Will China's Corporate Strategy of Indigenous Innovation be Successful in Responding to the Risk of Decoupling from the US?

ABSTRACT

The rising risk of US-China decoupling has fundamental implications for corporate strategies. Dealing with this risk, China's most important strategy is indigenous innovation, which is to innovate by relying on domestic resources. We ask: Who are more likely to adopt indigenous innovation? Who are able to mitigate the decoupling risk by adopting indigenous innovation? We conduct a text analysis of the corporate annual reports for all companies in Chinese stock markets between 2017 and 2019. Measuring the decoupling risk, we construct a Trump Index based on former President Donald Trump's anti-China tweets. We then analyze how indigenous innovation reduces the shock of the Trump Index on stock prices. We find that: 1) Enterprises which are private, or having R&D experience, or having high PE are more likely to adopt indigenous innovation; 2) indigenous innovation reduces the impact of decoupling; enterprises which are private, or having R&D experienced executives, or less active in CSR are more likely to succeed in indigenous innovation. The paper paints a general picture of partial rather than universal success of indigenous innovation in responding to the decoupling risk.

Keywords: Indigenous innovation; US-China decoupling; Trump tweets; text analysis

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INTRODUCTION

The world of international business is undergoing a fundamental shift, having tremendous implications for corporate strategies. The world's two largest economies, China and the US, previously highly interlinked and closely coupled, are now faced with a significant risk of decoupling. At the moment, this risk in many ways has already become a reality. A process of decoupling was initiated by the harsh anti-China rhetoric and policies of former US President Donald Trump; and now, President Joe Biden's administration has mostly continued following the same course in its own policy approach. If continued, this move towards the decoupling of the US and Chinese economies will likely reverse the trend of globalization that characterized the past few decades.

Arguably, the most important strategy adopted by Chinese corporations is indigenous innovation (*zi zhu chuang xin*) in order to deal with the risk of decoupling. In essence, indigenous innovation calls for a corporation to advance its own technologies by relying on domestic engineers and technologies, as well as the resources of domestic universities, research institutions, and other domestic corporations (Chen, 1994; Fu, 1998). The strategy of indigenous innovation is based on two rationales. First, without continued innovation, Chinese corporations will not be able to out-compete their Western counterparts once decoupling occurs. Second, the US and other Western corporations may suddenly cut off access to the

supply of critical new technologies, which means that the Chinese side should attempt to achieve complete control over its own technologies and its capacity for continued technological progress.

The Chinese corporate strategy of indigenous innovation is likely to change the landscape for the global business environment and therefore is an area that is deserving of very careful research and analysis. Moreover, corporations in other countries may emulate the Chinese strategy of indigenous innovation and this will therefore further transform the structure of many business sectors. At the same time, the strategy of indigenous innovation is sometimes perceived to be anti-free market in its principles and hence will require careful consideration moving forward.

Given the rising importance of indigenous innovation, the existing body of literature on the topic is at present inadequate and inconclusive. Even so, past research has nonetheless long identified the importance of indigenous innovation (Chen, 1994; Fu, 1998). Following this trend, some researchers proposed theories to explain the rise and uniqueness of indigenous innovation (Chen, 2017; Chen, Yin and Li, 2020; Xu et al., 2007). Recently, Lv and Liu (2019) and Zhang, Yang and Liu (2022) further analyzed the features of indigenous innovation in practice. Zhang et al. (2022) found that indigenous innovation has played a positive role primarily in non-economic and non-business aspects, such as patriotism, elitism and endurance of hardship. As for the overall impact from the strategy of indigenous innovation, there is no consensus in the literature (Chand, Qian, Wang, & Yin, 2018).

In this paper, we focus on two critical issues arising from the strategy of indigenous innovation: First, which enterprises are more likely to adopt the strategy of indigenous innovation? Second, is the strategy of indigenous innovation able to mitigate the risk of decoupling? In order to answer the first question, we

conduct a text analysis of corporate annual reports for all the listed companies on Chinese stock markets for the period between 2017 and 2019 and identify those enterprises adopting an indigenous innovation strategy. In order to analyze whether indigenous innovation is an effective strategy to respond to China-US economic decoupling, we construct a so-called Trump Index, which is a measure of then-US President Trump's anti-China tweets. We then analyze whether and how Chinese enterprises adopting indigenous innovation have been affected relatively less by the Trump Index in terms of their share prices during each calendar year between 2017 and 2019.

Before implementing our statistical analysis, we conduct a theoretical analysis of the two research issues by relying upon existing literature. Based on this theoretical analysis, we form eight theoretical hypotheses to be tested. In the end, some of these hypotheses are supported by the empirical analysis, while others are rejected.

This paper offers several findings that are not found or supported by the statistical analysis produced in the existing research literature. As for which enterprises are more likely to adopt the strategy of indigenous innovation, we discover the following results: 1) enterprises under the ownership of the central government are less likely to adopt this strategy, contrary to theoretical analysis; 2) top executives with strong R&D experience are more inclined to adopt indigenous innovation as their strategy; 3) enterprises with a good track record in R&D are more likely to engage in indigenous innovation; and, 4) enterprises with high PE ratios are more likely to adopt the strategy of indigenous innovation. As for the outcomes of adopting indigenous innovation as a corporate strategy, we discover the following results: 1) those enterprises adopting indigenous innovation are overall less impacted by the risk of decoupling; 2) state-

owned enterprises (SOE) are less effective in adopting indigenous innovation to mitigate the risk of decoupling; 3) firms with top executives who have research backgrounds perform better; and, 4) firms actively adopting corporate social responsibility (CSR) are less effective in using the indigenous innovation strategy than other firms.

A general implication of the findings is that indigenous innovation is likely to achieve partial rather universal success in dealing the US-China decoupling risk, since good firms may adopt the strategy and only good firms can achieve success in implementing the strategy. Meanwhile, other firms either do not adopt the strategy or fail to implement the strategy.

This paper makes three contributions to the research literature on indigenous innovation. The first is that we conduct a two-step analysis of indigenous innovation using a large dataset by asking which firms adopted the strategy and the resulting impacts after adopting the strategy. This approach has not been deployed in the existing literature. Second, we study indigenous innovation in the context of China-US decoupling, quantifying the risk through the text analysis of tweets made by former US President Trump. In this way, we convert high-frequency stock price responses to the daily Trump Index into a low frequency annualized firm-specific set of statistics, which matches average share price volatility to the Trump Index. Third, in terms of methodology, we apply the text analysis of corporate annual reports to identify which firms have adopted the strategy of indigenous innovation while using forward-looking stock share prices as an indicator of the future impact arising from the strategy of indigenous innovation.

In the remaining sections, we first conduct our theoretical analysis of the indigenous innovation strategy by drawing on various research literature in the areas of strategic management, international

business, and innovation. Based on this theoretical analysis, we form a set of theoretical hypotheses to be tested. Next, we explain the data we use for testing our hypotheses as well as how we constructed the Trump Index and the index measuring a firm's annual average volatility matched to the Trump Index. We then explain the method we apply for statistical analysis. Subsequently, we present and discuss the results of this statistical analysis. Finally, we summarize the paper.

THEORY AND HYPOTHESES

In the following, we first conduct a theoretical analysis of which type of enterprises are more likely to implement indigenous innovation. We do so by survey relevant literature and then we propose our hypotheses to be test in the empirical part.

We first analyze whether State-Owned Enterprises (SOEs), in particular, central government owned SOEs, may be more interested in pursuing indigenous innovation for non-economic reasons than other enterprises. This argument is based on the research of many economics and management scholars who have long pointed out that due to the lack of incentives of (SOEs) have interests in pursuing national and government objectives with less regard for market success (Ghorbani, Xie, Jin, & Wang, 2022; Xu & Zhang, 2008, Megginson & Netter, 2001; Yang, Ru, & Ren, 2015). In China, indigenous innovation is often times a top-down instruction for SOEs by the government. Therefore, we posit that central government SOEs and their managers are often obligated to pursue indigenous innovation like CSR projects (Córdoba-Pachón, Garde-Sánchez, & Rodríguez-Bolívar, 2014).

Next we study the relationship between the background of senior executives and the firms adoption of indigenous innovation. There is a large literature of the upper echelon theory, which argue that firm executives have hefty power on firms' performance (Hambrick & Mason, 1984; Hambrick, 2007). Therefore, the background and experience board directors have received would have considerably huge influence on important decisions driven by their inclinations (Golden & Zajac, 2001). Guided by Hambrick's logic (1981), executives may dictate the firm' destiny through their decisions in every critical timepoint. Furthermore, executives' background and experience (Carpenter, Geletkanycz, & Sanders, 2004), board structure (Baysinger & Hoskisson, 1990; Baysinger, & Kosnik, & Turk, 1991) and social ties (Geletkanycz & Hambrick, 1997) are further studied by researchers. Therefore, firm performance may be affected these factors (Klein, 1998). Moreover, the upper echelons theory has explanation power in firm's innovation activities (Damanpour, & Schneider, 2006) In other words, literature have strengthened the role of strategic leadership (Elenkov, Judge, & Wright, 2005; Ireland, & Hitt, 1999). Based on this we theorize that firms having senior executives with R&D background are more likely to engage in indigenous innovation.

We also theorize that firms which are very experienced in innovation and have made good progress in innovation in the past are more likely to conduct indigenous innovation. The reason is that a lot of research has shown that when a firm is successful in the past relying on a strategy, the firm is likely to continue the same strategy. In other words, there is an inertia in corporate strategy. Indigenous innovation is after all a kind of innovation and therefore firms with good success in innovation in the past will like pursue indigenous innovation.

Finally, we explore the market valuation and the likelihood of adopting indigenous innovation. When a firm is highly valued by the stock market, its price-to-earnings ratio (PE) is high and the firm tend to have easier time raising capital than others. Such firms are more likely to conduct indigenous innovation.

Based on the above theoretical arguments, we believe that factors such as state ownership, the number of valid inventions a firm holds, the background of senior executive and the firm's PE contribute to the firms' performance. We form the following hypotheses:

Hypothesis 1: Central government SOEs are more likely than other enterprises to adopt the strategy of indigenous innovation.

Hypothesis 2: Firms that have senior executives with research background are more willing to conduct indigenous innovation than others.

Hypothesis 3: Firms which have achieved more technological inventions are more willing to conduct indigenous innovation than others.

Hypothesis 4: Firms with a higher PE ratio are more likely to conduct indigenous innovation than others.

Next, we analyze the effectiveness of strategy of indigenous innovation in tackling the risk of US-China economic decoupling.

To begin with, we theorize that overall, the strategy of indigenous innovation helps a firm to mitigate the negative impact of the decoupling risk. The reason is that when China is decoupled from the US, a Chinese firm may lose the opportunity to obtain technology from the US. Indigenous innovation exactly aims to enhance a Chinese firm's own capacity to innovate and therefore make up the loss of technology from foreign sources. This line of reasoning is based on the innovation literature, which provides insights

on how firms utilize their resources to conduct R&D and innovation to prevent technology crises from harming firms' interests. Innovation literature believes that firms can use innovation strategically in order to achieve competitive advantage (Ireland, & Hitt, 1999), and adapt their strategy to changing market and customer demands (Amit, & Zott, 2001) and achieve superior performance (Roberts 1999; Zahra, Ireland, & Hitt, 2000). Therefore, the strategic management of innovation represents a crucial component of a firm's strategy (Hamel, 2000; Keupp, Palmié, & Gassmann, 2012) and a kind of knowledge management for firms (Quintane, Casselman, Reiche, & Nylund, 2011).

We further posit that an SOE is less effective in implementing indigenous innovation in comparison with other types of enterprises. This is based on existing literature about the behavior of SOE (Hart, Shleifer, & Vishny, 1997; Shleifer, 1998; Zhou, Gao, & Zhao, 2017, Choi, Lee, & Williams, 2011, Steensma, & Yang, 2013; Zhou et al., 2017). The literature has shown that relative to a POE, an SOE is more attuned to top-down instructions from the government and is less efficient in carrying out a bottom-up business strategy such as innovation. Therefore, after announcing a strategy of indigenous innovation, an SOE is less effective in fending off the decoupling risk than a POE.

Next, we analyze the relationship between background of the senior executive and effectiveness of indigenous innovation. We argue that an experienced senior executive in R&D should be more effective in carrying out the strategy of indigenous innovation than an inexperienced senior executive. This argument follows the aforementioned upper echelon literature, which emphasizes that the senior executive is most effective in implementing corporate strategies in areas of his expertise.

Finally, we study whether a firm active in pursuing projects of corporate social responsibility (CSR) is more effective in implementing the strategy of indigenous innovation. Normally, firms active in CSR are better managed and efficient in operation. However, in the Chinese context, a firm active in CSR is often very interested in its political and social image, rather than its profitability or efficiency. Therefore, such a firm may adopt indigenous innovation as a CSR project and is actually unable to fully implement the strategy. That is, we argue that firms with active CSR project are less effective in carrying out indigenous innovation than other firms. Our argument is consistent with many studies exploring the relationship between the CSR and innovation (Gallego-Álvarez, Prado-Lorenzo, & García-Sánchez, 2011).

Based on the above theoretical analyses, we form four hypotheses. All these hypotheses relate the firm's characteristics to the effectiveness of the corporate strategy of indigenous innovation in mitigating the risk of US-China decoupling. They are as follows.

Hypothesis 5: Firms that adopt the strategy of indigenous innovation are less affected by the risk of US-China economic decoupling than other firms.

Hypothesis 6: SOEs are less effective in implementing indigenous innovation as a strategy to mitigate the decoupling risk than POEs.

Hypothesis 7: Firms led by senior executives with research experience are more effective in indigenous innovation as a strategy to mitigate the decoupling risk than others.

Hypothesis 8: Firms active in CSR projects are less effective in indigenous innovation as a strategy to mitigate the decoupling risk than others.

Figure 1 shows the research framework and the proposed hypotheses of this paper.

Insert Figure 1 about here.

INDEX CONSTRUCTION

The Trump Index

In this paper, we construct a *Trump Index* using former US President Donald Trump's twitter data to capture the risk of US-China decoupling. We define the Trump Index as the accumulated trade-related tweets against China by Trump. The reason we choose trade-related tweets against China is that China is the largest trade partner of the US, and the extensive trade between China and the US has been highly symbolic of globalization and the two countries economic ties. Another reason we use the Trump Index is that the former president would often announce protectionist policies after his tweets (Lang, & Li, 2021). For example, on May 5th, 2019, Trump tweeted that tariffs on $200 billion of Chinese imports would be raised on Friday from 10% to 25%. Indeed, he followed up by implementing this policy shortly after tweeting. We use 13,958 tweets posted by @realDonaldTrump. The primary data source comes from the Trump Twitter Archive (http://www.trumptwitterarchive.com).

Following Baker, Bloom, & Davis (2016), we use the machine learning methods to analysis Trump's Twitter data, and constructs the Trump Index (see Figure 2). The index cannot only reflect the tortuous evolution of China-US trade war, but also provides high-frequency data for empirical research. The data is processed as follows. First, we randomly select 5,700 tweets from all samples to create a training set. We manually label each tweet with two tags: *china* and *theme*. *china* (dummy variable) denotes whether the tweet is related to China. *theme* (factor variable) denotes the theme of the tweet. We divide all tweets into

six themes: domestic politics, crisis response, news media, economics and trade, security and diplomacy, and others. Tweets are preprocessed before being passed to the classifier (Abdelwahab, Bahgat, Lowrance, & Elmaghraby, 2015; Zhao & Gui, 2017). Then, we use the SVM model for supervised learning. 80% of the training set is used to train the model, and the rest is used to test the accuracy of the trained model. For *china*, the accuracy rate is close to 100%; for *theme*, the average accuracy rate also reaches 74%, which shows the SVM model produces acceptable classification accuracy. Finally, we use the trained model to label all 13,958 tweets. To further improve the classification accuracy, we use keywords to filter the labeled results. Based on the text analysis of each tweet, we construct the Trump Index. We count the number of tweets on China's economic and trade issues post by Trump every day. To reduce the volatility of the index, we also use the moving average of the past 10 days to obtain the daily Trump Index.

Insert Figures 2 and 3 about here.

We further test the validity of the index in two ways. First, we list the key events of China-US trade war, and compare it with the Trump Index constructed (see Figure 3). We find that the fluctuation of the index perfectly coincides with the evolution of China-US trade war. Second, we compare the Trump Index with the Trade Policy Uncertainty (TPU) index. Davis, Liu, & Shen (2019), Huang and Luk (2020) proposed the monthly TPU index to capture the uncertainty caused by the China-US trade war (see Figure 4). The results show that the trend of the Trump Index constructed in this paper is highly consistent with that of the TPU in the literature, indicating the validity of the Trump Index constructed.

Insert Figure 4 about here.

The Stock Performance Index (SPI)

To quantify how different firms respond to the risk of US-China economic decoupling, we construct a Stock Performance Index (SPI) for each company annually. The stock market provides us a unique perspective to evaluate the performance of enterprises. According to the efficient market hypothesis (EMH), in equilibrium, there should be no arbitrage opportunity in the stock market, and the prices reflect all available information (Fama, 1970). Latest research in finance has also proved that the China-US trade war has had a significant impact on the stock price (Burggraf, Fendel, & Huynh, 2019; Egger & Zhu，2019; Guo, Jiao, & Xu, 2021, Wang, Wang, Zhong, & Yao, 2021).

We construct the SPI by adopting a two-stage regression. In the first stage regression, we calculate the cumulative abnormal return (CAR). In finance, an abnormal return is the difference between the actual return of a stock and the expected return, triggered by some unexpected events. China-US trade war is a typical unexpected event, and its impacts on firms can be reflected in the CAR. In calculating the CAR, we adopt the Fama-French three-factor model (see Equation 2 to 4), which is the most commonly used model in asset pricing research (Fama, & French, 1993). In the second stage regression, we explore the correlation between the CAR and the Trump Index for each firm (see Equation 5). The coefficient estimator $\widehat{\beta_{1,i}}$ is the Stock Performance Index (SPI), which reflects the impact of the risk of decoupling on a particular firm. A

positive SPI indicates that risk of US-China economic decoupling has a positive impact on the firm's stock market performance, while a negative SPI represents a negative impact. If the SPI equals to zero, it means the risk of US-China economic decoupling makes no difference.

$$\mathrm{ER}_{i,t} = \alpha + \beta_1(\mathrm{RM}_t - \mathrm{RF}_t) + \beta_2\mathrm{SMB}_t + \beta_3\mathrm{HML}_t + \varepsilon_{i,t} \quad (2)$$

$$\mathrm{AR}_{i,t} = \mathrm{ER}_{i,t} - \left[\widehat{\alpha} + \widehat{\beta_1}(\mathrm{RM}_t - \mathrm{RF}_t) + \widehat{\beta_2}\mathrm{SMB}_t + \widehat{\beta_3}\mathrm{HML}_t\right] \quad (3)$$

$$\mathrm{CAR}_{i,t}(\tau_1, \tau_2) = \sum_{j=\tau_1}^{\tau_2} \mathrm{AR}_{i,t+j} \quad (4)$$

$$\mathrm{CAR}_{i,t} = \alpha_i + \beta_{1,i}\mathrm{TrumpIndex}_t + \boldsymbol{\beta}'_{2,i}\boldsymbol{X}_t + \lambda_w + \eta_q + \varepsilon_{i,t} \quad (5)$$

$$\mathrm{SPI}_i = \widehat{\beta_{1,1}} \quad (6)$$

By adopting the two-stage regression, we turn high-frequency data consisting of the daily Trump Index and stock market return into low-frequency data that convey yearly firm-specific SPI index, which reflects the company's performance in response to the risk of US-China economic decoupling. Table 1 presents the summary statistics of the SPI. We can find SPI is normally distributed with a negative mean. This indicates that, on average, the risk of US-China economic decoupling has a negative impact on firms' performance. However, the impact on different firms varies significantly, which we believe is due to firms adopting different coping strategies.

Insert Table 1 about here.

The Strategy of Indigenous Innovation

We conduct text analysis of the company's annual report and construct a dummy variable Indigenous

Innovation Strategy (IIS) for each company annually. Existing research demonstrates that the Management's Discussion and Analysis (MD&A) section of a public company's annual report is informative and reflect the company's future strategy (Cole & Jones, 2005; Muslu, Radhakrishnan, Subramanyam, & Lim, 2015). We use the text of the MD&A section in the annual and semi-annual reports of Chinese A-share non-financial listed companies, and use text analysis methods to identify whether the company has adopted an indigenous innovation strategy.

The identification strategy of indigenous innovation strategy is as follows. If a company's MD&A section includes keywords "indigenous innovation (*zizhu chuangxin*)" or "indigenous R&D (*zizhu yanfa*)" in both the annual report of the previous year and the semi-annual report of this year, we identify the company as one adopting the indigenous innovation strategy. To ensure the validity of the IIS index, we also used other keywords to identify the indigenous innovation strategy for robustness check. Empirical tests showed that the conclusions still hold. Figure 5 presents the proportion of companies adopting the indigenous innovation strategy. We find that before 2007, almost no companies mentioned the indigenous innovation strategy. In the years after the outbreak of the global financial crisis (GFC), only a small proportion (about 5%) of Chinese companies adopted the indigenous innovation strategy. However, the strategy was again rarely mentioned after 2012. When Trump was elected the president of the United States in 2017, with the rising risk of US-China economic decoupling, more and more Chinese companies began to adopt the indigenous innovation strategy. By 2021, this proportion was already close to 25%.

Insert Figure 5 about here.

DATA AND METHODOLOGY

Variables, Measures, and Data Sources

We use the data of Chinese non-financial listed companies from 2017 to 2019 to empirically test whether the indigenous innovation strategy (IIS) can help firm respond better to the risk of US-China economic decoupling. The samples of newly listed companies and de-listed companies are deleted to ensure the generality of the results. The data covers the SPI, IIS, ownership, market value, R&D investment, number of valid invention patents, the existence of a CSR project, PE ratio, Tobin's Q, ROA, and leverage ratio of each firm, as well as the age, gender, and work experience of senior executives. We also include the trade volume, R&D intensity of the province, that may affect the effectiveness of the indigenous innovation strategy. The measures of the variables and descriptive statistics are presented in Table 2. The data sources are from the CSMAR database and self-constructed index. To rule out the influence of outliers, we discard values smaller than 0.5th percentile or greater than 99.5th percentile for all variables.

Insert Tables 2 and 3 about here.

The Setup of Regressions

According to the analysis of IIS index in the previous section, with the rising trend of the risk of US-China economic decoupling, more and more Chinese listed firms are adopting the indigenous innovation strategy. To test what kinds of firms are more likely to adopt the indigenous innovation strategy, we adopt the following Probit regression specification, for firm i in year t,

$$P(IIS_{i,t} = 1) = F[\alpha + \beta_1 SOE_{i,t-1} + \beta_2 ResearchBack_{i,t-1} + \beta_3 ValidInvention_{i,t-1} +$$

$$\beta_4 R\&DInvest_{i,t-1} + \beta_5 CSR_{i,t-1} + \beta_n \text{Controls}_{i,t-1} + FixedEffects + \varepsilon_{it}] \quad (7)$$

The dependent variable $IIS_{i,t}$is a dummy variable which equals to 1 if the firm adopts the indigenous innovation strategy. The key independent variables include $SOE_{i,t-1}$, dummy variable equals to 1 if the firm is state-owned enterprise; $ResearchBack_{i,t-1}$, dummy variable equals to 1 if senior executives have research work experience; $ValidInvention_{i,t-1}$, the logarithm of the number of total valid inventions of the firm; $R\&DInvest_{i,t-1}$, the firm's R&D investment as a percentage of total assets; $CSR_{i,t-1}$, dummy variable equals to 1 if the firm adopts the company social responsibility (CSR) projects. The control variables include the market value, PE ratio, Tobin's Q, ROA, and leverage ratio of each firm. We also control the year fixed effect and industry fixed effect. To avoid the reversal causality, we use the one year lagged value for all independent and control variables, and the t-statistics are cluster at the industry level.

According to the analysis above, the SPI index reflects the firm's performance in response to the risk of US-China economic decoupling. To test whether the indigenous innovation strategy can help the firm better cope with the risk of US-China economic decoupling, we use the following regression specification, for firm i in year t,

$$SPI_{it} = \alpha + \beta_1 IIS_{i,t} + \beta_2 SOE_{i,t} * IIS_{i,t} + \beta_3 ResearchBack_{i,t} * IIS_{i,t} + \beta_4 CSR_{i,t} * IIS_{i,t} +$$

$$\beta_n \text{Controls}_{i,t} + FixedEffects + \varepsilon_{i,t} \quad (8)$$

where the dependent variable SPI_{it} denotes the performance of the firm's response to the risk of US-China economic decoupling. The key independent variables are $IIS_{i,t}$, dummy variable denotes whether the firm adopts the indigenous innovation strategy. To test the moderating effect of other factors, we also include

$SOE_{i,t} * IIS_{i,t}$, interaction variable tests whether the state ownership can affect the effectiveness of indigenous innovation strategy; $ResearchBack_{i,t} * IIS_{i,t}$, interaction variable tests whether the manager's research background can affect the effectiveness of indigenous innovation strategy; $CSR_{i,t} * IIS_{i,t}$, interaction variable tests whether the firm having CSR projects can affect the effectiveness of indigenous innovation strategy. The control variables are the same as equation (7). We also control the year fixed effect and firm fixed effect. To avoid the reversal causality, we use one year lagged value for all control variables. And the t-statistics are cluster at the firm level.

REGRESSION RESULTS

Table 4 presents the estimation results for equation (7) based on the annual data from 2017 to 2019. Columns (1)-(2) in Table 4 are the results of the baseline regression. We find that the coefficients of *Central SOE* are significantly negative, which shows that central government SOEs are less likely to propose the indigenous innovation strategy. We also find that the coefficients of *Local SOE* are not significant, which means that local SOEs are no different from other enterprises in whether adopting indigenous innovation. Thus, H1 is not supported by the empirical results. This shows that central SOEs are actually more occupied by many other government mandates so that indigenous innovation does not arouse as much interest of the central SOEs as we hypothesized.

The results also shows that the coefficients of *ResearchBack*, *log(ValidInvention)*, and *R&D* are significantly positive. This indicates that firms whose senior executives have research background, with more valid invention patents, and higher R&D investment are more likely to adopt the indigenous innovation strategy. Thus, H2 and H3 are supported by the empirical results.

Columns (1)-(2) of also show that the coefficient of *PE Ratio* is significantly positive, which show that firms with higher market valuations are more likely to adopt indigenous innovation strategies, which support H4. We also use the Logit model to rerun the equation (7) for robustness check. Columns (3)-(4) in Table 4 present the results, which shows that the conclusions are robust.

Insert Table 4 about here.

Table 5 presents the estimation results for equation (8) based on the annual data from 2017 to 2019. Columns (1) in Table 5 presents the results of the baseline regression.

We find that the coefficient of *IIS* is significantly positive, which shows that, on average, firms that adopt indigenous innovation strategy perform better facing the risk of decoupling, which support H5.

We then test the moderating effects of other factors. Columns (2)-(3) in Table 5 present the results incorporating the ownership interaction, which shows that the coefficients of *IIS* * *SOE* and *IIS* * *Central SOE* are significantly negative. This indicates that the state ownership, especially central state ownership would weaken the effect of indigenous innovation strategy in mitigating the decoupling risk, which support H6.

Column (4) in Table 5 presents the results incorporating the senior executive background interaction, which shows that the coefficient of *IIS* * *ResearchBack* is not significant. Thus, H7 is not supported by the empirical results. Combining this finding with that of H2, we think a likely explanation is that R&D experienced senior executives are passionate about innovation and therefore are willing to adopt indigenous innovation. However, indigenous innovation is different from their experiences in the past when US and

China were highly coupled so that they are not particularly more effective than others in actually implementing indigenous innovation.

Column (5) in Table 5 presents the results incorporating the CSR interaction, which shows that the coefficient of *IIS * CSR* is significantly negative. This indicates that the CSR strategy actually would weaken the effectiveness of the indigenous innovation strategy. Thus, H8 is supported by the empirical results.

Insert Table 5 about here.

To test the robustness of the results, we change the identification strategy for the key variable IIS index and re-run the regression (8). Table 6 presents the estimation results. The empirical tests showed that the main conclusions still hold.

Insert Table 6 about here.

DISCUSSIONS AND CONCLUSIONS

Main Findings

In summary, this paper focuses on the indigenous innovation strategy, uses a unique dataset, and provides evidence to the following two questions. First, dealing with the risk of US-China economic decoupling, what kind of firms are more likely to adopt indigenous innovation strategy. Second, after adopting the indigenous innovation strategy, what is the impact on firm's performance in response to risk of US-China economic decoupling. Based on our theoretical analysis and empirical tests, we have following key findings.

First, we use the text analysis method and the MD&A texts to identify firm's adoption of the indigenous innovation strategy. We find that during the past five year, more and more Chinese listed firms are adopting the indigenous innovation strategy. The empirical results show that SOEs, especially central SOEs are less likely to propose the indigenous innovation strategy. This may be due to SOEs' easy access to government resource support, thus there is no need for indigenous innovation. However, for more market-oriented private enterprises, they are more sensitive to the risk of US-China economic decoupling, and are more likely to adopt the indigenous innovation strategy to deal with possible technological blockades. We also find that firms whose senior executives have research background, with more valid invention patents are more likely to adopt the indigenous innovation strategy. These enterprises are often technology-oriented. Facing the risk of US-China economic decoupling, firms find less possibilities of foreign technological cooperation. Therefore, they are more inclined to adopt indigenous innovation strategies to improve R&D capabilities. The results also show firms with higher PE ratio are likely to obtain investment and adopt the indigenous innovation strategy.

Second, we construct a so-called Trump Index to quantify the risk of US-China economic decoupling, and use the firms' performance in the stock market to evaluate their response to the risk of US-China economic decoupling. Based on this, we empirically test whether adopting the strategy of indigenous innovation can mitigate the risk of decoupling. Consistent with our hypotheses, the empirical results show that firms that adopt indigenous innovation strategy perform better facing the risk of decoupling. We then test the moderating effects of other factors. We find that state ownership weakens the effectiveness of

indigenous innovation strategy. This may be due to the fact the indigenous innovation is a bottom-up process while state-owned enterprises are more comfortable with a top-down approach. The results also show that the firms active in CSR are less effective in adopting the indigenous innovation strategy.

Theoretical Contribution

This paper makes three theoretical contributions to the literature. First, we conduct a two-step analysis of indigenous innovation using a large dataset by asking which firms adopted the strategy and the resulting impacts after adopting the strategy. This approach has not been deployed in the existing literature. Second, we link indigenous innovation to the issue of China-US decoupling, quantifying the risk through the text analysis of tweets made by former US President Trump. In this way, we convert high-frequency stock price responses to the daily Trump Index into a low frequency annualized firm-specific set of statistics, which matches average share price volatility to the Trump Index. Third, we utilize a text analysis of corporate annual reports to identify firms which adopt the strategy of indigenous innovation and we use stock share prices as a harbinger of the future impact arising from the strategy of indigenous innovation.

Practical Implication

A practical implication of the paper is that China's indigenous innovation is likely to achieve partial rather universal success in dealing with the US-China decoupling risk, since despite campaigns by the government, only around a quarter of firms adopt the strategy and among these firms, only some of them

can achieve success in implementing the strategy. In particular, successful firms are likely to be private firms with senior executives experienced in R&D.

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TABLE 1

Summary Statistics of SPI Index

	min	p10	p25	p50	p75	p90	max
SPI	-13.78	-2.945	-1.265	-0.005	1.260	3.029	10.83

TABLE 2

Descriptive Statistics of Variables

Variable	Definition	N	Mean	SD	Min	Median	Max
IIS	dummy variable, 1 if the firm adopts the indigenous innovation strategy	5501	0.092	0.289	0	0	1
SPI	stock performance index, self-constructed	5501	0.007	2.838	-13.78	-0.005	10.83
SOE	dummy variable, 1 if SOE	5501	0.402	0.490	0	0	1
ResearchBack	dummy variable, 1 if the senior executives have research and design work experience	5461	0.214	0.410	0	0	1
log(ValidInvention)	ln (number of firm's valid invention)	4930	2.906	1.715	0	2.890	9.725
R&D	R&D investment/ total assets	4630	2.253	2.120	0	1.957	22.09
CSR	dummy variable, 1 if the firm adopts the CSR strategy	5499	0.118	0.323	0	0	1
OpenEnvir	the trade volume / local GDP	5480	6.689	4.415	0.184	6.880	15.78
log(Mkt Cap)	ln (end-of-period market value)	5501	23.06	1.253	20.71	22.87	28.07
PE Ratio	price/prior year net income)	5501	3.358	0.930	0.496	3.275	8.207
Tobin Q	end-of-period market cap/total assets	5501	1.696	1.102	0.750	1.394	15.49
ROA	end-of-period net income/total assets	5501	0.054	0.042	0.001	0.044	0.305
Lev	end-of-period debt /total assets	5501	0.424	0.193	0.032	0.416	0.940
Age	age of manager	5460	54.21	7.344	30	54	81
Female	dummy variable, 1 if female	5461	0.058	0.235	0	0	1

TABLE 3

Correlation Coefficient of Variables

	SPI	IIS	SOE	ResearchBack	log(ValidInvention)	R&D	CSR	log(Mkt Cap)	PE Ratio	Tobin Q	ROA	Leverage	Age	Female
SPI	1													
IIS	-0.018	1												
SOE	0.096***	-0.052***	1											
ResearchBack	0.017	0.069***	0.049***	1										
log(ValidInvention)	0.005	0.080***	0.100***	0.161***	1									
R&D	-0.087***	0.127***	-0.161***	0.139***	0.265***	1								
CSR	0.013	-0.001	0.127***	0.002	0.155***	0.016	1							
log(Mkt Cap)	0.120***	-0.031**	0.308***	-0.015	0.392***	-0.105***	0.233***	1						
PE Ratio	-0.034**	0.056***	-0.098***	0.047***	-0.073***	0.125***	-0.096***	-0.376***	1					
Tobin Q	-0.020	0.034**	-0.131***	0.028**	-0.017	0.264***	-0.041***	-0.057***	0.351***	1				
ROA	-0.070***	0.026*	-0.197***	0.004	-0.031**	0.188***	-0.025*	-0.017	-0.380***	0.366***	1			
Leverage	0.083***	-0.064***	0.237***	-0.042***	0.142***	-0.150***	0.086***	0.510***	-0.203***	-0.291***	-0.420***	1		
Age	-0.009	0.011	-0.061***	0.065***	0.076***	0.003	0.016	0.038***	-0.063***	0.010	0.053***	-0.060***	1	
Female	-0.019	0.021	-0.062***	-0.035**	-0.022	-0.034**	-0.006	-0.039***	0.039***	0.019	-0.012	0.006	-0.073***	1

TABLE 4

The Regression Results of Equation (7)

	Probit Model		Logit Model	
	(1)	(2)	(3)	(4)
Variable	IIS	IIS	IIS	IIS
Central SOE	-0.153*	-0.145*	-0.277*	-0.263*
	(0.082)	(0.083)	(0.157)	(0.157)
Local SOE	-0.021	0.018	-0.044	0.028
	(0.069)	(0.070)	(0.134)	(0.135)
CSR	-0.019	-0.022	-0.032	-0.033
	(0.082)	(0.083)	(0.158)	(0.157)
ResearchBack	0.116**	0.100*	0.229**	0.190*
	(0.058)	(0.059)	(0.108)	(0.111)
log(ValidInvention)	0.059***	0.051**	0.113***	0.097**
	(0.020)	(0.021)	(0.039)	(0.039)
R&D	0.060***	0.043***	0.102***	0.074***
	(0.012)	(0.012)	(0.020)	(0.020)
PE Ratio	0.142***	0.129***	0.265***	0.243***
	(0.042)	(0.044)	(0.077)	(0.080)
Leverage	-0.340*	-0.236	-0.692*	-0.482
	(0.189)	(0.199)	(0.366)	(0.384)
log(Mkt Cap)	0.002	0.017	0.002	0.030
	(0.032)	(0.034)	(0.063)	(0.066)
Tobin Q	-0.043	-0.046	-0.081	-0.088
	(0.032)	(0.033)	(0.058)	(0.060)
ROA	0.781	0.558	1.545	1.211
	(0.949)	(0.967)	(1.792)	(1.828)
Constant	-1.956***	-2.718***	-3.365**	-4.922***
	(0.715)	(0.806)	(1.382)	(1.579)
Control variables	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	No	Yes	No	Yes
Observations	4,476	4,408	4,476	4,408

Clustered t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

TABLE 5

The Regression Results of Equation (8)

Variable	(1) SPI	(2) SPI	(3) SPI	(4) SPI	(5) SPI
IIS	0.387*	0.682**	0.687**	0.495*	0.662**
	(0.230)	(0.285)	(0.281)	(0.274)	(0.288)
IIS * SOE		-0.889*			
		(0.476)			
IIS * Central SOE			-1.793**		
			(0.733)		
IIS * Local SOE			-0.369		
			(0.538)		
IIS * ResearchBack				-0.363	
				(0.450)	
IIS * CSR					-0.836*
					(0.438)
ResearchBack	0.508*	0.527*	0.540*	0.556*	0.507*
	(0.306)	(0.304)	(0.302)	(0.307)	(0.307)
Constant	-12.763	-13.301	-13.547	-13.018	-14.323
	(10.472)	(10.469)	(10.444)	(10.490)	(10.468)
Control variables	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	4,478	4,478	4,478	4,478	4,476
R-squared	0.017	0.018	0.019	0.017	0.019

Clustered t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

TABLE 6

The Robustness Test Results of Equation (8)

Variable	(1) SPI	(2) SPI	(3) SPI	(4) SPI	(5) SPI
IIS	0.299**	0.561***	0.533***	0.325*	0.522***
	(0.142)	(0.186)	(0.184)	(0.167)	(0.187)
IIS * SOE		-0.710**			
		(0.283)			
IIS * Central SOE			-0.687*		
			(0.395)		
IIS * Local SOE			-0.624*		
			(0.333)		
IIS * ResearchBack				-0.101	
				(0.292)	
IIS * CSR					-0.362*
					(0.204)
ResearchBack	0.502	0.522*	0.522*	0.549*	0.486
	(0.308)	(0.307)	(0.308)	(0.320)	(0.310)
Constant	-12.794	-13.376	-13.274	-12.793	-13.884
	(10.450)	(10.447)	(10.451)	(10.454)	(10.429)
Control variables	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	4,478	4,478	4,478	4,478	4,476
R-squared	0.017	0.019	0.019	0.017	0.019

Clustered t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

FIGURE 1

Research Framework and the Proposed Hypotheses

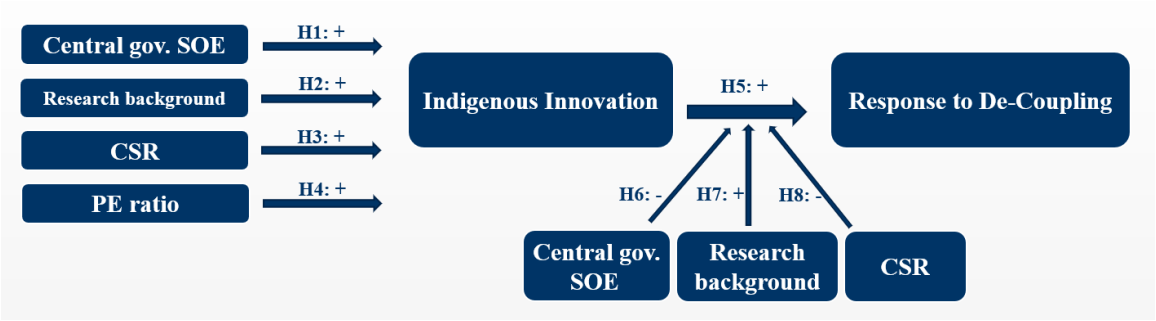

FIGURE 2

Flowchart of Natural Language Processing

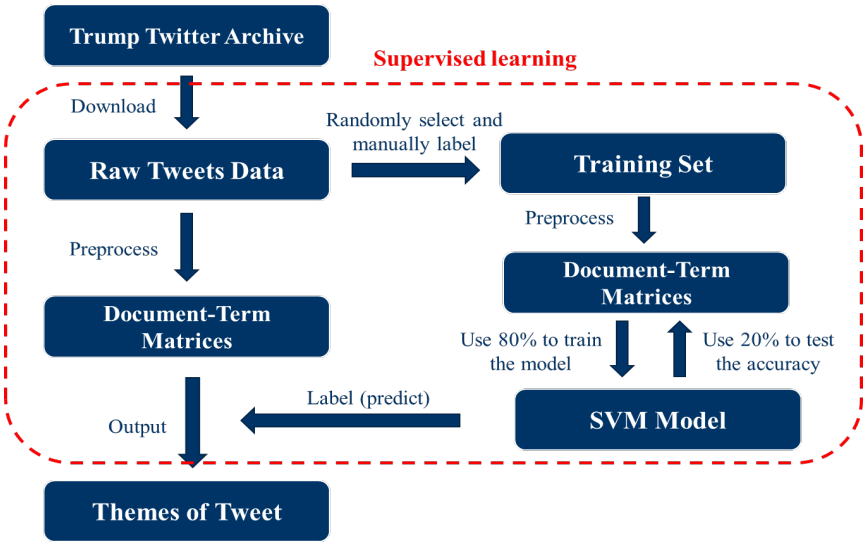

FIGURE 3

Diagram of the Trump Index

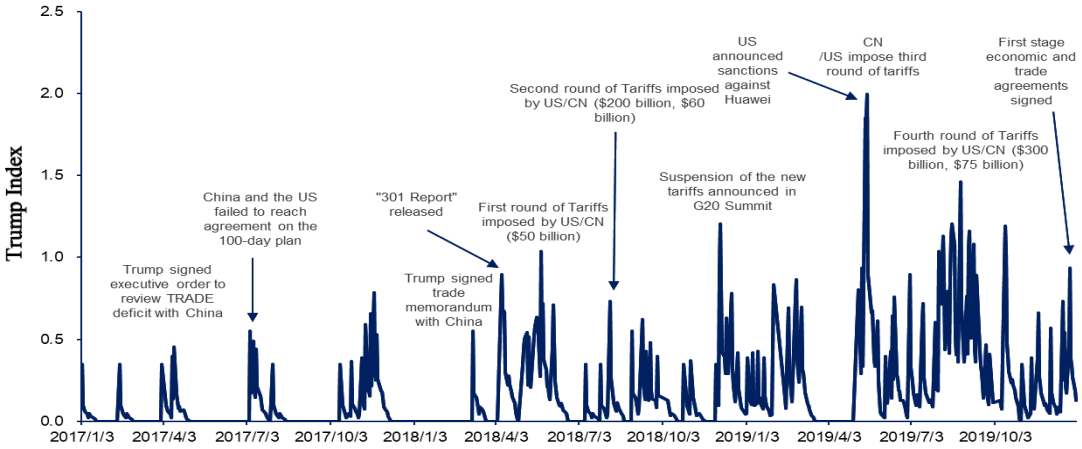

FIGURE 4

Diagram of the TPU Index

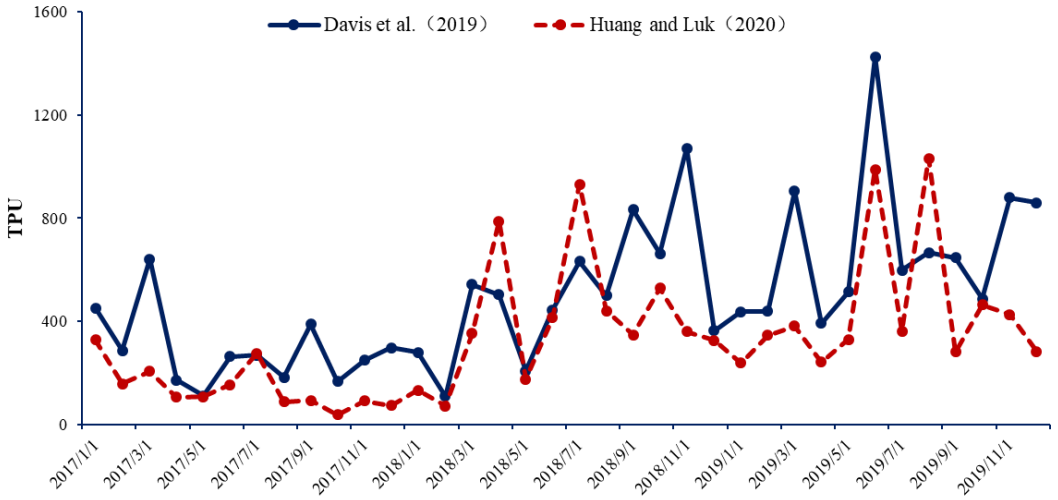

FIGURE 5

Proportion of companies adopting the indigenous innovation strategy