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說英語有助於創新嗎？來自台灣的證據

Does Speaking English Help Innovation? Evidence from Taiwan

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摘要

本研究旨在探討發行英文財務報告是否能提升企業創新。我主張發行英文財務報告可以提升企業創新，因為它降低信息不對稱，並降低外國投資者的資金成本，有利於企業獲得更多資源與資金用於創新行為。隨著信息不對稱的減少能使外資更有效地監督企業，因此會使企業更重視長期績效，並致力於有益於長期績效的活動，例如創新。研究結果顯示，強制發行英文財務報告與企業創新呈正相關。此外，本研究結果還發現，強制發行英文財務報告與外資持股比例呈正相關。這些結果表明，英文財務報告可以通過降低信息不對稱來減少語言障礙，吸引外國投資，並提升企業創新。總的來說，研究結果表明，英文財務報告對企業創新有著強大的影響力。

關鍵字：英文財務報導、創新、外資持股

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Abstract

This study examines whether issuing English financial reports can enhance corporate innovation. I argue that issuing English financial reporting can improve corporate innovation by mitigating information asymmetry and reducing foreign investors' capital costs. In turn, it allows businesses to allocate more resources towards innovative activities. Moreover, as the information asymmetry decreases, foreign investors can monitor enterprises more effectively, encouraging corporations to contribute to long-term valued activities, such as innovation. I find that mandatory English financial reporting is positively associated with corporate innovation. In addition, I also find that mandatory English financial reporting is positively correlated with the degree of foreign ownership. These findings indicate that English financial reports can reduce language barriers by reducing information asymmetry, attracting foreign investment, and enhancing corporate innovation. Overall, the results suggest that English financial reporting strongly impacts corporate innovation.

Keywords: English financial reporting, innovation, foreign ownership

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1. Introduction

The prior literature has explored the determinants that affect a firm's innovation, including firm characteristics (e.g., Asensio-López, Cabeza-García, & González-Álvarez, 2018; Hsieh, Yeh, & Chen, 2010; Luong, Moshirian, Nguyen, Tian, & Zhang, 2017), manager characteristics (e.g., Galasso & Simcoe, 2011; Chemmanur, Kong, Krishnan, & Yu, 2019Sunder, Sunder, & Zhang, 2017), capital market (e.g., Dong, Hirshleifer, & Teoh, 2017; Fang, Tian, & Tice, 2014; Nanda & Rhodes-Kropf, 2013), industrial characteristics (e.g., Bloom, Schankerman, & Van Reenen; 2013; Spulber, 2013; Lefebvre, Sorenson, Henchion, & Gellynck; 2016), law and policy (e.g., Bayar, Chemmanur, & Liu, 2016; Bhattacharya, Hsu, Tian, & Xu, 2017; Mukherjee, Singh, & Žaldokas, 2017), and macroeconomics (e.g., Gao & Zhang, 2017; Hsu, Tian, & Xu, 2014; Mukherjee et al., 2017). However, exploring how external shock affects a firm's innovation still does not attract enough attention, especially in the regulation of mandatory English financial reporting.

To address this research gap, this study examines the impact of mandatory English financial reporting on a firm's innovation. Financial reporting/disclosure affects a firm's innovation by reducing information asymmetry (Simpson & Tamayo, 2020), and English financial reporting is a form of financial reporting/disclosure. Issuing English financial reporting is associated with decreased information asymmetry, increased foreign ownership, and increased analyst following (Jeanjean, Stolowy, Erkens, & Yohn, 2015). With language barriers, foreign investors tend to underweight their investment in an international portfolio (Lundholm, Rahman, & Rogo, 2018) or take lower equity stakes in foreign targets (Cuypers, Ertug, & Hennart, 2015), so issuing English financial reporting is crucial for the foreign investor to mitigate their bias. However, English financial reporting also has potentially negative effects on firms, for example, linguistic

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complexity and translation. Brochet, Naranjo, and Yu (2016) show that the consequence of using non-plain English or erroneous expressions during conference calls is that abnormal stock return volatility and trading volume would be lower. Nobes and Stadler (2018) state that poor quality of translation would result in misleading. In other words, linguistic complexity and translation issues in English financial reporting may negatively affect the investor's reactions and capital market. These findings suggest that English financial reporting would affect firms, investors, and the capital market.

I argue that implementing mandatory English financial reporting could enhance corporate innovation for three reasons. Firstly, adopting English financial reporting can alleviate information asymmetry for non-native investors by reducing linguistic distance and language barriers. As English is globally acknowledged as the language of business and finance, the majority of financial information is disseminated in English (Lang & Stice-Lawrence, 2015). Consequently, by presenting financial reporting in English, firms can enhance their visibility and diminish investors' information processing expenses (Jeanjean et al., 2015). Moreover, allowing non-native investors to read and comprehend financial reporting grants them equal access to information as native investors. This equitable access helps reduce information asymmetry between companies and investors (Jeanjean et al., 2015).

Secondly, reducing information asymmetry enables companies to attract more investors, achieve lower capital costs, and engage in innovation activities with more resources. Foreign investors also gain greater capacity to oversee companies effectively. By providing transparent and accessible financial information, companies can effectively communicate their performance and prospects to a broader range of investors (Roychowdhury, Shroff, & Verdi, 2019; Simpson & Tamayo, 2020). This heightened investor interest and confidence can lead to improved liquidity of the stock market, a

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decreased cost of capital, and enhanced access to funding for innovation initiatives. Foreign investors are widely regarded as being particularly attentive to long-term performance in Taiwan. The adoption of English financial reports enables foreign investors to enhance their monitoring capabilities, leading to heightened attention toward long-term performance and a dedicated focus on activities that contribute to sustainable outcomes (Riaz, Ray, Ray, & Kirkbride, 2013), such as innovation.

Finally, English financial reporting has the potential to create a spill-over effect for firms globally, ultimately fostering innovation. Murray et al. (2016) find that increased transparency in financial reporting, as demonstrated by reduced research access costs, plays a pivotal role in encouraging early and late-stage innovation by facilitating the exploration of novel research concepts. Moreover, foreign-owned firms can introduce new technologies and knowledge from their home countries, contributing to the innovation ecosystem of the host country. This influx of ideas and technologies can provide domestic firms with valuable access to innovation resources. Guadalupe et al. (2012) support this notion, showing a significant correlation indicating that foreign ownership positively influences the innovation capabilities of the acquired firm. The presence of foreign ownership can lead to higher levels of innovation, particularly driven by exporting through a foreign parent company.

However, it is important to acknowledge the potential downside of implementing mandatory English reporting, as it could potentially dampen corporate innovation. While performance-based compensation contracts have the potential to align managers' interests with shareholders, promoting risk-taking behavior and fostering a long-term outlook, there is a concern when compensation becomes tied solely to accounting metrics. This can result in managerial myopia (Graham, Harvey, & Rajgopal, 2005; Stein, 1989, 2003), where managers prioritize short-term earnings at the expense of long-term investments.

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Consequently, managers may forego valuable net present value (NPV) projects to boost current earnings, potentially stifling corporate innovation (Simpson & Tamayo, 2020). On the other hand, Breuer, Leuz, and Vanhaverbeke (2019) suggest that the disclosure of proprietary knowledge through financial reporting may diminish incentives for innovation. This implies that implementing mandatory English financial reporting could potentially dampen innovation levels within firms. However, it is crucial to consider that the impact of disclosure on innovation is influenced by multiple channels, such as financing, compensation, and learning. Thus, the overall effect of mandatory financial reporting on innovation entails a complex balance among these channels. In conclusion, there is a possibility that mandatory English financial reporting could have a reducing effect on a firm's innovation.

In addition, I argue that mandatory English financial reporting can improve corporate innovation, especially in companies with higher foreign ownership. Guadalupe, Kuzmina, and Thomas (2012) indicate that foreign ownership is positively related to firm innovation. The increased market access and resources that come with foreign ownership can provide the acquired firm with the opportunities and resources it needs to innovate, mainly due to exporting through a foreign parent. Additionally, firms enjoy greater benefits from increasing their process innovation with the simultaneous introduction of new machines and organizational practices. Foreign institutional investors (FII) can have a positive influence on firm innovation. A study by Luong et al. (2017) found that FIIs have a causal effect on corporate innovation, even after controlling for other factors that could affect innovation. Foreign institutional investors (FIIs) can help to improve firms' innovative efforts by actively monitoring firms, having more tolerance for failure, and facilitating knowledge spillovers from high-innovation economies.

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Since 2018, the Taiwanese government has implemented a regulatory requirement for listed companies to disclose their financial reporting gradually in English. Subsequent amendments in 2022 extended this requirement to encompass all companies whose stock is exchanged in the Taiwan Stock Exchange (TSE) market, ensuring the submission of English financial reports.[1] This regulation provides a quasi-nature experiment for me to investigate the impact of mandatory English financial reporting on a firm's innovation. Besides, I adopt a Difference-in-Difference design to mitigate the endogenous issue and investigate the effect of mandatory English financial reporting on a firm's innovation. To extend the investigation, I also test the results of mandatory English financial reporting on a firm's innovation with different levels of foreign ownership.

The empirical findings align with my hypothesis that the implementation of mandatory English financial reporting improves the firm's innovation. Besides, the effects of mandatory English financial reporting on a firm's innovation only appear with higher foreign ownership. Those results indicate that the benefits of adopting English financial reporting, including lower information asymmetry, improved reputation among international investors, increased visibility in the global market, attracted foreign ownership, etc., help the firm's innovation.

This study contributes three ways to the literature on adopting English financial reporting. I offer a novel explanation and understanding by integrating the viewpoints of Simpson and Tamayo (2020) with my research. First, my study provides evidence consistent with the suggestion by Simpson and Tamayo (2020) that adopting English financial reporting can decrease information asymmetry between companies and non-native investors. Thus, my research provides a fresh perspective for understanding the impact of adopting English financial reporting on firm behavior. It highlights the potential

[1] I will disscuss the regulation more in section 2.2.1.

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for firms to address the potential positive consequences of adopting English financial reporting through specific benefits, such as reducing information asymmetry and attracting foreign investors. This novel explanation and understanding hold significant theoretical and practical implications for the field of English financial reports and corporate innovation research.

Second, my study contributes to the advancement of our comprehension of the consequences of English reporting and their economic consequential effects on firms' behavior. Specifically, I examine the influence of adopting English on the phenomenon of corporate innovation and further investigate the impact of a nation's adopting English financial reports implementation and subsequent changes on a firm's information asymmetry to increase foreign investments. This valuable contribution extends the existing body of knowledge in the field of corporate innovation.

Third, my research elucidates the significant economic consequences of English financial reports within the framework of financial, compensation, and learning channels (Simpson & Tomayo, 2020). By delving into the interplay among benefits of English financial reports, corporate innovation, and information asymmetry, I underscore the critical importance of considering information asymmetry, transparency, and liability when addressing the adoption of English financial reports on firm behavior. This contribution enriches the evolving literature on English financial reporting and its consequential effects on corporate outcomes.

In Section 2, I describe the literature review regarding the influence of disclosure and adopting English financial reports and the determinates of innovation. In Section 3, I develop our hypotheses. In Section 4, I describe our sampling, data sources, measurement techniques, empirical models, and variables. In Section 5, I present my empirical results. I present a discussion of the research in Section 6 and conclusions in Section 7.

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2. Literature Review

2.1 Financial Reporting and Disclosure

Roychowdhury et al. (2019) argue that financial reporting can help investors make more informed investment decisions by reducing information asymmetry and uncertainty. Reducing information asymmetry can lead to reduced adverse selection and moral hazard, which can improve investment efficiency. Financial reporting can also mitigate information uncertainty, promote peer learning, and collect new information from reporting requirements, all of which can enhance a firm's decision-making system and improve investment efficiency.

Simpson and Tamayo (2020) extend the work of Roychowdhury et al. (2019) and focus on three channels for how financial reporting and disclosure affect a firm's innovation: financing, compensation, and learning. From the aspects of financing channel, financial reporting and disclosure may affect innovation by improving access to external financing. Transparent disclosures reduce information asymmetry, enabling innovative firms to attract capital at lower costs (Botosan, 1997; Healy, Hutton, & Palepu, 1999; Diamond & Verrecchia, 1991; Leuz & Verrecchia, 2000). From the compensation channel, financial reporting could mitigate moral hazards related to adverse selection among managers. It can improve investment efficiency by aligning managers' interests with those of shareholders through performance-based compensation contracts. However, it can also cause managerial myopia if linked to short-term earnings or specific earnings targets. For the last one, learning channel, financial reporting and disclosure can play a significant role in fostering innovation by facilitating knowledge sharing and learning between firms. By disclosing information about their innovative activities and outcomes, firms can provide valuable insights to other firms, which can help them to learn from

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successes and avoid pitfalls. This can promote a culture of innovation and knowledge diffusion in the business ecosystem, which can lead to increased innovation overall.

In this section, I use the framework of Roychowdhury et al. (2019) and Simpson and Tamayo (2020) to provide a literature review of the effect of financial reporting and disclosure on a firm's behavior. Figure 1 presents a simplified classification of the financial reporting and disclosure literature.

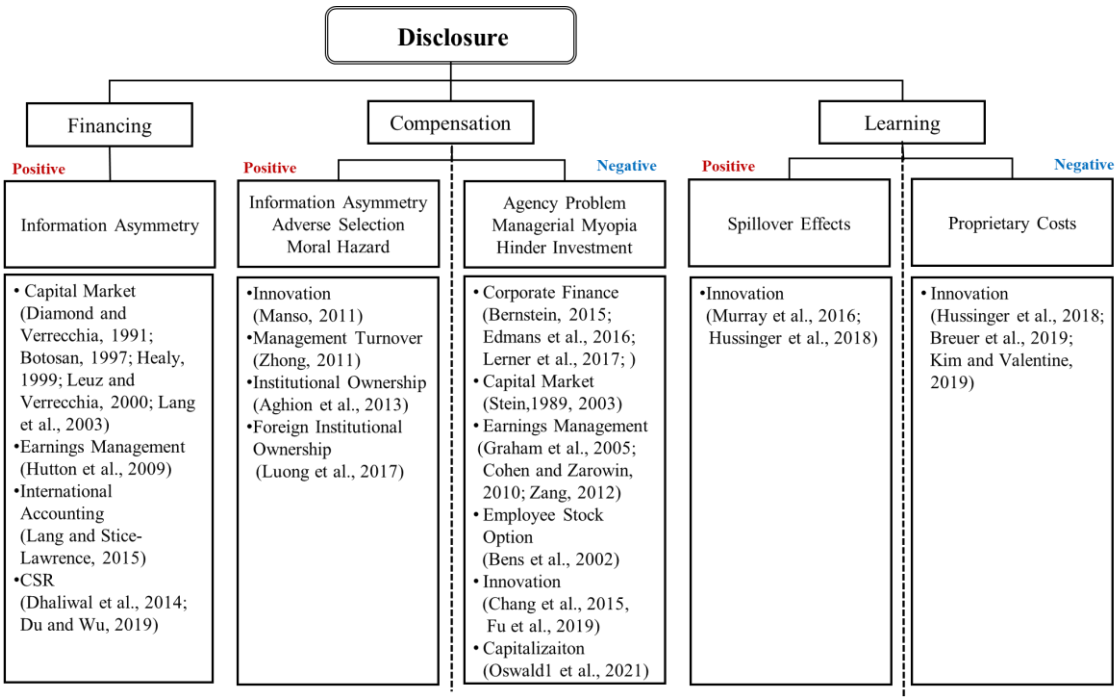

Figure 1 Structure of the Theory on Disclosure

2.1.1 Financing Channel

More transparent disclosure reduces the information asymmetry between managers and capital providers, increasing the availability of external financing and reducing its cost, thereby affecting firms' behavior (Simpson & Tamayo, 2020). For example, accounting information could reduce adverse selection problems between the firm and new investors, then attracting new investors who provide capital and enabling financially constrained firms to pursue new investment opportunities (Myers & Majluf, 1984; Roychowdhury et al., 2019). When investors have less information than managers about

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a firm's investment opportunities, they may be reluctant to invest or demand a higher return, increasing the cost of capital. Hutton, Marcus, and Tehranian (2009) find that firms with more opaque financial reports are more likely to experience a financial crisis, suggesting that financial reporting transparency can reduce information asymmetry and improve investment efficiency. Furthermore, Lang, Lins, and Miller (2003) found that cross-listing in the U.S. improves a firm's information environment and increases market value., suggesting that financial reporting can improve investment efficiency by reducing information asymmetry. Effective disclosure practices can help companies build trust and credibility with stakeholders and can also reduce the cost of raising external capital. This is because more transparent disclosures can help to reduce adverse selection costs, which are the costs that investors incur when they are unable to fully assess the risk of an investment. (Botosan 1997; Diamond & Verrecchia 1991; Healy et al. 1999, Leuz & Verrecchia 2000).

Prior literature also provides evidence of the effect of financial reporting and disclosure via financing channel. Leuz and Verrecchia (2000) examined the economic consequences of increased disclosure through a study on German firms that switched from the German reporting regime to an international one (IAS or U.S. GAAP). The findings demonstrated that these firms experienced a decrease in the cost of equity capital and an increase in the proportion of equity financing after the switch. This suggests that increased disclosure can have measurable economic benefits for firms. Additionally, firms with international reporting strategies exhibited a 25% higher median turnover compared to other firms. These findings support the notion that a firm's commitment to greater disclosure can lower costs of capital arising from information asymmetries. Lang and Stice-Lawrence (2015) conducted a comprehensive study on the relationship between textual attributes in annual reports and transparent disclosure. They found a clear

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correlation between textual characteristics and key economic outcomes like liquidity, institutional ownership, and analyst following. Dhaliwal, Li, Tsang, and Yang (2014) found that the issuance of corporate social responsibility (CSR) reports reduces the cost of equity capital and analyst forecast error, suggesting that CSR reports contain credible information about CSR performance and are relevant for assessing firm performance. Du and Wu (2019) examined the readability and tone of CSR reports and their impact on the stock market; they investigate whether the readability and tone of CSR reports can predict future CSR performance and whether these textual attributes are value-relevant to the stock market.

2.1.2 Compensation Channel

Positive Effects

Simpson and Tamayo (2020), the compensation channel can help to mitigate moral hazard problems by making it easier to monitor managers' investment decisions through the use of accounting numbers in compensation contracts. More transparent disclosures in financial reporting can facilitate this monitoring by making accounting numbers more reliable and informative.

Manso (2011) argues that incentive schemes that reward long-term achievements while also accepting initial failures are essential for motivating innovation. He found that a comprehensive compensation plan, job security, and prompt feedback on performance are all important elements of such schemes. When it comes to managerial compensation, an optimal incentive scheme that encourages innovation can be realized through a combination of strategies such as extended vesting periods for stock options, option repricing, implementing golden parachutes, and establishing managerial entrenchment.

Zhong (2018) finds that firms with more transparent financial reporting were more likely to invest in research and development (R&D). This is because transparent financial

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reporting makes it more difficult for managers to engage in opportunistic behavior, such as cutting R&D spending to boost short-term earnings.

Institutional ownership and foreign institutional ownership have been found to positively impact innovation outputs by increasing monitoring and knowledge spillovers. For example, Aghion, Van Reenen and Zingales (2013) find that firms with higher levels of institutional ownership were more likely to introduce new products. This is because institutional investors have a strong incentive to monitor managerial behavior and ensure that firms are investing in innovation. Luong et al. (2017) highlight that foreign institutional ownership plays a dual role by actively monitoring and promoting knowledge spillovers from economies with advanced innovation capabilities. Consequently, this results in heightened levels of innovation.

Negative Effects

Accounting numbers can cause managerial myopia, particularly when the market places a strong emphasis on short-term earnings or specific earnings targets. (Simpson and Tamayo, 2020). For example, Stein (1989.) finds that managers may forgo long-term projects with uncertain payoffs in favor of shorter-term projects with lower net present values (NPVs) because they are often rewarded for short-term performance. CEOs may forgo profitable investments to strengthen earnings, a phenomenon known as managerial myopia (Graham et al. 2005). This type of managerial myopia is likely to be more pronounced for assets that are difficult to measure and have delayed payoffs, such as innovation (Stein, 2003).

Managers who are concerned about their own job security may divert resources away from innovative activities, even if these activities would be in the best interests of the company (Bernstein, 2015; Lerner & Seru., 2017; Simpson & Tamayo, 2020). Roychowdhury (2006) documents that firms use cuts in R&D spending to meet zero or

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positive earnings benchmarks, among other earnings management dials; managers may reduce R&D spending to improve their short-term financial performance. Research has shown that managers may be more likely to cut R&D spending to boost their own compensation or to meet short-term financial targets. As exemplified by Bens, Nagar, and Wong's (2002) research findings, there exists a discernible correlation indicating a reduction in research and development (R&D) expenditure during periods when stock options are exercised by companies. A discernible observation in Edmans, Heinle, and Huangs' (2016) research reveals that companies led by managers holding vested equity demonstrate a notable tendency towards lower rates of growth in research and development (R&D) activities, as well as capital expenditure. Cohen and Zarowin (2010) find that managers may cut R&D spending around SEOs to boost their short-term financial performance. Zang (2012) conducts an investigation that meticulously examined the trade-off between accruals-based and real earnings management. The study's significant finding indicates that, in most instances, managers tend to prioritize decisions related to engaging in real earnings management before resorting to decisions involving accruals-based earnings management.

Furthermore, there is also evidence that managers may increase R&D spending in certain circumstances. For example, Oswald et al. (2019) shed light on an intriguing phenomenon within U.K. firms. Specifically, their research reveals that firms that opted to expense their research and development (R&D) expenditures before the implementation of International Financial Reporting Standards (IFRS) exhibit a distinct behavior when they transition to mandatory capitalization. These firms demonstrate a noteworthy increase in their R&D expenditures compared to those firms that continue to capitalize on such expenses. In the empirical investigation carried out by Chang et al. (2015), a significant relationship is unveiled between conditional conservatism and

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managerial decisions concerning research and development (R&D) expenditures. The findings indicate that the presence of conditional conservatism tends to prompt managers to reduce R&D expenditures. However, this adverse impact is notably amplified in situations where CEO compensation is strongly contingent on the firm's accounting performance. Fu et al. (2019) conduct a comprehensive study that offers compelling evidence regarding the impact of reporting frequency on innovative output within organizations. Notably, their research findings establish a statistically significant negative relationship between higher reporting frequency and the level of innovative output. The researchers attribute this phenomenon to the escalation of short-term pressure on managers, which appears to hinder their ability to prioritize and sustain long-term innovative endeavors.

The compensation channel can lead to managerial myopia, which can, in turn, lead to suboptimal investment decisions in innovation. This is especially likely when the market focuses on short-term earnings or specific earnings goals. There is evidence that this effect is exacerbated by managerial career concerns and by the use of accruals-driven earnings management. The literature also suggests that mandatory capitalization of R&D expenditures and lower reporting frequency can help mitigate the negative effects of the compensation channel on innovation. Additionally, it highlights the importance of understanding how institutional pressures and regulatory environments can influence information disclosure practices among multinational corporations in host countries.

2.1.3 Learning Channel

Positive Effects

Simpson and Tamayo (2020) emphasize the significance of financial reporting in the context of innovation. Their study highlighted the learning channel, which pertains to the role of financial reporting in disseminating information and knowledge among market

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participants. Effective and transparent disclosures play a pivotal role in mitigating information asymmetry between company insiders, particularly managers and external capital providers. By doing so, such disclosures can significantly improve the accessibility of external financing and concurrently reduce its associated cost. This positive financial environment created by enhanced transparency has the potential to stimulate and foster innovation within the organization.

The academic literature also emphasizes the favorable impact of financial reporting on fostering innovation, specifically through learning mechanisms. As investors gain deeper insights into a company's innovative endeavors, this can trigger spillover effects that encourage further exploration of novel ideas, ultimately contributing to the advancement of aggregate innovation. Murray, Aghion, Dewatripont, Kolev, and Stern (2016) have conducted a study revealing that heightened openness in financial reporting, exemplified by reduced research access costs, plays a crucial role in facilitating early and late-stage innovation by promoting the exploration of pioneering research concepts.

Negative Effects

It is essential to consider the potential drawbacks of financial reporting concerning innovation. Dissemination of proprietary knowledge through mandatory disclosure may lead to reduced ex-ante incentives for innovation as the likelihood of redistribution of innovation rents among peers, suppliers, and customers increases (Breuer et al., 2019). Kim and Valentine (2019) focused on the asymmetric effects of disclosure regulations. Their research revealed a noteworthy pattern wherein certain firms experienced heightened innovation when their rivals disclosed more information following the AIPA. Conversely, other firms faced a decrease in innovation as a result of their disclosures being made available to competitors.

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In the realm of disclosure regulations, Hussinger, Keusch, and Moers (2018) conducted a study to assess the consequences of the disclosure regulation introduced by the America Inventors' Act (AIPA) on the patent practices of listed firms. Contrary to conventional expectations, the study revealed that the decline in patenting activity is not attributed to a decrease in R&D investments. Instead, an intriguing strategic shift occurred, with firms transitioning from a patenting approach to a trade secret, which consequently impacted the overall transparency of R&D-intensive enterprises.

Hussinger et al. (2018) have presented compelling evidence regarding the effects of the AIPA (Amendment to the Indian Patents Act) disclosure regulation. Their findings indicate a noticeable reduction in patenting activity among publicly listed firms as a consequence of this regulation. Surprisingly, however, the study reveals that the impact on R&D investment remains unaffected. Instead, firms have adapted their strategies by shifting from patenting to embracing secrecy. Unfortunately, this change harms the overall transparency of firms that conduct a lot of research and development.

Kim and Valentine (2019) find that the effect of AIPA disclosure regulation is asymmetrical. Firms whose rivals reveal more information after AIPA experience an increase in innovation, while firms whose own disclosures are divulged to competitors experience a decrease in innovation. These results underscore the dual nature of R&D investment, which can generate both spillover benefits and proprietary costs. Firms subject to the AIPA disclosure regulation may strategically disclose their patents in an attempt to mitigate the proprietary costs associated with compliance. However, it is important to note that these disclosure decisions may not fully offset the overall costs of disclosure.

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2.2 English Financial Reporting

To improve the quality of information disclosure and help foreign investors obtain the required English information more conveniently to attract foreign investment, Taiwan's government revised and issued new regulations asking listed companies in Taiwan to issue English financial reporting since the fiscal year of 2018.

The literature on English financial reporting is limited, so I also use the literature regarding linguistics. For the positive effect of issuing English financial reporting, the arguments focus on reducing information asymmetry (e.g., Hinds, Neeley, & Cramton, 2014; Jeanjean, Lesage, & Stolowy, 2010), linguistic distance (e.g., Cuypers et al., 2015), investor bias (Lundholm, 2018), etc. On the other hand, the arguments for the negative effects of English financial reporting focus on linguistic complexity (e.g., Brochet et al., 2016) and translation complexity (e.g., Nobes & Stadler, 2018).

In this section, I will first introduce the regulations in Taiwan and then provide a literature review of English in business and reporting. Figure 2 presents a simplified classification of the related literature.

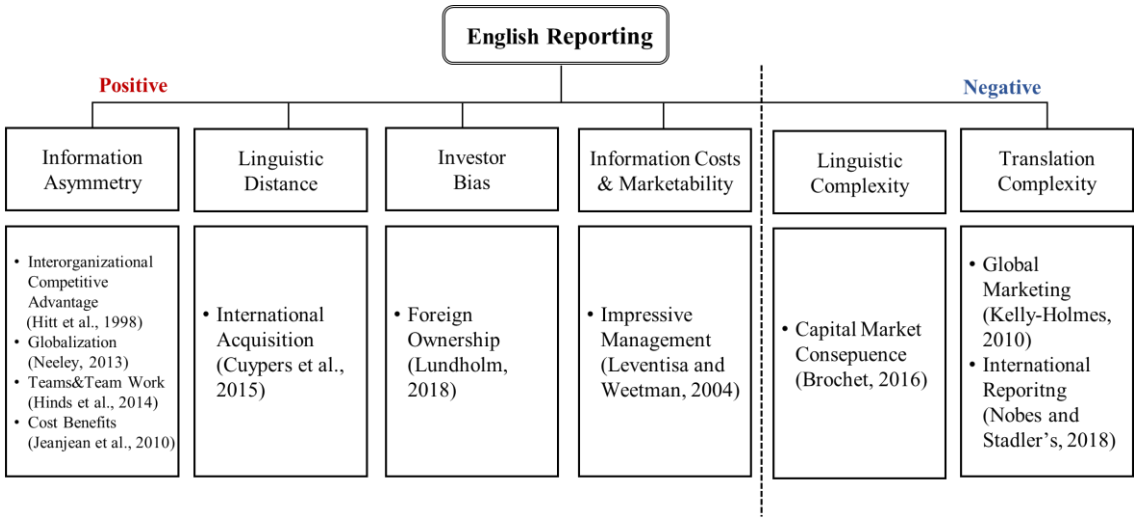

Figure 2 Structure of the Theory on English Reporting

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2.2.1 Regulations of English Financial Reporting in Taiwan

There are two regulations in Taiwan regarding the mandatory issue of English financial reporting, "Taiwan Stock Exchange Corporation Rules Governing Information Filing by Companies with TWSE Listed Securities and Offshore Fund Institutions with TWSE Listed Offshore Exchange-Traded Funds" [2] and "Taipei Exchange Rules Governing Information Reporting by Companies with TPEx Listed Securities."[3] The first regulates the company's stock exchange in the TSE market, and the second regulates the company's stock exchange in the Over-the-Counter (OTC) market.

For the TSE companies, on August 28, 2018, the regulation required the companies with the common stock to have achieved NT$10 billion, or the total shareholding of foreign investors achieved 30% to issue English financial reporting since the fiscal year 2018. on September 30, 2020, the regulation required the companies with the common stock to have achieved NT$2 billion to issue English financial reporting since the fiscal year 2020 and all the TSE companies to issue English financial reporting since the fiscal year 2022.

For the OTC companies, on August 30, 2018, the regulation required the companies with common stock to have achieved NT$10 billion, or the total shareholding of foreign investors achieved 30% to issue English financial reporting since the fiscal year 2018. on October 7, 2020, the regulation required the companies with common stock to have achieved NT$2 billion to issue English financial reporting since the fiscal year 2020 and the companies with common stock to have achieved NT$600 million to issue English financial reporting since the fiscal year 2022.

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[2] The rule is also available in its English version on the website provided below:
http://eng.selaw.com.tw/LawArticle.aspx?LawID=FL007250&ModifyDate=1100409

[3] The rule is also available in its English version on the website provided below:
http://eng.selaw.com.tw/LawArticle.aspx?LawID=FL007526&ModifyDate=1120206

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Table 1 presents the timeline and requirements for mandatorily issuing English financial reporting.

[insert Table 1 here]

2.2.2 Positive Effects

Information Asymmetry

From the international business aspect, language barriers are an essential issue, and they would induce information asymmetry. Language barriers can significantly affect international business communication. Overcoming language barriers to reduce information asymmetry is critical for facilitating international trade and investment, building successful business relationships, and achieving global market objectives. Studies have shown that misunderstandings arising from language differences can hinder effective negotiations, collaboration, and decision-making in cross-border transactions (Hinds et al., 2014; Neeley, 2013). Language proficiency is essential in international negotiations and decision-making processes. Companies with language expertise gain a competitive edge in navigating complex negotiations and resolving disputes (Hitt, Keats, & DeMarie, 1998). Adopting English as a common language in financial reporting and communication can attract foreign investors and expand global market access (Jeanjean et al., 2010).

In today's globalized economy, the adoption of English financial reports by non-English-speaking countries has become increasingly prevalent. Jeanjean et al. (2010) examine why non-English-speaking countries publish their annual reports in English. One significant motivation for non-English-speaking countries to publish their financial reports in English is the economic consequence it entails. By communicating in English, companies can reduce information asymmetry by mitigating language barriers and

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making their financial statements more easily understandable to international investors, thereby expanding the base of potential shareholders.

Linguistic Distance

Cuypers et al. (2015) examine the impact of linguistic distance and lingua franca proficiency on equity stake decisions in cross-border acquisitions. The findings reveal that greater linguistic distance corresponds to a lower stake acquired by the acquirer. Additionally, proficiency in a lingua franca, particularly English, plays a crucial role in reducing information asymmetry and potentially influencing stake acquisition decisions. In other words, English plays a crucial role in reducing linguistic distance and would positively affect international acquisition.

Investor Bias

Investor bias refers to the tendency of investors to underweight or overweight certain stocks or markets based on various factors. In the context of the documents provided, the term "home bias" or "foreign investor bias" is used to describe the phenomenon where international investors tend to underweight foreign stocks in their portfolios (Lundholm et at., 2018). This bias is particularly relevant when examining foreign investors' investment decisions concerning Quebec firms. Lundholm et at. (2018) analyze the impact of language differences between investors and firms on investment decisions and suggest that language-related attributes, such as differences in accounting rules, cultural norms, and language, can contribute to foreign investors' underweighting of Quebec firms.

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Information Costs and Marketability

According to Leventis and Weetman (2004), disclosure in Greek Listed Companies in 1997 examines the voluntary disclosure practices of Greek listed companies during a period of significant expansion in the Athens Stock Exchange. Despite no legal mandate, Greek firms commonly adopt annual reporting, supplementing mandatory financial statements with voluntary information. Some companies opt for English reports, possibly aiming to compete globally and enhance their reputation. Bilingual reporting correlates with higher transparency, cost reduction for investors, and responsiveness to market pressures. This study provides evidence that companies reporting solely in Greek do so to offset bad news, meet legal obligations, and address diverse factors affecting disclosure. In other words, dual language reporting allows companies to cater to a broader stakeholder group by using both their native language and English in financial disclosures, and bilingual reporting correlates with higher transparency, cost reduction for investors, and responsiveness to market pressures.

In conclusion, the adoption of English financial reports in non-English-speaking countries is a strategic decision aimed at overcoming language barriers, attracting foreign investment, and enhancing global visibility. By leveraging the benefits of English reporting, these countries seek to facilitate cross-border communication, foster transparent financial disclosures, and increase their international competitiveness.

2.2.3 Negative Effects

Linguistic Complexity

Linguistic complexity can significantly impact capital market reactions to information disclosures. Jeanjean et al. (2015) delve into the effects of language complexity, vividness, tone, and readability on foreign investment and stock liquidity. Language complexity can impact foreign investors' ability to comprehend financial

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information accurately, influencing their investment decisions. Companies that aim to attract foreign investors and expand their shareholder base need to consider the language used in their annual reports and ensure that it is easily understandable to a diverse international audience. Brochet et al. (2016) highlight how the degree of "Frenchness" of firms influences U.S. investors' reluctance to invest in Quebec stocks and document that non-plain English and erroneous expressions resulting from language barriers can reduce the transparency of verbal disclosure, leading to varied market reactions. In conclusion, language plays a crucial role in international business and financial reporting. Clear communication through plain English enhances transparency and reduces information asymmetry, boosting stakeholder confidence.

Translation Complexity

International marketing and advertising campaigns face challenges related to language and cultural nuances. Kelly-Holmes (2010) emphasizes the importance of clear and accurate translations to avoid misleading messages and varying market reactions. Companies need to consider language complexities and cultural sensitivities to ensure effective communication and brand perception. Nobes and Stadler's (2018) study investigated the difficulties of translating accounting terms, focusing on the term "impairment" in IAS 36 in 19 languages. The research stressed the need for accurate and consistent translations in financial reporting, highlighting the implications of misleading terms used for impairment in annual reports. Accurate and consistent translations are essential in financial reporting to avoid misunderstandings and misinterpretations of financial information. Non-English-speaking countries may opt for English reporting to present financial information in a standardized and easily understandable manner to international investors. In brief, firms must also be mindful of challenges related to

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accurate translation, potential information loss, and cultural nuances while presenting financial information in English.

2.3 Innovation

Technological innovation is essential for a country's economic growth and a firm's long-term competitive advantage. Schumpeter (1911), Solow (1957), and Romer (1986) find that innovation is a key driver of economic growth. In alignment with the research conducted by the Organization for Economic Co-operation and Development (OECD) in 2015, innovation is a fundamental driver that significantly influences a nation's economic growth and development. Innovation encompasses a spectrum of elements, such as the integration of technological advancements into physical capital, investments directed towards knowledge-based capital, the augmentation of multi-factor productivity growth, and the dynamic process of creative destruction. Together, these aspects assume a central and indispensable role in shaping the trajectory of a country's economic progress and prosperity.

In the pursuit of understanding the factors that influence innovation, several determinants have been explored in various studies. As shown in Figure 3, in Section 2.3.1, I first review the internal factors and innovation literature. In Section 2.3.2, I review the external factors and innovation literature.

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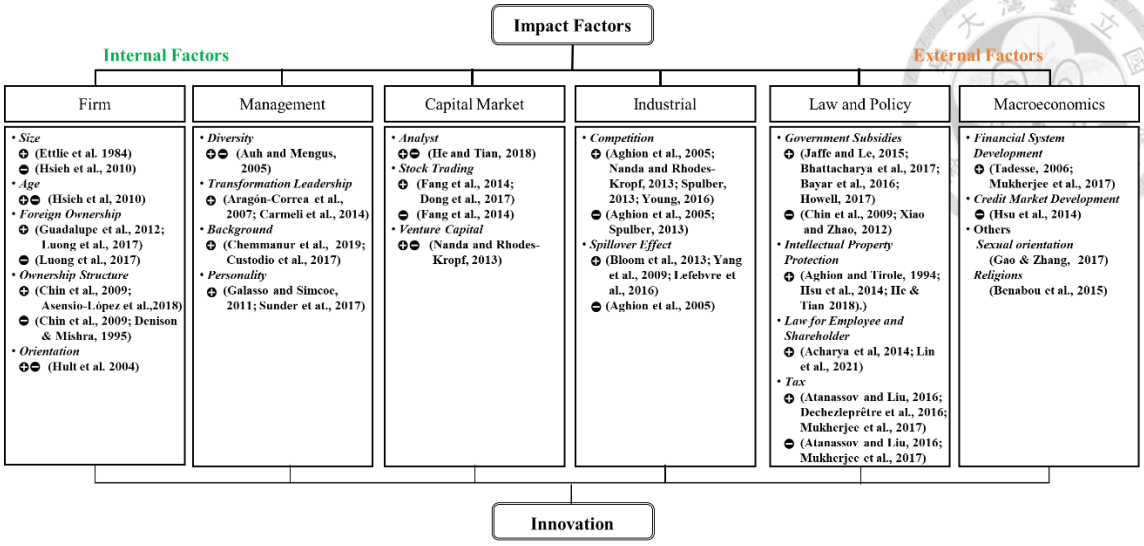

Figure 3 Structure of the Theory on Innovation

2.3.1 Internal Factors

2.3.1.1 Firm Characteristics

Firm Size

The relationship between firm size and innovation has been a topic of debate among scholars for many years. Some argue that larger firms are more likely to innovate due to their access to more resources (Ettlie, Bridges & O'Keefe, 1984), while others argue that smaller firms are more innovative due to their flexibility and responsiveness to change (Bhattacharya & Bloch, 2004). The findings of this study have implications for both scholars and practitioners. For scholars, these findings provide further evidence of the importance of firm size in innovation.

Firm Age

The impact of age on innovation does not have a unified perspective in scholarly research. Some studies suggest that young firms may lack the necessary knowledge and experience to foster innovation, which can hinder their innovation performance (Hsieh et

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al., 2010). Conversely, other research argues that older firms may be more prone to organizational inertia, which can impede their ability to innovate (Hsieh et al., 2010).

Foreign Ownership

Foreign ownership has the potential to introduce new technologies and knowledge to the host country, thereby facilitating innovation among domestic firms. The presence of foreign-owned companies can also intensify competition within the host country, compelling domestic firms to innovate in order to maintain a competitive edge. Additionally, foreign-owned firms may display a greater willingness to invest in research and development (R&D) compared to their domestic counterparts, resulting in increased innovation activities. Furthermore, foreign-owned firms often adhere to superior corporate governance practices, which can create an environment conducive to innovation. Guadalupe et al. (2012) indicate a noteworthy correlation, which suggests that foreign ownership has a positive influence on the innovation capabilities of the acquired firm. This is because foreign ownership can lead to higher levels of innovation driven by exporting through a foreign parent. Luong et al. (2017) also find that empirical evidence suggests a constructive and causative relationship between foreign institutional ownership and corporate innovation by examining samples of 26 non-US countries from 2000 to 2010. This is because foreign institutional investors may actively monitor firms, encouraging a higher tolerance for failure and promoting the diffusion of knowledge from economies with a strong focus on innovation are two key strategies for stimulating innovation. These factors can all improve firms' innovative efforts.

Ownership Structure

Ownership structure can impact a firm's incentives to innovate, as suggested by Ferreira, Manso, and Silva (2014). For example, firms with dispersed ownership may be

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less likely to innovate as they have fewer incentives to invest in long-term projects with uncertain payoffs. On the other hand, firms with concentrated ownership may be more likely to innovate, as their owners have a greater stake in the firm's long-term success. Asensio-López et al. (2018) suggest that the relationship between ownership concentration and innovation can be nonlinear. It explains that low levels of ownership concentration may lead to positive effects on innovation due to incentive alignment and value creation (Chen, Li, Shapiro & Zhang, 2014). However, high levels of ownership concentration, especially in countries with weaker protection for minority shareholders, may result in negative effects on innovation due to risk aversion and diversion of resources (Denison & Mishra, 1995). In Taiwan's electronics industry context, Chin, Chen, Kleinman and Lee (2009) find a negative relationship between ownership structure and innovation. The presence of controlling owners as CEOs or board chairs was associated with reduced innovation in the industry. Agency problems and control divergence were identified as factors contributing to this relationship (Chin et al., 2009).

Orientation

Hult, Hurley and Knight (2004) argue market orientation, learning orientation, and entrepreneurial orientation are all internal antecedents that influence firm innovation. Market orientation is a firm's strategic approach to innovation that is characterized by a proactive and customer-focused orientation. Market-oriented firms are constantly scanning the market for new opportunities, adapting their products, services, and processes to meet the needs of their customers. Learning orientation refers to the firm's ability to acquire, assimilate, and apply new knowledge. Entrepreneurial orientation refers to the firm's willingness to take risks and innovate. Learning orientation emphasizes the acquisition and application of knowledge within the organization, fostering innovation through organizational learning (Hsieh et al., 2010). On the other hand,

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entrepreneurial orientation involves a firm's willingness to take risks, be innovative, and engage in aggressive ventures to create new products or ventures (Hsieh et al., 2010). Both learning and entrepreneurial orientations contribute to a firm's ability to generate and implement innovative ideas.

Overall, orientation plays a critical role in influencing innovation within firms. Whether it is market orientation, learning orientation, or entrepreneurial orientation, these orientations shape a firm's approach to innovation and can have a significant impact on its ability to generate and implement innovative ideas.

2.3.1.2 Management

Diversity

TMT (top management team of a corporate) diversity, which refers to the variety of backgrounds, experiences, and perspectives among a firm's CEO and top management team, has a significant impact on firm innovation. Auh and Menguc (2005) argue that TMT diversity in functional, experience, and educational backgrounds is positively associated with firm innovation. This means that having diversity within the top management team, in terms of different skills, expertise, and educational backgrounds, can contribute to the firm's ability to innovate.

Transformational Leadership

A study by Aragón-Correa et al. (2007) found that transformational leadership was positively associated with firm innovation. The researchers found that transformational leaders were more likely to encourage their employees to be creative and take risks, which led to the development of new products and services. Carmeli, Sheaffer, Binyamin, Reiter-Palmon, and Shimoni (2014) also found that transformational

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leadership was associated with increased levels of employee creativity, which in turn led to increased innovation.

Manager's Background

The prior literature has documented the relationships between manager characteristics and innovation, such as CEO's attitude (e.g., Galasso and Simcoe, 2011), leadership style (e.g., Aragón-Correa et al., 2007), and management quality (e.g., Chemmanur et al., 2019), CEO's skill set and experience (e.g., Custódio, Ferreira, Matos, Custodio, 2017).

Chemmanur et al. (2019) find a significant correlation between top management quality and the successful promotion of innovation. The study states that top management quality plays a critical role in this process by attracting and recruiting highly skilled inventors, thereby fostering a conducive environment for innovation within the organization. The researchers use a comprehensive factor analysis approach to construct a composite metric called the "management quality factor." This metric is derived from various individual proxies, each representing distinct dimensions of management team quality. These proxies included team size, the proportion of managers with MBA or doctoral degrees, and the average level of employment-based and education-based connections among the managerial staff. The study yields compelling results, indicating that superior-quality management teams within private firms play a crucial role in elevating both investment and productivity levels of their innovation projects well in advance of the firms' eventual public listing.

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Manager's Personality

Studies indicate that personality traits can have a significant impact on innovation. CEOs with certain personality characteristics, such as overconfidence, risk-taking, and openness to experience, are more likely to drive innovation success. Galasso and Simcoe (2011) find evidence that firms run by overconfident CEOs have higher levels of innovation, as measured by patent counts. A study of 450 large US public listed firms found that CEOs possessing substantially in-the-money stock options upon full vesting and their propensity to display overconfidence tendencies. Furthermore, Sunder et at. (2017) also provide evidence that the sensation-seeking trait, as exhibited by pilot CEOs, is associated with better innovation outcomes, including patents, diversity, and originality of innovation projects. Boards can utilize these insights to identify and support CEOs who are likely to excel in driving innovation within their organizations.

2.3.2 External Factors

2.3.2.1 Capital Market

Financial market intermediaries, such as financial analysts, have an impact on corporate innovation. Previous studies have generally found that financial analysts play a positive role in information production and dissemination. However, some research suggests that there may be a potential negative effect of analyst coverage on innovation. For example, He and Tian (2013) found that firms with greater analyst coverage produce fewer patents and receive fewer future citations for their patents. This may be due to the pressure to meet short-term earnings targets, which can lead firms to focus on less risky projects that are less likely to lead to innovation.

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Analyst

Previous literature has explored the impact of financial analysts on corporate innovation and has generally highlighted their positive role concerning information creation and communication. However, He and Tian (2018) found that the coverage by financial analysts may have a "dark side" effect on innovation. Their study suggests that firms with greater analyst coverage produce fewer patents and receive fewer future citations for their patents, potentially due to the pressure from analysts to meet short-term earnings targets, impeding investment in long-term innovative projects (He & Tian, 2018).

Stock Trading

In addition to financial analysts, stock market trading and prices can also influence corporate innovation. Fang et al. (2014) state that increased stock market liquidity can impede firm innovation. They suggest that this may be because increased liquidity can lead to the increased risk of hostile takeovers and the influence of institutional investors with short-term investment horizons, which can make it more difficult for firms to invest in long-term projects such as innovation. Conversely, Dong et al. (2017) reveal that stock market overvaluation can stimulate innovation, particularly in terms of investment in innovative projects. They suggest that this may be because overvaluation can lead to increased investment in risky assets, such as innovation, which can have positive spillover effects for the economy as a whole.

Venture Capital

Nanda and Rhodes-Kropf (2013) find that venture capital (VC) investment has positive and negative impacts on startup innovation. On the one hand, VC investment in hot markets, characterized by high investment activity, leads to more extreme success and innovation for the startups that survive. These startups are valued higher at IPO or

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acquisition, file more patents in subsequent years, and have more highly cited patents. This suggests that VC investment during active investment periods stimulates innovation in startups and leads to greater success.

On the other hand, VC investment in hot markets also increases the likelihood of failure for startups. Startups funded in hot markets have a higher probability of going bankrupt compared to those funded in less active investment periods. This indicates that VC investment in riskier and more innovative startups is more prevalent during periods of high investment activity.

2.3.2.2 Industrial Characteristics

Competition in Market

The dynamics of product markets can have a significant impact on the innovation process and firms' incentives to innovate. In some cases, market dynamics can create incentives for firms to innovate, while in other cases, they can discourage innovation. For example, in markets with high levels of competition, firms may be more likely to innovate to differentiate their products and gain a competitive advantage. Conversely, in markets with low levels of competition, firms may be less likely to innovate because they do not face as much pressure from rivals. (He and Tian, 2018). Competition in the product market can have an inverted-U relationship with innovation, where moderate competition stimulates firms to invest in innovative projects (Aghion, Bloom, Blundell, Griffith, & Howitt, 2005). In competitive markets, firms may opt for risky and costly innovative projects to signal their quality and differentiate themselves from competitors (Young, 2016).

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Competition in Intellectual Property

Competition and intellectual property protections are shown to be complementary factors that enhance incentives for innovation (Spulber, 2013). Market competition can help inventors reap the rewards of their innovations by reducing the amount of profit that producers can extract from them. In addition, competition in the market for inventions can help to deter firms from reducing their innovation output in order to achieve monopoly profits. However, when intellectual property is not fully protected, competition can actually stifle innovation (Spulber, 2013).

Spillovers Effect

R&D spillovers refer to the transfer of knowledge and innovation between firms or industries as a result of their research and development activities. These spillovers have been found to have a significant impact on the innovation performance of firms.

Firms can benefit from the R&D efforts of their rivals in two ways: technological spillovers and product market rivalry spillovers (Bloom et al., 2013). Technological spillovers occur when a firm's R&D investments lead to the development of new knowledge that can be used by other firms. Product market rivalry spillovers occur when a firm's R&D investments lead to the development of new products or services that compete with the products or services of other firms. Both types of spillovers can enhance a firm's productivity and profitability (Bloom et al., 2013).

Lefebvre et al. (2016) explore that social capital and knowledge-sharing within learning networks can have a significant impact on knowledge-sharing performance and innovation outcomes. Social capital refers to the norms of trust and reciprocity that exist within a network, while knowledge sharing refers to the process of exchanging information and insights between individuals or groups. When social capital is high,

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individuals are more likely to trust and cooperate with each other, which can facilitate knowledge sharing. Knowledge sharing, in turn, can lead to new insights and innovations.

Yang, Motohashi, and Chen (2009) examine the effectiveness of science parks in promoting innovation in new technology-based firms (NTBFs) by comparing the R&D productivity of firms located within and outside a science park. The results demonstrate that R&D productivity is higher in park firms, indicating the importance of agglomeration and technology spillover effects on innovation (Yang et al., 2009). Overall, these documents highlight the significance of R&D spillovers for innovation. They show that R&D spillovers can enhance a firm's productivity, contribute to knowledge sharing and social capital, and promote innovation within and outside science parks.

2.3.2.3 Law and Policy

Government subsidies

Some studies highlight the positive impact of government subsidies on innovation. For example, Bhattacharya et al. (2017) found that policy uncertainty, rather than policy itself, reduces technological innovation. They observed a significant decrease in patenting outcomes during times of policy uncertainty, especially in more innovation-intensive industries (Bhattacharya et al., 2017). Bayar et al. (2016) proposed that government-funded venture capitalists and subsidy schemes could stimulate socially desirable fundamental innovations. Howell (2017) discovers that government subsidies for start-up companies have a substantial positive influence on patenting and revenues of financially constrained entrepreneurial firms. Similarly, Jaffe and Le (2015) found that R&D subsidies increase the propensity of firms to apply for patents and introduce new goods and services (Jaffe & Le, 2015).

On the other hand, government subsidies may also have negative consequences for innovation. (Xiao and Zhao, 2012) found a negative effect of state-controlled banks

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on business innovation, especially in small companies. Additionally, the presence of a controlling owner who serves as CEO or Chairman of the board was found to reduce innovation in the context of Taiwan's electronics industry by Chin et al. (2009).

Intellectual Property Protection

The relationship between law and policy and innovation has been explored in the literature, examining how different legal and policy frameworks can influence firms' incentives and activities related to innovation. The legal system and government policies of a country can have a significant impact on innovation activities. Aghion and Tirole (1994) argue that laws related to shareholder protection, intellectual property (IP) rights, employee protection, bankruptcy, and insider trading can all influence firms' willingness to invest in innovation. For example, they find that strong IP protection rules can encourage firms to innovate by providing them with greater returns on their investment. He and Tian (2018) provide empirical support for the findings of Aghion and Tirole. They find that the strength of IP protection rules and regulations is positively correlated with firms' motivation to innovate. In other words, firms are more likely to innovate in countries where IP rights are well-protected. These findings suggest that the legal environment can play an important role in stimulating innovation. Governments can encourage innovation by enacting laws that protect IP rights, promote competition, and provide support for research and development.

Law for Employee and Shareholder

Additionally, labor laws have been found to have an impact on innovation. Wrongful discharge laws protect employees from being fired for arbitrary or unfair reasons. This can encourage employees to take risks and come up with new ideas, which can lead to increased innovation output for employers. Acharya, Baghai, and

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Subramanian (2013) found that wrongful discharge laws can increase innovation output. The passage of laws that reduce shareholder litigation risk, such as universal demand (UD) laws, can also encourage innovation by reducing external pressure on managers and allowing them to have a greater incentive to contribute to long-term, innovative projects (Lin, Liu, & Manso, 2021).

Furthermore, the institutional features of a country, including its shareholder protection, legal origin, corporate contracting environment, and privatization of the economy, have also been studied about innovation. These institutional features can influence the innovative capacity of firms. For example, strong shareholder protection can encourage firms to make long-term investments, while a good legal environment can provide firms with a safe and stable operating environment. (He & Tian, 2018). These factors can shape the overall environment for innovation within a country.

Tax

Taxes can have an impact on innovation activities within corporations. Several papers discuss how corporate taxes affect innovation. Atanassov and Liu use a differences-in-differences methodology to examine the impact of state income tax escalations on firms' patenting endeavors. They find that large state income tax escalations can reduce firms' patenting activities by up to 15%. Mukherjee et al. use a similar methodology to examine the impact of taxes on new product introductions. Their results indicate that tax can also affect new product introductions, with a 1% increase in corporate taxes leading to a 0.3% decrease in new product introductions. Both studies suggest that high corporate taxes can discourage innovation by reducing the incentives for firms to take risks. This is because high corporate taxes reduce the expected returns from innovation, making it less likely that firms will invest in new projects. Additionally,

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high corporate taxes can make it more difficult for firms to raise capital, which can also discourage innovation.

Dechezleprêtre et al. (2016) also highlight the substantial influence of taxes on both R&D spending and patenting activity. For example, Dechezleprêtre et al. (2016) find that the implementation of a tax relief scheme for R&D spending results in a significant surge in aggregate R&D spending among the firms surveyed. This additional investment in R&D has a positive spillover effect, stimulating innovation among other firms in the sample. These findings suggest that taxes can serve as an effective policy tool for fostering innovation. However, policymakers should exercise prudence in designing tax policies to avoid excessive advantages for larger firms or any inadvertent discouragement of innovation within specific sectors.

2.3.2.4 Macroeconomics

Financial Market Development

Financial market development has been found to have significant implications for a country's innovation activities. Empirical studies have consistently demonstrated that market-centered financial systems exert a favorable influence on innovation outcomes across a wide array of industrial sectors. In contrast, in bank-centered countries, innovation is particularly prevalent in information-intensive sectors. These findings underscore the importance of financial systems in shaping a country's innovative landscape, which is dependent on the specific industrial structure of its economy (Tadesse, 2006).

Studies have found that well-developed financial markets can help firms to innovate. For example, countries with well-developed equity markets, industries that rely more heavily on financing from external sources, and those that are technology-intensive

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tend to be more innovative. This suggests that well-developed equity markets play a key role in fostering innovation in these industries. This is because well-developed equity markets provide firms with access to the capital they need to invest in research and development, and they also provide a forum for firms to raise funds from investors who are willing to take on more risk.

Credit Market Development

According to Hsu et al. (2014), credit markets can hinder innovation in high-tech industries reliant on external finance for two main reasons. Firstly, risk-averse banks tend to avoid funding uncertain and risky activities, causing firms to under-invest in innovative projects (Hsu et al., 2014). Secondly, credit markets often require collateral, posing challenges for industries with high intangible asset value, such as research and development or intellectual property (Hsu et al., 2014). Additionally, compared to equity markets, credit markets lack timely security price feedback, which restricts the efficient flow of external finance to cutting-edge innovative projects (Hsu et al., 2014).

Other

A country or region's demographic and social characteristics can have an influence on innovation. For example, research has shown that religiosity in a country or region can be negatively associated with innovation, as individuals with greater religiosity may have less favorable opinions about innovation (Bénabou, Ticchi, and Vindigni, 2015).

In addition, studies have explored the impact of other social factors on innovation. Sexual orientation, for instance, has been found to affect corporate innovation. Studies in the United States have uncovered that implementing state-level Employment Non-Discrimination Acts (ENDAs), firms and employees intending to curtail discrimination against individuals based on their sexual orientation and gender identity fosters corporate

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innovation. These laws facilitate a harmonious alignment between innovative firms and employees who support gender rights and equality, resulting in higher levels of creativity (Gao & Zhang, 2017).

Furthermore, some studies have examined the relationship between the characteristics of a society or nation and its innovation levels. For example, papers have explored the legal and financial environment of a country can have a significant influence on firms' incentives to innovate. For example, laws that protect shareholders, intellectual property, and labor can create a more stable and predictable environment for businesses, which can encourage them to invest in research and development (Aghion & Tirole, 1994). Similarly, a well-developed financial system can provide firms with the capital they need to finance innovative projects (He & Tian, 2018). Finally, international trade rules can open up new markets for innovative products and services, which can also provide an incentive for firms to innovate (He & Tian, 2018).

Therefore, demographic and social characteristics can play a role in shaping the innovation landscape and outcomes.

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3. Hypothesis Development

3.1 Mandatory English Financial Reporting and Innovation

Jeanjean et al. (2010) state that English is widely recognized as a global lingua franca, a common language used for communication in international business. English is the world's second most spoken language, and stock exchanges located in English-speaking countries represent a significant portion of the global stock market capitalization. (Jeanjean et al., 2010)[4] In the meantime, English plays a crucial role in attracting foreign investors. Using English as an external financial reporting language can help non-English-speaking companies enlarge their investor base and decrease the value discount of their stocks (Jeanjean et al., 2010). In summary, English financial reporting is important because it can enhance communication between non-English-speaking companies and international investors, facilitates comparability of financial statements, attract foreign investors and help companies raise funds.

Information asymmetry refers to a situation where one party has access to more or better information compared to the other party (Akerlof, 1970; Spence, 1973; Stiglitz & Rothschild, 1976). Roychowdhury et al. (2019) document that financial reporting and disclosure can reduce information asymmetry. However, the language barrier would cause information asymmetry between the company and foreign investors because they have different information about the company. Cuypers et al. (2015) reveal that greater linguistic distance decreases the stake acquired by the acquirer in a merger and acquisition setting. Brochet et al. (2016) also highlight that linguistic distance affects investment willingness because linguistic distance brings out the issue of transparency of verbal

[4] Jeanjean et al. (2010) state that stock exchanges located in English-speaking countries represent 65% of the world stock market capitalization, and 93% of financial analysts who are members of the CFA institute are located in English-speaking countries

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disclosure, leading to varied market reactions. From this aspect, English financial reporting is a way to reduce the information asymmetry caused by language barriers. Jeanjean et al. (2015) show that adopting English as an external reporting language is associated with decreased information asymmetry. In other words, English financial reporting, just like financial reporting and disclosure, could reduce information asymmetry, especially between the company and non-native investors. Besides, issuing English financial reporting could help foreign investors decrease information processing costs and make proper investment decisions. Beneish and Yohn (2008) state that foreign investors encounter higher information processing costs that constrain their investment decisions. Jeanjean et al. (2015) also argue that issuing an annual report in English can potentially reduce information processing costs for foreign investors and enhance their understanding and awareness of the company. Therefore, the information asymmetry and adverse selection between the company and non-native investors can be minimized by employing English financial reporting. Additionally, it can lower the information processing costs for non-native investors, enabling them to make informed decisions and mitigate the risks of adverse selection.

When information asymmetry decreases, companies can attract more capital providers, reduce the cost of capital, and have more resources to innovate, which improves the company's innovation (Simpson & Tamayo, 2020). In addition, foreign investors can monitor the company more effectively (Simpson & Tamayo, 2020). Jeanjean et al. (2010) argue that adopting English reporting enables companies to enhance the comprehensibility of their financial statements for international investors. This, in turn, boosts their visibility in global markets, attracts foreign investment, supports their global expansion strategies, and facilitates cross-border transactions. Luong et al. (2017) show that foreign institutional ownership positively affects corporate innovation. Accordingly,

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issuing English reporting reduces information asymmetry, attracts foreign investors, decreases the cost of capital, and gives the company more funds to increase its innovation. In other words, issuing English reporting reduces information asymmetry and the cost of capital and attracts foreign investors to provide the company with additional funds to bolster its innovation efforts. Manso (2011) demonstrates that optimal incentive schemes that emphasize a high tolerance for early mistakes as part of the learning process and provide rewards for long-term success can effectively drive innovation. Manso also argues that dedication to a sustained, extended compensation arrangement, job security, and timely performance feedback are crucial factors in motivating innovation. Luong et al. (2017) indicate that foreign institutional investors are actively involved in monitoring firms, displaying a higher level of resilience towards failure, and facilitating the transfer of knowledge from high-innovation economies. These factors collectively contribute to enhancing firms' innovative endeavors. Therefore, through the compensation channel, issuing English financial reporting would decrease information asymmetry and attract foreign investors, who monitor the company more effectively and tolerate failure more, contributing to the company's innovation.

English financial reporting can have a positive spillover effect for firms worldwide, leading to boosted innovation. Murray et al. (2016) found that increased transparency in financial reporting, as demonstrated by reduced research access costs, plays a pivotal role in encouraging early and late-stage innovation by facilitating the exploration of novel research concepts. Foreign-owned firms bring with them new technologies and knowledge from their home countries. This can help to facilitate innovation among domestic firms by providing them with access to new ideas and technologies. Guadalupe et al. (2012) found a significant correlation indicating that foreign ownership positively influences the innovation capabilities of the acquired firm. This is because foreign

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ownership can lead to higher levels of innovation, particularly driven by exporting through a foreign parent company.

In conclusion, I believe that mandatory English financial reporting would improve the firm's innovation. This can be attributed to the implementation of English financial reporting, which decreases information asymmetry through financing, compensation, and learning mechanisms. As a result, foreign investors are attracted to the company, leading to more effective monitoring and greater tolerance for failure. This ultimately stimulates increased investment and fosters innovation. This leads to my first hypothesis:

H1: The mandatory English financial reporting improves the firm's innovation.

3.2 Mandatory English Financial Reporting and Innovation with Different Levels of Foreign Ownership

Taiwan's government revised and issued new regulations asking listed companies in Taiwan to issue English financial reporting to improve the quality of information disclosure and help foreign investors obtain the required English information more conveniently to attract foreign investment. From this aspect, the revised regulations aim to reduce language barriers and information asymmetry for foreign investors. Therefore, I believe the effect of mandatory English reporting improves the firm's innovation would be stronger with higher foreign ownership.

Foreign investors could provide new funds, technology, and equipment to improve the firm's innovation. Drawing on the context of mergers and acquisitions in Spain, Guadalupe et al. (2012) present evidence supporting the notion that foreign firms engage in a "cherry-picking" strategy by acquiring the top-performing companies within industries. Moreover, these foreign firms tend to allocate more resources toward various innovation activities upon acquisition. The study reveals that firms enhance their process innovation by introducing new machinery and adopting novel organizational practices

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concurrently. Additionally, acquired firms that export through their parent company demonstrate an increase in product innovation and a higher level of assimilation of foreign technologies. From this perspective, companies with higher foreign ownership tend to exhibit superior innovation performance due to the infusion of new funds, technology, and equipment.

Foreign investors also have more effective monitoring power, tolerance for mistakes as part of the learning process, and provide rewards for long-term success to courage the firm to devote itself to innovation. Manso (2011) highlights that implementing incentive schemes that prioritize a significant tolerance for mistakes as part of the learning process while offering rewards for long-term success can serve as a powerful driver for innovation. Luong et al. (2017) argue that foreign institutional investors play an active role in monitoring firms, displaying a heightened tolerance for failure, and facilitating the transfer of knowledge from high-innovation economies, significantly contributing to the advancement of firms' innovative efforts. Taking together, Foreign investors possess enhanced monitoring capabilities, exhibit greater tolerance for mistakes as part of the learning process, and offer incentives for long-term success. These attributes encourage firms to dedicate themselves to innovation.

In conclusion, the effect of mandatory English reporting on the firm's innovation would be stronger with higher foreign ownership. This can be attributed to the English financial reporting aims to help reduce the information asymmetry for foreign investors. With decreased information asymmetry, foreign ownership would provide resources, improve monitoring, and make the company focus on long-term performance to enhance the company's innovation. This leads to my second hypothesis:

H2: The mandatory English financial reporting improves the firm's innovation with higher foreign ownership.

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4. Research Design and Methodology

4.1 Variable Constructions

Innovation

Prior research extensively utilizes patenting outcomes as a measure of a firm's innovation (Deng, Hung, Lee, & Qiao, 2022). In line with previous studies (e.g., Mahmood & Zheng, 2009; Yang et al., 2009; Chang & Chen, 2013; Mahmood, Chung, & Mitchell, 2013; Yang, 2022), I collected patent and citation data from the TIPO (Taiwan Intellectual Property Office) database.[5] This database covers all patent applications granted in Taiwan since 1950 and is considered a highly credible source (Chin, Lee, and Kleinman, 2006; Mahmood et al., 2013). Following the approach of Mahmood et al. (2013), I searched the database using the name of each firm in traditional Chinese script to identify patent applications. Furthermore, I recorded patent identification numbers, application and approval dates, and patent types. The sample period spans from 2014 to 2021.

To begin, I compute the number of patent applications a firm eventually receives in a given year. Utilizing the patent application year is more appropriate for representing the timing of innovation than the grant year (Deng et al., 2022; Griliches, Pakes, and Hall, 1988). Additionally, I assess the patent citation in the subsequent years to gauge the impact of each patent.

Following the prior literature (e.g., Chin et al., 2006; Glaeser and Landsman, 2021; Hsieh et al., 2010; Yang, 2022), I use the nature logarithm of patent counts (*INNOVATION_NUM*) and the nature logarithm of patent citations (*INNOVATION_CITA*) as the proxy as firm's innovation. The natural logarithm is used to adjust for the right-skewed distributions of these measures, and I add one to the actual values in calculating

[5] http://twpat1.tipo.gov.tw

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the natural logarithm to keep the firm-year observations with zero patent or zero citation (Deng et al., 2022).

Regulation of mandatory English Financial Reporting

In August 2018, the Taiwanese government started to revise " Taiwan Stock Exchange Corporation Rules Governing Information Filing by Companies with TWSE Listed Securities and Offshore Fund Institutions with TWSE Listed Offshore Exchange-Traded Funds" and "Taipei Exchange Rules Governing Information Reporting by Companies with TPEx Listed Securities." Those regulations ask firms that achieved certain conditions in Taiwan to prepare English financial reporting and upload it on the government's website. Table 1 presents the timeline and requirements for issuing English financial reporting mandatorily.

Control variables

Following the literature (e.g., Chin et al., 2009; Deng et al., 2022; Ettlie et al., 1984; Hsieh, Yeh, and Chen, 2010; Mahmood & Zheng, 2009; Mahmood et al., 2013;),

I identify a set of control variables that can affect firms' innovation outcomes, including firm and industry characteristics. The control variables in my baseline regressions include *VOLUNTARY*, a dummy variable equals one is the firm issue english report voluntary and zero otherwise; *SIZE*, measured by the natural logarithm of the firm's total assets; *AGE*, measured by the natural logarithm of one plus the number of years a firm has been in operation; *ROA*, as measured by operating income divided by average total assets; *CR*, as measured by the total current assets divided by the total current liabilities; *LEVERAGE*, measured by the total liabilities divided by the total equities; Δ*SALES*, measured by the change of net sales scaled by the net sales of the previous year; *CAPEX*, measured as capital expenditures scaled by total assets; *RND*, measured as R&D

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expenditures scaled by total assets; *TANGIBILITY*, measured as net property, plant, and equipment scaled by total assets; *HHI*, measured as the Herfindahl index, based on market share within the industry code; *VOLATILITY*, measured as the standard deviation of *ROA* over the last three years. In addition, *HHI* and squared HHI (*HHI*2) are included in my baseline regressions to control for the non-linear effects of product market competition (Aghion et al., 2005; Deng et al., 2022). The detailed variable definitions are available in Appendix 2.

4.2 Main Research Design

To investigate whether and how mandatory English financial reporting affects firms' innovation activities, I regard the government's regulation as an exogenous shock that affects both the demand for and supply of English financial reporting. English financial reporting is crucial for firms to increase transparency and communicate with foreign investors. In addition, the regulation also provides a unique quasi-nature experimental setting to investigate the effects on firms' innovation activities.

I follow the prior literature (Allen, Lewis-Western, and Valentine, 2021; Chan, Chen, Chen, and Yu, 2012; Deng et al., 2022) and exam the impact of mandatory English financial reporting on innovation outcomes. To investigate my hypothesis 1, I estimate the following DiD model:

$$INNOVATION = \beta_0 + \beta_1 TREAT \times POST + \beta_2 POST + \beta_3 TREAT + \sum_{j=1}^{n} \alpha_j CV_j + IndFE + YearFE + \varepsilon \quad (1)$$

Where *INNOVATION*, which is consisted of two proxies (*INNOVATION_NUM* and *NNOVATION_CITA*), is the proxy for innovation outcomes. *TREAT* is a dummy variable that equals one if a firm is affected by mandatory English financial reporting regulation

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and zero otherwise. *POST* is a dummy variable that equals one if the firm year falls in the post-period for the English financial reporting rule and zero otherwise.

The interaction term *TREAT×POST* is the key variable of interest and serves as the DiD estimator that captures incremental changes (from pre-regulation to post-regulation periods) in the treatment group's innovation outcomes relative to the corresponding changes in the control group. By regarding the staggered implementation of mandatory English reporting regulation as an exogenous shock to firms' financial reporting, I address endogeneity concerns and can therefore draw causal inferences.

CV is a vector of firm and industry characteristics that influence firm innovation described in the previous section. *IndFE* and *YearFE* represent the industry-fixed and year-fixed effects.

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5. Results

5.1 Data and Sample Collection

I conduct hypothesis testing using a sample of listed companies in Taiwan, covering the period from 2014 to 2021. I obtain the patent and citation data from TIPO (Taiwan Intellectual Property Office) database. The data for issuing English financial reporting is collected from Market Observation Post System (MOPS).[6] Firm-level variables' data are collected from Taiwan Economic Journal (TEJ). Furthermore, I exclude the financial sector and sample with incomplete data.

5.2 Descriptive Statistics and Pairwise Correlations

Descriptive Statistics

Table 2 presents the descriptive statistics for the variable I use in the regression analyses. My variable of interest is *INNOVATION_NUM* (mean value is 0.648 with a standard deviation of 1.075) and *INNOVATION_CITA* (mean value is 0.208 with a standard deviation of 0.597). The mean value of *TREAT*, which equals 1 if the sample is affected by mandatory English financial reporting regulation, equals 0.335, which means 33.5% of my sample is affected by the regulation.

[insert Table 2 here]

Pairwise Correlations

Table 3 presents the correlation matrix. The correlation between *TREAT * POST* and *INNOVATION_NUM* is 0.09 ($p < 0.01$), which means a positive correlation exists between mandatory English financial reporting and innovation. The correlation between

[6] https://emops.twse.com.tw/server-java/t58query

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*TREAT * POST* and INNOVATION_CITA is 0.01 (p > 0.1), which means a positively significant correlation exists between mandatory English financial reporting and innovation; however, there is no significant.

[insert Table 3 here]

5.3 The Effect of Mandatory English Financial Reporting on Firm's Innovation

Table 4 presents the regression results for H1. Columns (1) and (2) present the results of the regression model (1), with column (1) using *INNOVATION_NUM* as the dependent variable and column (2) using *INNOVATION_CITA* as the dependent variable. From column (1), the coefficient of *TREAT * POST* is positively significant (β = 0.324, p < 0.01), and the coefficient of *TREAT * POST* is also positively significant (β = 0.199, p < 0.01) in column (2), indicating a consistent and statistically significant positive relationship. Based on these findings, H1 is supported, meaning mandatory issuing English financial reporting increases the firm's innovation.

[insert Table 4 here]

5.4 The Effect of Mandatory English Financial Reporting on Firm's Innovation with the Degree of Foreign Ownership

Table 5 presents the regression results for H2. Columns (1) and (2) present the results of the regression model (1) using *INNOVATION_NUM* as the dependent variable, with high foreign ownership in column (1) and low foreign ownership in column (2). Columns (3) and (4) present the results of the regression model (1) using *INNOVATION_CITA* as the dependent variable, with high foreign ownership in column (3) and low foreign ownership in column (4). The coefficient of *TREAT * POST* is

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positively significant (β = 0.272, p < 0.01) in column (1), positively (β = 0.000, p > 0.1) in column (2), positively significant (β = 0.244, p < 0.01) in column (3), negatively (β = -0.028, p > 0.1) in column (4). The results indicate the significant positive effect of mandatory issuing English financial reporting on the firm's innovation only exists in the high foreign ownership group, supporting H2.

[insert Table 5 here]

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6. Additional Analysis

6.1 The Effect of Mandatory English Financial Reporting on Firm's Future Innovation

Innovation activity takes time (Deng et al., 2022). Therefore, I measure the proxy of innovation as year *t*+1. Table 6 presents the regression results. Columns (1) and (2) present the results of the regression model (1), with column (1) using I*NNOVATION_NUM_F1* as the dependent variable and column (2) using *INNOVATION_CITA_F1* as the dependent variable. From column (1), the coefficient of *TREAT * POST* is positively significant (β = 0.356, p < 0.01), and the coefficient of *TREAT * POST* is also positively significant (β = 0.185, p < 0.01) in column (2), indicating a consistent and statistically significant positive relationship. The results still support H1.

[insert Table 6 here]

Table 7 presents the regression results of the effect of mandatory English financial reporting on the firm's innovation in year *t*+1 with the degree of foreign ownership. The results remain the same as in Table 4, supporting H2.

[insert Table 7 here]

6.2 The Effect of Readability

Readability is one of the most important issues in English financial reporting. For example, Nobes and Stadler (2018) state that Accurate and consistent translations are essential in financial reporting to avoid misunderstandings and misinterpretations of financial information. Besides, Jeanjean et al. (2015) point out that language complexity,

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vividness, tone, and readability can impact foreign investors' ability to comprehend financial information accurately, influencing their investment decisions. Based on these arguments, I establish the following regression model to test the effect of readability on a firm's innovation following Gunning (1952) and Loughran and McDonald (2014).

$$INNOVATION = \beta_0 + \beta_1 READABILITY + \sum_{j=1}^{n} \alpha_j CV_j + IndEF + YearFE + \varepsilon \quad (2)$$

where *READABILITY*, which is consisted of two proxies (*Fog_Index* and *LM_PE_Index*), is the proxy for readability. *Fog_Index*, developed by Gunning (1952), a higher score means lower readability, which consists of two dimensions for sentence length and complex words. *LM_PE_Index*, established by Loughran and McDonald (2014), is the measure of plain English readability, and a higher score means lower readability, which consists of six dimensions for sentence length, word length, passive voice, legalese, personal pronouns, and others.

I use the sample of issuing the English financial reporting only. Untabled results show that the coefficient of *Fog_Index* and *LM_PE_Index* are all significantly negative. The results show that the readability of English financial reporting could enhance a firm's innovation. The results compile the viewpoints from Jeanjean et al. (2015), Nobes and Stadler (2018), and Simpson and Tomayo (2020), indicating that the readability of English financial reporting decreases information asymmetry and enhances the foreign investors' ability to comprehend financial information accurately, furthermore, promote a firm's innovation.

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7. Conclusion

In this research, I investigate the effect of mandatory English financial reporting on the firm's innovation. My primary objective is to examine how disclosure changes a firm's behavior, especially in English financial reporting. The Taiwan government implemented a new version of the regulations in 2014, requiring listed companies in Taiwan, step by step, to issue English financial reporting. Hence this provides a quasi-nature experiment for me to investigate the effect of mandatory English financial reporting on the firm's innovation. My first hypothesis states that the firm's innovation would increase after implementing mandatory English financial reporting. Moreover, foreign investors are one of the main beneficiaries of mandatory English financial reporting regulations. Therefore, I further explore whether the level of foreign ownership will affect the impact of mandatory English financial reporting regulations and corporate innovation.

The empirical results are consistent with my hypothesis after using the data from listed companies in Taiwan from 2014 to 2021 to explore my research question. Through the Difference-in-Difference design, I treat the regulation of mandatory English financial reporting as an exogenous shock to investigate the causality between English financial reporting and a firm's innovation. The results indicate that mandatory English financial reporting improves a firm's innovation, especially in a firm with higher foreign ownership. This evidence shows that English financial reporting could mitigate information asymmetry between the firm and foreign investors and improve a firm's innovation.

This study makes several contributions to the existing literature on disclosure, the adoption of English financial reporting, and innovation. Firstly, I integrate the perspectives of Jeanjean et al. (2015) and Simpson and Tamayo (2020) to prove that adopting English financial reporting reduces information asymmetry and uncertainty between companies and non-native investors. This fresh perspective sheds light on the

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impact of adopting English financial reporting on firm behavior, emphasizing the potential benefits such as reducing information asymmetry and attracting foreign investors. These findings have significant theoretical and practical implications for English financial reporting and corporate innovation research.

Secondly, the study enhances our understanding of the consequences of English reporting and its economic effects on decision-making within firms. Specifically, it examines the influence of adopting English on corporate innovation and investigates how a nation's implementation of English financial reporting and subsequent changes affect a firm's information asymmetry and ability to attract foreign investments. This contribution expands the existing knowledge in the field of corporate innovation.

Lastly, the study sheds light on the economic consequences of English financial reporting by exploring the financial, compensation, and learning channels proposed by Simpson and Tomayo (2020). Examining the interplay between the benefits of English financial reporting, corporate innovation, and information asymmetry underscores the importance of considering information transparency and liability when analyzing the adoption of English financial reporting and its impact on firm behavior. This contribution adds depth to the evolving literature on English financial reporting and its effects on corporate outcomes.

This research has several limitations and suggestions for future research as follows. First, my study uses the Taiwan sample and may not be generalized to other countries or regions. Second, Simpson and Tomayo (2020) provide three channels to explore the relationship between financial reporting/disclosure and firm innovation, and future research could focus on the impact of English financial reporting on a firm's innovation through which channel. In the additional analysis, I further investigate the

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readability issue of English financial reporting; future studies could explore this area to examine the effect of English financial reporting readability.

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Table 1 Time and Requirement of the Regulations for English Financial Reporting in Taiwan

Fiscal Year	Firms need to issue English financial reporting mandatorily
2018	For all listed companies, the common stock has achieved NT$10 billion, or the total shareholding of foreign investors reached 30%.
2020	For all listed companies, the common stock has achieved NT$2 billion.
2022	(1) All TSE companies.
	(2) For OTC companies, the common stock has achieved 600 million.

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Table 2 Descriptive Statistics (*n* = 12,644)

	Mean	SD	Min	p25	Median	p75	Max
INNOVATION_NUM	0.648	1.075	0.000	0.000	0.000	1.099	6.859
INNOVATION_CITA	0.208	0.597	0.000	0.000	0.000	0.000	4.762
INNOVATION_NUM_F1	0.605	1.044	0.000	0.000	0.000	1.099	6.859
INNOVATION_CITA_F1	0.171	0.542	0.000	0.000	0.000	0.000	4.762
TREAT	0.335	0.472	0.000	0.000	0.000	1.000	1.000
POST	0.171	0.377	0.000	0.000	0.000	0.000	1.000
*TREAT*POST*	0.124	0.330	0.000	0.000	0.000	0.000	1.000
VOLUNTARY	0.101	0.302	0.000	0.000	0.000	0.000	1.000
SIZE	15.201	1.495	10.574	14.192	15.031	16.043	19.775
AGE	3.221	0.571	0.000	2.890	3.296	3.638	4.331
ROA	0.031	0.095	-0.441	0.002	0.038	0.079	0.275
VOLATILITY	0.037	0.043	0.001	0.012	0.023	0.044	0.268
CR	2.832	3.063	0.247	1.419	1.936	3.040	24.808
LEVERAGE	0.956	0.940	0.042	0.378	0.716	1.207	7.344
ΔSALES	0.086	0.489	-0.732	-0.092	0.024	0.154	4.180
CAPEX	0.038	0.047	0.000	0.007	0.021	0.051	0.270
RND	0.032	0.048	0.000	0.002	0.015	0.038	0.292
TOBINQ	1.550	1.042	0.584	0.971	1.219	1.716	7.487
HHI	0.092	0.086	0.027	0.058	0.064	0.080	0.852
HHI2	0.016	0.055	0.001	0.003	0.004	0.006	0.727

Note: This table presents descriptive statistics for the sample. *INNOVATION_NUM* is the nature logarithm of patent counts. *INNOVATION_CITA* is the nature logarithm of patent citations. *INNOVATION_NUM_F1* is the nature logarithm of patent counts in year t+1. *INNOVATION_CITA_F1* is the nature logarithm of patent citations in year t+1. *TREAT* is the dummy variable that equals one if a firm is affected by the mandatory English reporting regulation and zero otherwise. *POST* is a dummy variable that equals one if the sample year corresponds to the implementation year of the mandatory English reporting regulation and any following year and zero otherwise. *TREAT*POST* is *TREAT* times *POST*. *VOLUNTARY* is a dummy variable, and equal to one is the firm issuing English reports voluntarily. *SIZE* is the natural logarithm of the firm's total assets. *AGE* is measured by the natural logarithm of one plus the number of years a firm has been in operation. *ROA* is measured by operating income divided by average total assets. *VOLATILITY* is measured as the standard deviation of ROA over the last three years. *CR* is measured by the total current assets divided by the total current liabilities. *LEVERAGE* is the total liabilities divided by the total equities. Δ*SALES* is the change of net sales scaled by the previous year's net sales. *CAPEX* is capital expenditures scaled by total assets. *RND* is the R&D expenditures scaled by total assets. *TOBINQ* is. *HHI* is the Herfindahl index, based on market share within the industry code. *HHI2* is the square of *HHI.*

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Table 3 Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
(1) *INNOVATION_NUM*	1.00																			
(2) *INNOVATION_CITA*	0.75***	1.00																		
(3) *INNOVATION_NUM_F1*	0.84***	0.70***	1.00																	
(4) *INNOVATION_CITA_F1*	0.62***	0.73***	0.72***	1.00																
(5) *TREAT*	0.17***	0.15***	0.17***	0.13***	1.00															
(6) *POST*	0.10***	0.00	0.08***	-0.05***	0.38***	1.00														
(7) *TREAT*POST*	0.09***	0.01	0.08***	-0.03***	0.53***	0.83***	1.00													
(8) *VOLUNTARY*	0.16***	0.12***	0.16***	0.11***	0.06***	0.26***	-0.13***	1.00												
(9) *SIZE*	0.35***	0.28***	0.34***	0.25***	0.60***	0.32***	0.35***	0.22***	1.00											
(10) *AGE*	0.03***	0.01	0.03***	0.00	0.04***	0.02*	0.01	0.03***	0.28***	1.00										
(11) *ROA*	0.13***	0.08***	0.14***	0.08***	0.11***	0.10***	0.09***	0.09***	0.25***	0.05***	1.00									
(12) *VOLATILITY*	-0.08***	-0.07***	-0.09***	-0.07***	-0.10***	-0.04***	-0.03***	-0.08***	-0.30***	-0.18***	-0.24***	1.00								
(13) *CR*	-0.09***	-0.07***	-0.09***	-0.06***	-0.10***	-0.05***	-0.06***	-0.03***	-0.23***	-0.10***	-0.05***	0.12***	1.00							
(14) *LEVERAGE*	-0.01	0.01	-0.01	0.00	0.12***	0.08***	0.09***	0.00	0.23***	0.09***	-0.21***	0.01	-0.35***	1.00						
(15) *ΔSALES*	-0.02**	-0.02***	-0.02***	-0.03***	0.00	0.02**	0.02*	0.00	0.00	-0.04***	0.14***	0.13***	0.01*	0.04***	1.00					
(16) *CAPEX*	0.09***	0.06***	0.09***	0.05***	0.04***	0.03***	0.04***	0.03***	0.07***	-0.12***	0.10***	0.00	-0.13***	-0.03***	0.03***	1.00				
(17) *RND*	0.21***	0.13***	0.19***	0.12***	-0.10***	-0.03***	-0.05***	0.01	-0.24***	-0.26***	-0.15***	0.16***	0.16***	-0.17***	0.03***	-0.05***	1.00			
(18) *TOBINQ*	0.04***	0.01	0.03***	0.01	0.00	0.06***	0.04***	0.06***	-0.20***	-0.25***	0.12***	0.25***	0.20***	-0.14***	0.19***	0.13***	0.35***	1.00		
(19) *HHI*	-0.10***	-0.06***	-0.10***	-0.06***	0.13***	0.04***	0.07***	-0.02**	0.12***	0.17***	0.03***	-0.04***	-0.04***	0.01	-0.05***	0.02*	-0.18***	-0.05***	1.00	
(20) *HHI2*	-0.07***	-0.04***	-0.07***	-0.04***	0.07***	0.02***	0.03***	-0.01	0.07***	0.10***	0.02**	-0.04***	-0.04***	0.01	-0.03***	0.02**	-0.11***	-0.03***	0.90***	1.00

Note 1: *** p<0.01, ** p<0.05, * p<0.1
Note 2: Appendix 1 provides the definitions of variables

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Table 4 Innovation and Mandatory English Financial Reporting

	(1)	(2)
	INNOVATION_NUM	*INNOVATION_CITA*
*TREAT*POST*	0.324***	0.199***
	(4.187)	(4.097)
TREAT	-0.110***	-0.035**
	(-4.149)	(-2.073)
POST	-0.243***	-0.224***
	(-3.692)	(-5.403)
VOLUNTARY	0.302***	0.185***
	(5.804)	(4.944)
SIZE	0.316***	0.143***
	(29.056)	(21.122)
AGE	0.092***	0.014
	(6.094)	(1.613)
ROA	0.449***	0.086*
	(4.717)	(1.690)
VOLATILITY	0.393**	0.180*
	(2.079)	(1.772)
CR	-0.014***	-0.004***
	(-6.377)	(-3.633)
LEVERAGE	-0.040***	-0.007
	(-4.267)	(-1.443)
Δ*SALES*	-0.039***	-0.018***
	(-2.954)	(-2.844)
CAPEX	1.233***	0.311***
	(6.423)	(2.812)
RND	5.695***	2.032***
	(23.070)	(14.724)
TOBINQ	0.026**	0.012**
	(2.575)	(2.032)
HHI	-2.272**	-0.333
	(-1.998)	(-0.520)
HHI2	0.227	-1.126
	(0.131)	(-1.246)
Constant	-4.664***	-2.034***
	(-13.217)	(-9.596)
Observations	12,644	12,644
Industry FE	Yes	Yes
Year FE	Yes	Yes
Adjusted R^2	0.297	0.185

Note 1: *** p<0.01, ** p<0.05, * p<0.1
Note 2: Appendix 1 provides the definitions of variables

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Table 5 Innovation and Mandatory English Financial Reporting with Respect to Foreign Ownership

	(1)	(2)	(3)	(4)
	INNOVATION_NUM	*INNOVATION_NUM*	*INNOVATION_CITA*	*INNOVATION_CITA*
	High foreign ownership	*Low foreign ownership*	*High foreign ownership*	*Low foreign ownership*
*TREAT*POST*	0.272***	0.000	0.244***	-0.028
	(2.716)	(0.002)	(4.018)	(-0.400)
TREAT	-0.148***	-0.020	-0.063***	-0.016
	(-4.122)	(-0.520)	(-2.761)	(-0.660)
POST	-0.114	-0.062	-0.204***	-0.012
	(-1.286)	(-0.618)	(-3.927)	(-0.202)
VOLUNTARY	0.280***	0.130	0.199***	0.004
	(4.661)	(1.488)	(4.519)	(0.071)
SIZE	0.395***	0.132***	0.185***	0.055***
	(26.094)	(11.480)	(19.121)	(9.042)
AGE	0.153***	-0.066***	0.023*	-0.020*
	(7.068)	(-3.089)	(1.812)	(-1.724)
ROA	0.300**	0.647***	-0.005	0.187***
	(2.048)	(5.838)	(-0.063)	(3.210)
VOLATILITY	0.522	-0.218	0.146	-0.000
	(1.643)	(-1.096)	(0.835)	(-0.000)
CR	-0.013***	-0.016***	-0.002	-0.005***
	(-3.550)	(-6.847)	(-1.117)	(-5.120)
LEVERAGE	-0.037**	-0.019**	0.000	-0.005
	(-2.298)	(-2.277)	(0.021)	(-1.171)
ΔSALES	-0.069***	-0.015	-0.031**	-0.007
	(-2.799)	(-1.130)	(-2.515)	(-1.222)
CAPEX	1.025***	1.252***	0.096	0.478***
	(3.330)	(5.747)	(0.547)	(3.620)
RND	6.789***	4.100***	2.614***	1.244***
	(18.452)	(13.352)	(11.954)	(8.326)
TOBINQ	0.029**	-0.005	0.012	0.003
	(2.077)	(-0.383)	(1.384)	(0.359)
HHI	-1.868	-2.159*	0.435	-0.704
	(-1.061)	(-1.713)	(0.405)	(-1.091)
HHI2	-1.208	0.549	-2.248	-0.676
	(-0.549)	(0.251)	(-1.641)	(-0.606)
Constant	-6.461***	-0.985**	-3.056***	-0.302
	(-11.880)	(-2.576)	(-8.941)	(-1.418)
Observations	6,327	6,317	6,327	6,317
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.357	0.150	0.235	0.0725

Note 1: *** p<0.01, ** p<0.05, * p<0.1
Note 2: Appendix 1 provides the definitions of variables

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Table 6 Future Innovation and Mandatory English Financial Reporting

	(1)	(2)
	INNOVATION_NUM_F1	*INNOVATION_CITA_F1*
*TREAT*POST*	0.356***	0.185***
	(4.666)	(4.104)
TREAT	-0.099***	-0.015
	(-3.743)	(-0.982)
POST	-0.276***	-0.253***
	(-4.232)	(-6.579)
VOLUNTARY	0.323***	0.193***
	(6.126)	(5.358)
SIZE	0.295***	0.117***
	(27.685)	(18.805)
AGE	0.088***	0.004
	(5.911)	(0.516)
ROA	0.542***	0.119***
	(5.907)	(2.614)
VOLATILITY	0.220	0.090
	(1.239)	(1.010)
CR	-0.012***	-0.003***
	(-5.900)	(-3.702)
LEVERAGE	-0.040***	-0.010**
	(-4.480)	(-2.088)
Δ*SALES*	-0.035***	-0.018***
	(-2.939)	(-3.474)
CAPEX	1.138***	0.146
	(6.023)	(1.385)
RND	5.112***	1.596***
	(21.143)	(12.444)
TOBINQ	0.024**	0.014**
	(2.456)	(2.434)
HHI	-0.599	-0.664
	(-0.560)	(-1.129)
HHI2	-1.619	-0.681
	(-1.095)	(-0.859)
Constant	-4.705***	-1.496***
	(-13.664)	(-7.982)
Observations	12,644	12,644
Industry FE	Yes	Yes
Year FE	Yes	Yes
Adjusted R^2	0.284	0.172

Note 1: *** p<0.01, ** p<0.05, * p<0.1
Note 2: Appendix 1 provides the definitions of variables

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Table 7 Future Innovation and Mandatory English Financial Reporting with Respect to Foreign Ownership

	(1) *INNOVATION_ NUM_F1*	(2) *INNOVATION_ NUM_F1*	(3) *INNOVATION_ CITA_F1*	(4) *INNOVATION_ CITA_F1*
	High foreign ownership	*Low foreign ownership*	*High foreign ownership*	*Low foreign ownership*
*TREAT*POST*	0.277***	0.133	0.209***	0.094
	(2.814)	(1.100)	(3.791)	(1.298)
TREAT	-0.119***	-0.037	-0.026	-0.025
	(-3.347)	(-0.940)	(-1.243)	(-1.084)
POST	-0.120	-0.127	-0.225***	-0.119*
	(-1.380)	(-1.291)	(-4.853)	(-1.935)
VOLUNTARY	0.298***	0.165*	0.191***	0.091
	(4.896)	(1.899)	(4.538)	(1.538)
SIZE	0.371***	0.123***	0.153***	0.046***
	(24.926)	(11.149)	(16.996)	(8.498)
AGE	0.145***	-0.061***	0.013	-0.028**
	(6.906)	(-2.871)	(1.195)	(-2.483)
ROA	0.370***	0.778***	0.026	0.229***
	(2.589)	(7.237)	(0.361)	(4.386)
VOLATILITY	0.160	-0.186	0.024	-0.012
	(0.538)	(-0.957)	(0.156)	(-0.116)
CR	-0.009**	-0.016***	-0.001	-0.005***
	(-2.569)	(-7.407)	(-0.854)	(-5.430)
LEVERAGE	-0.035**	-0.024***	-0.001	-0.011***
	(-2.200)	(-3.143)	(-0.137)	(-2.633)
ΔSALES	-0.046**	-0.026**	-0.023**	-0.014***
	(-2.012)	(-2.372)	(-2.097)	(-3.284)
CAPEX	1.030***	1.098***	-0.117	0.381***
	(3.384)	(5.094)	(-0.725)	(2.868)
RND	6.161***	3.631***	2.033***	1.004***
	(16.782)	(12.620)	(9.931)	(7.268)
TOBINQ	0.023*	0.003	0.016*	0.004
	(1.676)	(0.261)	(1.951)	(0.534)
HHI	-0.920	0.219	-0.625	-0.362
	(-0.538)	(0.185)	(-0.616)	(-0.653)
HHI2	-2.120	-2.111	-1.525	-0.421
	(-1.002)	(-1.189)	(-1.117)	(-0.609)
Constant	-6.298***	-1.416***	-2.110***	-0.322*
	(-11.868)	(-3.678)	(-6.926)	(-1.737)
Observations	6,327	6,317	6,327	6,317
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.342	0.144	0.218	0.0747

Note 1: *** p<0.01, ** p<0.05, * p<0.1
Note 2: Appendix 1 provides the definitions of variables

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Appendix 1 Variable Definitions

Variables	Definitions
Dependent Variable	
INNOVATION_NUM	The natural log of one plus the number of patents a firm filed (and eventually granted) in the year.
INNOVAION_CITA	The natural log of one plus the citations of patents a firm granted in the year.
Main Independent Variable	
TREAT	A dummy variable equals one if a firm is affected by the mandatory English reporting regulation and zero otherwise.
POST	A dummy variable equals one if the firm year falls in the post-period for the English financial reporting rule and zero otherwise.
Control Variables	
SIZE	The natural logarithm of the firm's total assets.
AGE	The natural logarithm of one plus the number of years a firm has been in operation.
ROA	Operating income divided by average total assets.
CR	The total current assets divided by the total current liabilities.
LEVERAGE	The total liabilities divided by the total equities.
$\Delta Sales$	The change of net sales scaled by the net sales of the previous year.
CAPEX	The capital expenditures scaled by total assets.
RND	The R&D expenditures scaled by total assets.
TANGIBILITY	The net property, plant, and equipment scaled by total assets
HHI	The Herfindahl index, based on market share within the industry code
*HHI*2	The square of *HHI*.
VOLATILITY	The standard deviation of *ROA* over the last three years

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