects or group by year fixed effects. I further test the differences between the coefficient estimates, and do not find any statistically significant difference. This result suggests that, although the prevalence of zombie firms increases due to the financial crisis, it does not have a significant impact on how zombie congestion spills over onto other group members, and my findings are not driven by the global financial crisis.

Table 4.10: The Impact of Financial Crisis

	Dependent Variable: *Interest_Rate*		
	1 Pre-Crisis	2 During-Crisis	3 Post-Crisis
NonZ	-0.317	-0.284	-0.426
	[-3.342]	[-3.854]	[-5.740]
NonZ Frac	0.503	0.447	0.708
	[2.331]	[2.468]	[4.251]
Controls	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Group Year FE	Yes	Yes	Yes
Adjusted R^2	0.04	0.031	0.027
N	75,721	116,467	89,605

This table presents the results for the effect of zombie firms on their group peers' cost of debt before, during and after financial crisis. *NonZ* is a dummy equal to 1 if the firm is not defined as a zombie firm and 0 otherwise. *Frac* is the percentage of assets locked in zombie firms over those of all the firms in the group-year. The dependent variable, *Interest_Rate*, is the ratio of interest expense over total debt. Appendix 4B displays detailed variable definitions. All continuous variables are winsorized at 1% and 99%. *, **, *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

4.5 Conclusion

This paper provides evidence of the spill-over effect of zombie firms on the cost of debt of other group-affiliated firms in the same business group. Zombie congestion in business groups increases non-zombies' cost of debt significantly, and when zombie firms dominate the group, there is no difference between the interest rates charged to non-zombies and zombies. The spill-over takes effect through coinsurance within the internal market of business groups, and the increase in cost of debt works through zombies' spill-over onto non-zombies' default risk and information uncertainty. Zombie firms rely on support from other group members and resource reallocation in the group, and providing such support requires healthy firms to sacrifice their performance, increasing their cost of debt. Group size and diversification also complicate the information environments of business groups, which further intensifies the spill-over effect of zombie congestion. my results are robust to alternative cost-of-debt measures.

This paper contributes to the literature on the impact of zombie firms. Previous literature mostly studies their performance and spill-over effects on industry peers while, as far as I know, this is the first paper providing evidence on their impact in business groups. The findings also imply one possible reason why zombie firms are still alive in the market: support from business groups. Moreover, I make a contribution to the business group literature and improve the understanding of the mechanisms of the internal market and how external stakeholders perceive information about the group. I also shed light on the motives for resource allocation in business groups and how they coordinate members.

This study is also subject to some limitations. First, since the Amadeus database does not provide yearly ownership data, I cannot observe ownership changes for business group members over a longer period. Although this does

not have a big impact on my main findings, the limited data prevent my further tests on how business groups treat zombies in the long run. Second, due to the complications and differences in the literature on business group definition, I am not able to test the robustness of my group identification. The stale listing information does not allow much discretion in distinguishing the controlling rights for public and private firms. Third, although the model of the spill-overs does address some endogeneity concerns, the reason why zombie firms are kept alive may still be endogenous.

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Appendix 4A: Business Group Data Construction

I follow the following steps to construct a data set for business groups and their affiliates based on Shroff *et al.* (2014):

Step 1: Identify the ultimate owners (i.e., a firm where the shareholder with the highest direct ownership is an independent entity. To be an independent entity, the shareholder must be an individual or an entity with no shareholder owning more than 25 percent ownership.) from BvD Amadeus database.

Step 2: Link subsidiaries (Level 1) to ultimate owners if the direct shareholding is more than 25%. I do not consider indirect shareholding through unobservable entities.

Step 3: Link subsidiaries (Level 2) to subsidiaries (Level 1) if the direct shareholding or indirect shareholding through observable entities (Subsidiary Level 1) is more than 25%. Repeat this process for subsidiaries Level 3 and Level 4.

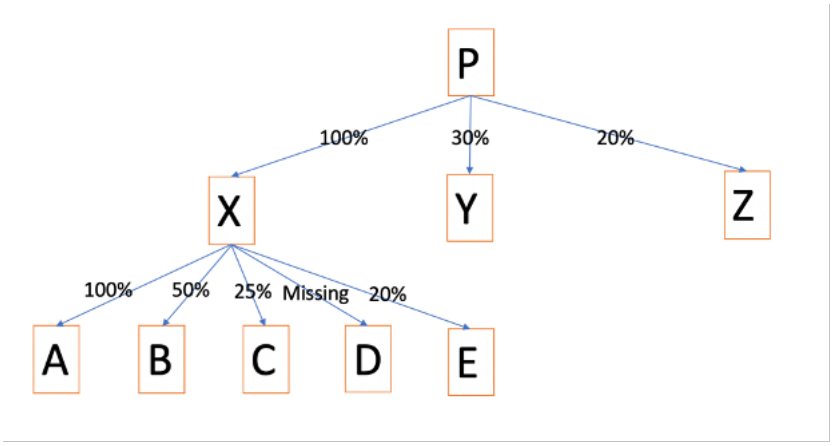

Figure 4.1: One Example of business group data construction

Figure 4.1 displays an example of a business group, with parent firm P and its direct subsidiaries X, Y and Z, and A, B, C, D and E are direct subsidiaries of X. The percentage of direct shareholding is as shown. I calculate the shareholding for all the firms in the business group and decide whether to keep it in the original sample based on the 25% rule.

Table 4.11: One Example of business group data construction

Parent	Subsidiary	Shareholding(%)	Level	Kept in Original Sample?
P	X	100	1	Yes
P	Y	30	1	Yes
P	Z	20	1	No
P	A	100	2	Yes
P	B	50	2	Yes
P	C	25	2	No
P	D	Missing	2	No
P	E	20	2	No

Appendix 4B: Variable Definition

Variable Name	Definition
Panel A: Independent Variables	
$Zombie_{i;t}$	=1 if the firm i is aged 10 years or older in year t and it had an interest coverage ratio less than one for three consecutive years (t 2 to t); 0 otherwise.
$NonZ_{i;t}$	=1 if $Zombie_{i;t}$ equals 0 in year t; and 0 otherwise.
$Frac_t$	Total assets in zombie firms over total assets in all firms in the group in year t.
Panel B: Dependent Variables	
$Interest\_Rate_{i;t}$	The interest expense over average debt for the year t.
$Interest\_Payment_{i;t}$	The interest payment over average debt for the year t.
$Finance\_Expense_{i;t}$	The finance expense over average debt for the year t.
$Asset\_Growth_{i;t}$	The difference between the firm's logarithm of assets in year t and that in year t 1.
$Emp\_Growth_{i;t}$	The difference between the firm's logarithm of the number of employees in year t and that in year t 1.
Panel C: Control Variables	
$Size_{i;t}$	Ln (1 + total assets).
$Leverage$	The book value of debt (long-term debt plus loans in current liabilities) over total assets.
$Tangibility_{i;t}$	Tangible fixed assets over total assets.
$OROA_{i;t}$	The operating profit before interest and tax (EBIT) over total assets in year t.
$Sales\_Growth_{i;t}$	The difference between the firm's logarithm of turnover in year t and that in year t 1.
$NegEquity_{i;t}$	=1 if the firm has a negative equity; and 0 otherwise.
$LnAge_{i;t}$	Ln (1 + the number of years since incorporation).
Panel D: Cross-sectional Variables	
$RelOROA_{i;t}$	=1 if the OROA of the firm is relatively higher in the group-year cluster; and 0 otherwise.
$RelSize_{i;t}$	=1 if the Size of the firm is relatively higher in the group-year cluster; and 0 otherwise.
$RelDebt_{i;t}$	=1 if the net debt (debt minus cash-holding) of the firm is relatively higher in the group-year cluster; and 0 otherwise.
$RelLev_{i;t}$	=1 if the Leverage of the firm is relatively higher in the group-year cluster; and 0 otherwise.
$Closeness_{i;t}$	=1 if the direct parent is a zombie firm or if one or more direct subsidiaries are zombie firms; and 0 otherwise.
$GNum_{i;t}$	=1 if the total number of firms in the group is relatively higher; and 0 otherwise.
$GAsset_{i;t}$	=1 if the total asset of firms in the group is relatively higher; and 0 otherwise.
$GSales_{i;t}$	=1 if the total sales of firms in the group is relatively higher; and 0 otherwise.
$GEmp_{i;t}$	=1 if the total employment of firms in the group is relatively higher; and 0 otherwise.

$GInd_{i;t}$	=1 if the number of 3-digit SIC industries of firms in the group is relatively higher; and 0 otherwise.
$Divers_{i;t}$	=1 if the unrelated diversification (Byun *et al.*, 2013) of the group is relatively higher; and 0 otherwise.

Chapter 5

Conclusion and Perspectives for Future Research

5.1 Conclusion

To summarize, this thesis studies three distinct research questions on government subsidies and zombie firms.

The first essay studies the effect of government subsidies on analyst forecast accuracy. Using a sample of Chinese listed firms during 2007–2016, I find that government subsidies improve the forecast accuracy of sell-side analysts. Sell-side analysts, as important financial intermediaries, play an essential role in representing the quality of information environment. My findings suggest that subsidized firms have better information quality. Cross-sectional tests indicate that firms with more opaque information environment and firms with greater negative publicity have stronger incentives to improve their information environment when they receive subsidies. The results are robust to a battery of sensitivity tests. This essay contributes to the literature on the financial reporting outcomes of government subsidies and factors influencing analyst forecast behaviour. While existing literature mainly studies the economic consequences of government subsidies, this essay adds to evidence on the effect of subsidies on capital market participants. With existing research on analyst properties and firm financial characteristics, this paper also sheds light on the political factors driving analyst forecast behaviour.

The second essay studies the effect of socio-political scrutiny on voluntary subsidy disclosure. Based on a regulatory shock that increases scrutiny on zombie firms in China, I conduct a difference-in-differences analysis and find that the treated firms reduce their disclosure about the source, policy basis and project names of the subsidies received after the shock. Cross-sectional analyses demonstrate that the effect is stronger for firms with higher media attention, more dependence on government support, and political connections. The overall findings indicate that when firms face intensive scrutiny from social and political stakeholders, they have incentives to reduce voluntary disclosure

about government subsidies. This essay extends current research on the disclosure pattern of government subsidies through a direct examination about the effect of socio-political scrutiny. Besides, it also adds to studies on the effect of stakeholders on firm information disclosure and provides evidence that external scrutiny can affect firms' disclosure incentives.

The third essay studies the spill-over effect of zombie firms on the cost of debt of other affiliates in the same business group. Utilizing a sample of European business group affiliates, I find that zombie congestion increases the interest rates of non-zombie firms in the group, and when zombie firms dominate the group, non-zombies suffer from the same level of high cost of debt as zombie firms. Cross-sectional tests on firm characteristics show that the effect is more pronounced for firms with more pledgeable income, less financial constraints, and closer relationships with zombies, while tests on group characteristics show that the effect is stronger in larger and more diversified business groups. Further tests reveal that zombie congestion increases the default risk of other affiliates and the ultimate controllers through inhibiting their investment and profitability. The overall findings demonstrate the underlying mechanism of coinsurance within business groups and the information complexity for external stakeholders. This essay contributes to the literature on the impact of zombie firms. While existing studies mostly focus on their own performance and their negative externality to industrial peers, this is the first study providing direct evidence on their impact in business groups. The findings also imply that group affiliation might be a potential reason why zombie firms are prevalent and stubborn. Besides, it also adds to the business group literature through providing more evidence on the coinsurance effect within groups and illustrating how external lenders understand information of group affiliates.

5.2 Limitations and Suggestions for Future Research

Admittedly, this thesis is subject to some limitations. First, the generalizability of my findings is not testable. Since China is the only large economy with sufficient data about mandatory subsidy disclosure, and the Chinese institutional setting is unique for its strong government intervention, it is not clear how market participants in other countries perceive subsidies and how firms in other countries disclose subsidy information. Also, the systematic differences of business groups across countries (Holmes *et al.*, 2018) also restrict my findings to group- and country-level characteristics. Second, limited data availability restrains my sample. In Chapter 3, due to the changes of regulations and accounting principles on government subsidies in China, I can only use a four-year sample period to analyse the effect of regulatory shock on disclosure incentives of subsidies, and the short sample does not allow me to observe a long-term effect. In Chapter 4, since the BvD Amadeus database does not provide yearly update of the ownership data, I cannot observe the ownership changes for business group members, and the stale information does not provide much discretion to test how business groups treat zombie firms in the long run. Third, although I use a battery of methodologies including firm fixed effects, instrumental variables and difference-in-differences approach to mitigate the endogeneity issue, there may still be omitted variables that could affect my interpretation of the findings as causal relations.

Overall, this thesis reveals several opportunities for future research on government subsidies and zombie firms. First, *do the effect of government subsidy and the effect on its disclosure pattern also apply to firms in other countries?* So far, studies on government subsidies mainly focus on the Chinese setting, while the FASB just required firms listed in the United States to disclose sub-

sidy information since 2021. Therefore, more research on subsidies with firms in other countries could be done in the future. Second, and relatedly, *do different institutional settings in different countries affect the financial reporting outcome and disclosure pattern of government subsidies?* Government subsidies, as an essential tool of government intervention, can reflect political influence on the economy. Conducting international research can improve understanding of how institutional characteristics shape subsidy disclosure and how market participants in different backgrounds perceive the outcome of subsidies. Third, *what is the spill-over effect of zombie firms on related affiliates in multinational enterprises?* Although I have provided some evidence with European firms, which geographically and economically connect to each other closely, a larger sample with subsidiaries in more countries can shed new light on the effect of zombie congestion. Another related question is *why business groups keep zombie firms alive*. While existing literature has explained the underlying mechanisms through which banks, governments and downward interest rates create zombies, the motivation of business groups is still under-examined, considering the negative externality of zombie firms to group affiliates.

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