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Effects of Outside Directors on Firms' Investments and Performance: Evidence from a Quasi-Natural Experiment in Japan

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Abstract

This study presents evidence on the impact of outside directors on firms' investment behavior and performance with a focus on the recent quasi-natural experiment that rapidly increased the number of outside directors in listed firms. Using a panel of Japanese firms, we compare listed and unlisted firms and conduct instrumental variable estimations to examine causal relationships. The results indicate that the rapid increase in the number of outside directors among listed firms did not promote active investments or risk-taking behavior. In addition, it had no significant impacts on the profitability and productivity of the firms at least in the short run.

Keywords: outside director, corporate governance, investment, R&D, ROA, TFP
JEL Classification: D22, G34, K22, M48

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1. Introduction

This study uses a large panel of Japanese firms and presents evidence on the impact of outside directors on firms' investment behavior and performance. Following an amendment to the Corporate Law and the introduction of the Corporate Governance Code, the number of independent outside directors in listed Japanese firms increased rapidly. We can view this change in board composition as a quasi-natural experiment, similar to the enactment of the Sarbanes-Oxley Act (SOX) in the U.S.

In recent years, the Japanese government actively implemented policies to promote corporate governance reforms with the aim of increasing the number of independent outside directors on the boards of listed firms. The government amended the Corporate Law in 2014 and introduced the Corporate Governance Code in 2015, which forced listed firms to explain, at both the shareholder meeting and in the annual report, why they do not have independent outside directors on the board if this is the case. Since the rule is a "comply or explain" style, appointing independent outside directors is not strictly a statutory obligation. However, in practice, the rules put strong pressure on listed firms because it is not easy to give convincing reasons why they appoint no independent outside directors. In 2018, the government amended the Corporate Governance Code to increase the number of independent outside directors and to ensure gender diversity on the board. The government is discussing a further amendment of the Corporate Law that would make appointing outside directors a statutory obligation.

Following the adoption of these policies, the number of outside directors has been increasing rapidly within listed firms, which is a sharp contrast to the unlisted firms that these policies do not affect. According to the Basic Survey of Japanese Business Structure and Activities (BSJBSA) conducted by the Ministry of Economy, Trade and Industry, the percentage of listed firms with at least one outside director shows an increasing trend, particularly since 2014, and reached 87% in 2017 (panel A of **Table 1**). In contrast, the percentage of unlisted firms with outside directors is hovering around 46%. The mean share of outside directors on the boards of listed firms also increased from 13% in 2011 to 25% in 2017, but the figure is stable around 18% for unlisted firms

(panel B of **Table 1**). The table also shows that the increase in outside directors reflects the increase in the number of independent outside directors (column (2)). All of these trends indicate that only listed firms responded to the pressure from the corporate governance reform.[1]

As we discuss in the next section, several studies investigate the effects of outside directors on firm behavior and performance, but such studies for Japanese firms are limited. Since the decision to increase outside directors is endogenous, simply observing the relationship between board composition and the behavior or performance of the firms cannot reveal causality. In this respect, this study contributes to the literature by exploiting the recent change in board composition in Japan arising from a quasi-natural policy experiment to examine the causal impacts of (independent) outside directors empirically. Specifically, we try to identify a causal relationship through (1) comparing listed and non-listed firms in a difference-in-difference (DID) framework and (2) conducting instrumental variable estimations for listed firms.

From the analysis, we do not detect evidence that the increase in the number of outside directors among listed firms promotes active investments and risk-taking behavior. In addition, it has no significant impacts on the profitability and productivity of the affected firms. These results support the view repeatedly expressed in the literature (e.g., Coles *et al*., 2008; Duchin *et al*., 2010; Miyajima and Ogawa, 2012; Schmidt, 2015) that the optimal board composition differs according to the firm's characteristics and that a one-size-fits-all style regulation can harm some types of firms.

The rest of this paper proceeds as follows. Section 2 briefly reviews the literature on the relationship between outside directors and firm performance. Section 3 explains the data and the method of analysis used in this study. Section 4 reports the results, and Section 5 concludes with the policy implications of the results.

2. Literature Review

A large number of theoretical and empirical studies examine the relationship between outside directors and firm performance. However, since board composition is an endogenous decision of

[1] In addition to the number of inside and outside directors, the BSJBSA includes the number of outside directors from related firms (parent and subsidiaries). We calculate the number of independent outside directors as the difference between the total number of outside directors and those from related firms.

the firm, we cannot interpret simple correlations between the introduction/expansion of outside directors and firm performance as a causal relationship (e.g., Hermalin and Weisbach, 2003; Adams *et al*., 2010; Wintoki *et al*., 2012; Roberts and Whited, 2013).

In this respect, the enactment of the Sarbanes-Oxley Act (SOX) and related reforms in the U.S., which forced listed firms to strengthen the roles of outside directors, presented a good exogenous change in board composition. Several studies exploit this natural experiment to analyze the causal impacts of outside directors on firm performance. The results do not necessarily support a popular belief that outside directors contribute to the benefit of shareholders. Linck *et al*. (2009) and Ahmed *et al*. (2010), for example, indicate that SOX had a negative impact on firm profitability by increasing the costs related to outside directors. Duchin *et al*. (2010) find that the effect of adding outside directors on firms' return on assets (ROA) and firm value is heterogeneous and depends on the cost to acquire information about the firm.

Lu and Wang (2018) analyze board independence in response to SOX and find that board independence has a positive impact on innovation according to the numbers and citations of patents.[2] Outside the U.S., Balsmeier *et al*. (2014) focus on the introduction of the Corporate Governance Code in Germany that recommended that firms appoint an adequate number of outside directors and find that outside directors from innovative firms increase patent applications, but that those from non-innovative firms are negatively associated with innovativeness.

To summarize, whether an increase in the number of outside directors benefits firms or not depends on various firm characteristics. Therefore, many studies point out that a one-size-fits-all regulation is not desirable (e.g., Coles *et al*., 2008; Linck *et al*., 2008; Duchin *et al*., 2010; Schmidt, 2015).

In Japan, empirical studies on the impact of outside directors include those by Miyajima and Ogawa (2012), Kim and Kwon (2015), Tanaka (2019), and Sako and Kubo (2019). Miyajima and Ogawa (2012) indicate that, on average, outside directors do not help improve ROA. Kim and Kwon (2015) report that, after controlling for the endogeneity of board composition, outside directors do not have a positive impact on firm productivity. However, the sample years of these studies (2005–2010) do not cover the period of recent corporate governance reforms.

Tanaka (2019), using a sample of Japanese listed firms for 2006–2015, finds that firms with

[2] On the other hand, Aghion *et al*. (2013) point out the possibility that boards composed mostly of outsiders may increase CEOs' risk aversion and jeopardize innovation.

more female outside directors exhibit higher firm value (Tobin's Q), after accounting for possible endogeneity concerns. Sako and Kubo (2019) analyze the role of professional directors (accountants and lawyers) on the board using a dataset of listed firms in Japan during 2004–2015. Although the set of professional directors includes both inside and outside directors, most should be outside directors. Their result indicates that the presence of professional directors increases ROA and Tobin's Q. However, these studies focus only subsets of outside directors (females and professionals), and most of the sample periods are before the introduction of the Corporate Governance Code in 2015.

Against this background, this study uses a panel of both listed and unlisted Japanese firms to address the effects of outside directors on investments, profitability, and productivity by exploiting the quasi-natural experiment of recent corporate governance reforms. As the impacts of board composition in non-Anglo-American firms is understudied (Adams *et al*., 2010), this study contributes to the literature by presenting causal evidence for Japanese firms.

3. Data and Methodology

This study uses panel data constructed from the BSJBSA for the years 2009–2017. The BSJBSA is an annual government collection of statistics on about 30 thousand firms with 50 or more regular employees engaged in the mining, manufacturing, electricity and gas, wholesale, retail, information and communications, and selected service industries. The BSJBSA captures data on the comprehensive structure and activities of Japanese firms, such as their financial information (sales, costs, profits, book value of capital, etc.), number of employees, composition of businesses, investments, research and development (R&D) expenditures, and international trade. Because the sample firms are coded by perpetual identification codes, we can construct a firm-level panel dataset accurately. The BSJBSA began to collect information on the number of inside/outside directors in 2009. It also collects the number of outside directors from related firms (parent and subsidiary) as a subset of outside directors.[3]

Among Japanese listed firms, the number of outside directors started to increase rapidly from

[3] As the BSJBSA does not have information about firms' listing status, we use the BSJBSA-security code converter constructed by RIETI to identify the listed firms.

2014 in response to the corporate governance reform (see **Table 1**). This study focuses on the increase in the number of outside directors between 2014 and 2016 (t) and analyzes the impact on firm behavior and performance in the next year (t+1) and the following year (t+2). We should note that board reform may take time to impact firm behavior and performance, but the most current available BSJBSA data is for 2017. We use the data prior to 2013 to (1) measure the trends in the dependent variables before the increase in the number of outside directors and (2) construct the instrumental variable (ratio of outside directors in the previous year) we apply to the increase in the number of outside directors.

Although board composition may affect various aspects of firm behavior, our interest is in whether the reform promotes active risk-taking and improves firm performance, as the Corporate Governance Code and other government documents, such as the Japan Revitalization Strategy 2014, suggest. Specifically, we use tangible investments and R&D expenditure (both divided by sales) as the dependent variables representing firm behavior. To measure firm performance, we use ROA and total factor productivity (TFP). [4]

From the BSJBSA data, we divide current profit by total assets to calculate ROA. We calculate TFP (expressed in logarithm) non-parametrically by the cost-share-based index number method, which uses a hypothetical representative firm of each three-digit industry as the reference. We compute the inputs (capital and labor) and output (value-added) of a hypothetical representative firm in the base year (2009) as the geometric means of all firms in the same three-digit industry, and the cost shares of labor and capital as arithmetic means. This method of TFP calculation is common in productivity studies (see Syverson, 2011). [5]

The value-added is the sum of the operating profits, depreciation, wages, welfare costs, rent, and paid taxes. Capital stock is the book value of tangible assets available in the BSJBSA. Since the BSJBSA does not provide the working hours of individual firm, labor input (total hours) is the sum of the number of full-time employees multiplied by their industry-level working hours and the number of part-time employees multiplied by their industry-level working hours. We source the numbers of full-time and part-time employees from the BSJBSA. We collect data on working hours at the industry-level from the Monthly Labor Survey (Ministry of Health, Labor

[4] Regarding ROA, investments per sales, and R&D expenditure per sales, we remove firms with values above 1 as outliers. Since we express TFP in logarithmic form, we do not apply outlier treatment.
[5] Nishimura et al. (2005), Fukao and Kwon (2006), and Morikawa (2015, 2016, 2019) are such studies that apply this TFP calculation method to the BSJBSA data.

and Welfare). The cost share of labor is the sum of wages and welfare costs divided by value-added. In calculating the real (constant price) values of value-added and capital stock, we apply the price deflators of the National Accounts (Economic and Social Research Institute, Cabinet Office).

In the estimations, the main explanatory variable ($OUTSIDE_{it}$) is the dummy for firms that increase the number of outside directors in year t. In addition, we include the interaction term of $OUTSIDE_{it}$ and listed firm ($LISTED_{it}$) in the estimations for both listed and unlisted firms. We control for the lagged values of the dependent variables (y_{it}), trend in the dependent variables in the prior three years ($\Delta y_{it-3,t}$), three-digit industry dummies (λ_{jt}), and year dummies (θ_t) (subscripts i and j denote firm and industry, respectively). The dependent variables (y_{it+1}) are tangible investments (INV_{it}), R&D investments ($R\&D_{it}$), ROA_{it}, and TFP_{it}.

To investigate firm behavior and performance in the next year (t+1), we estimate the following equation. For the estimations for the subsequent year (t+2), we replace y_{it+1} with y_{it+2}.

$$y_{it+1} = \beta_0 + \beta_1 OUTSIDE_{it} + \beta_2 (LISTED_{it} \times OUTSIDE_{it}) + \beta_3 LISTED_{it} + \beta_4 y_{it} + \beta_5 \Delta y_{it-3,t} + \lambda_{jt} + \theta_t + \varepsilon_{it}. \quad (1)$$

This specification is a sort of difference-in-difference (DID). Our main interest is the sign and significance of the coefficient on the interaction term (β_2). During the sample period, listed firms faced pressure to increase the number of outside directors. In contrast, unlisted firms were free from such pressure. Therefore, by comparing listed and unlisted firms, we can capture the effects of the reforms to board composition policies, including the amendment of the Corporate Law and the introduction of the Corporate Governance Code.

Since the BSJBSA has information on the number of outside directors from related firms (parent and subsidiary), we can calculate the number of *independent* outside directors as the difference between the total number of outside directors and those from related firms. We use a dummy for firms that increased the number of independent outside directors ($INDEP_{it}$) as an alternative to $OUTSIDE_{it}$. However, as we stated in the introduction, since the new outside directors are mostly independent outside directors, the estimation results for $OUTSIDE_{it}$ and $INDEP_{it}$ are similar.

Although listed firms faced strong pressure to increase the number of outside directors, they had no legal obligation to do so. Since listed firms had some discretion in terms of whether to

comply or not, the DID estimations cannot eliminate endogeneity in the board composition completely. To deal with this possibility, we apply an instrumental variable approach to the sample of listed firms. The instrument for $OUTSIDE_{it}$ is the ratio of outside directors on the board in the previous year ($OUTRATIO_{it-1}$). Similarly, in the estimations of $INDEP_{it}$, we use the ratio of independent outside directors in the previous year ($INDEPRATIO_{it-1}$) as the instrument. Equations (2) and (3) represent the first and second stage regressions, respectively. In addition to the 2SLS estimations, we perform fixed-effects estimations (FEIV), in which we replace the industry fixed-effects (λ_{jt}) with the firm fixed-effects.

$$OUTSIDE_{it} = \gamma_0 + \gamma_1 OUTRATIO_{it-1} + \gamma_2 y_{it} + \gamma_3 \Delta y_{it-3,t} + \lambda_{jt} + \theta_t + \eta_{it} \quad (2)$$

$$y_{it+1} = \beta_0 + \beta_1 OUTSIDE_{it} + \beta_2 y_{it} + \beta_3 \Delta y_{it-3,t} + \lambda_{jt} + \theta_t + \varepsilon_{it} \quad (3)$$

The assumption of this instrument is that listed firms with only a few or no outside directors felt the urgency to add outside directors. This instrument is similar to past studies on female directors on boards (e.g., Ahern and Dittmar, 2012; Bertrand *et al*., 2019). These studies use the ratio of female directors before the introduction of a female quota system as the instrument to estimate the impact of female directors on firm performance. As we report in the next section, this instrument has a strong predictive power for the increase in the number of outside directors. **Table 2** summarizes the major variables and provides the summary statistics by firms' listing status.

In addition to the analysis to explain the dependent variables in the next year (y_{t+1}), we also estimate the impact on the year after the next (y_{t+2}), although the treatment years are limited to 2014 and 2015. In these estimations, we replace y_{it+1} in equations (1)–(3) with y_{it+2}.

4. Results

4.1. Outside Directors and Investments

Table 3 reports the results on the relationship between increasing outside directors and investments (*INV*). According to the DID estimation (Column (1)), the coefficients for *OUTSIDE* and its interaction terms with *LISTED* are both small and statistically insignificant. In the first

stage of the 2SLS estimation (Column (2)), the coefficient on *OUTRATIO* is negative and highly significant (F-statistic=462.3), indicating that listed firms with few or no outside directors actively increased the number of outside directors. Although the Corporate Governance Code is of a "comply or explain" nature, and the appointment of outside directors is not a statutory obligation, the result confirms that the Corporate Governance Code put strong pressure on Japanese listed firms, which tend to avoid behavior that is different from that of other firms. However, in the second stage regression, the coefficient on *OUTSIDE* is negative and statistically insignificant. The coefficient on *OUTSIDE* is also negative and insignificant in the FEIV estimation (Column (3)). The estimation results for the relationship between the increase in outside directors and investments in the second year after appear in Columns (4)–(6) of the table. We do not detect any significant impact of outside directors on investments.

We report the estimation results from the analysis replacing *OUTSIDE* with *INDEP* in **Appendix Table A1**. In most cases, our coefficients of interest are statistically insignificant. In the DID estimation (Column (1)), the coefficient on *INDEP* is positive and statistically significant at the 5% level, but the coefficient on the interaction term with *LISTED* is negative and insignificant, meaning that listed firms affected by the corporate governance reform did not increase their investments.

R&D investments are generally regarded as high-risk investments relative to tangible investments. **Table 4** presents the results for R&D investments (*R&D*). Irrespective of the estimation method, the coefficients on both *OUTSIDE* and the interaction term of *LISTED* and *OUTSIDE* are statistically insignificant for *R&D* in the next year (Columns (1)–(3)). The results are essentially the same for the impact on *R&D* in the second year after (Columns (4)–(6)). When we replace *OUTSIDE* with *INDEP* (**Appendix Table A2**), the coefficients are generally insignificant. The only exception is the 2SLS estimation result in Column (2), in which the sign of the coefficient is *negative* and significant at the 5% level.

To summarize, following the introduction of the Corporate Governance Code, (independent) outside directors increased significantly among Japanese listed firms, but we find no causal evidence that the change in board composition promoted active risk-taking behavior in the affected firms. On average, an increase in outside directors is unrelated to tangible or R&D investments, at least in the two years after the board reform implementation.

4.2. Outside Directors and Firm Performance

This subsection reports the estimated impacts of outside directors on profitability (*ROA*) and productivity (*TFP*). **Table 5** provides the results for *ROA*. According to the DID estimation (Column (1)), the coefficients on *OUTSIDE* are positive and significant at the 1% level, meaning that an increase in outside directors is correlated with profitability for the sample that includes both listed and unlisted firms. However, the coefficient on the interaction term of *LISTED* and *OUTSIDE* is negative and significant at the 1% level and the absolute size of the coefficient is larger than that for *OUTSIDE*. Although the positive association between outside directors and *ROA* among unlisted firms is difficult to interpret causally, listed firms' rapid increase in outside directors in response to the pressure from the corporate governance reform did not contribute to these firms' profitability.

According to the 2SLS and FEIV estimations for the sample of listed firms (Columns (2) and (3)), the coefficients on *OUTSIDE* are positive, but statistically insignificant. The results are essentially the same for the impact on profitability in the second year (Columns (4)–(6)).

We report the results using *INDEP* as an explanatory variable in **Appendix Table A3**. In this case, our coefficients of interest are generally insignificant, except for the FEIV estimation result for *ROA* in the second year after (Column (6)), in which the coefficient is *negative* and significant at the 10% level. Overall, a natural interpretation of these estimation results is that an increase in (independent) outside directors does not have a positive impact on the profitability of Japanese listed firms.

Finally, **Table 6** reports the estimation results using *TFP* as the dependent variable. According to the DID estimation (Column (1)), the coefficient on *OUTSIDE* is positive and significant at the 1% level, indicating that an increase in outside directors is correlated with higher productivity in the sample that includes unlisted firms. However, the coefficient on the interaction term of *LISTED* and *OUTSIDE* is negative and significant at the 5% level, and its absolute size is larger than that for *OUTSIDE*, suggesting that the listed firms' rapid increase in outside directors due to the corporate governance reform did not contribute to productivity performance among these firms. In the 2SLS and FEIV estimations for the sample of listed firms (Columns (2) and (3)), the coefficients on *OUTSIDE* are statistically insignificant. Our coefficients of interest are all statistically insignificant in the estimation results for *TFP* in the second year after (Columns (4)–(6)).

In the estimations using *INDEP* as an explanatory variable (**Appendix Table A4**), the coefficients on *INDEP* are all insignificant in terms of the *TFP* in the next year (Columns (1)–(3)). In the FEIV estimation result for *TFP* in the second year after (Column (6)), the coefficient on *INDEP* is *negative* and significant at the 10% level. Overall, the increase in independent outside directors did not have a positive impact on the productivity of Japanese listed firms.

To summarize, we do not detect any causal evidence that the change in board composition among listed firms in response to the Corporate Governance Code contributed to profitability and productivity, at least on average. Since the time horizon of the analysis is limited to up to two years after the change in board composition, we cannot deny the possibility that a positive impact will appear with a long lag. Therefore, the impacts of the board reform should be re-evaluated when longer panel data become available, but the bottom line of this study is that the increase in outside directors is unrelated to firm performance, at least up to now.

5. Conclusion

In recent years, the Japanese government actively engaged in corporate governance reforms to expand the number of independent outside directors on the boards of listed firms. The government is discussing further reforms that would make appointing outside directors a statutory obligation. However, empirical studies on the impact of past reforms have been scant. To fill this gap, this study uses panel data for a large number of Japanese firms to present empirical evidence on the impact of (independent) outside directors arising from the quasi-natural experiment on the behavior and performance of the affected firms. An important contribution of this study is that it explores causality by employing the DID method to compare listed and unlisted firms and by using instrumental variable estimations.

We can summarize the results as follows. First, in sharp contrast to unlisted firms, listed firms rapidly increased the number of independent outside directors in response to the corporate governance reform. Second, we do not find evidence that the increase in the number of outside directors promotes active risk-taking behavior among listed firms. Third, outside directors have no significant impact on the profitability and productivity of these firms.

These results support the view that optimal board composition differs according to a firm's characteristics and that a one-size-fits-all style regulation is harmful to some types of firms. From

the management perspective, the results suggest that it is desirable for firms to search for appropriate talent fitted to their business strategy and that firms should avoid rushing to appoint outside directors as a token to address the governance reform.

Although this study offers contributions to the literature and potentially contributes to policy making, it has some limitations. First, the analysis is limited to up to two years after the changes in board composition. It is desirable to evaluate the long-term impacts when longer panel data become available. Second, the estimation results indicate average treatment effects, which do not deny potential heterogeneity among firms and individual directors. For example, some talented outside directors with an appropriate fit with their firms may have contributed to change in firm behavior and to improvements in performance. Third, this study analyzes the impacts of outside directors on only tangible/intangible investments, profitability, and productivity. Whether the newly appointed outside directors contribute to improved compliance with laws and regulations, thereby reducing the incidence of scandals, is beyond the scope of this study.

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Table 1. Trend in Outside Directors.

A. Firms with Outside Directors on the Board (percentage).

FY	(1) Outside directors		(2) Independent outside directors	
	Listed firms	Unlisted firms	Listed firms	Unlisted firms
2011	52.8%	46.7%	42.7%	21.1%
2012	54.4%	46.7%	42.5%	20.9%
2013	57.8%	46.4%	46.2%	20.7%
2014	68.6%	46.1%	57.8%	20.4%
2015	85.3%	46.5%	76.5%	19.7%
2016	86.5%	46.2%	77.6%	19.8%
2017	87.1%	46.5%	78.2%	20.3%

B. Mean Share of Outside Directors on the Board (percentage).

FY	(1) Outside directors		(2) Independent outside directors	
	Listed firms	Unlisted firms	Listed firms	Unlisted firms
2011	13.1%	18.4%	9.8%	6.9%
2012	13.8%	18.4%	9.7%	6.8%
2013	14.5%	18.3%	10.4%	6.7%
2014	16.8%	18.2%	12.8%	6.6%
2015	21.8%	18.4%	18.0%	6.3%
2016	24.2%	18.4%	20.3%	6.4%
2017	25.1%	18.4%	21.3%	6.5%

Notes: Figures compiled from the BSJBSA data. The number of independent outside directors is the difference between the total number of outside directors and those from related (parent and subsidiary) firms.

Table 2. Summary Statistics of the Variables.

		(1) All firms	(2) Listed firms	(3) Unlisted firms
INV_{+1}	Mean	0.0293	0.0373	0.0285
	SD	(0.0643)	(0.0609)	(0.0646)
$R\&D_{+1}$	Mean	0.0061	0.0228	0.0044
	SD	(0.0276)	(0.0503)	(0.0235)
ROA_{+1}	Mean	0.0510	0.0564	0.0505
	SD	(0.0822)	(0.0699)	(0.0833)
TFP_{+1}	Mean	-0.0407	0.0934	-0.0547
	SD	(0.4796)	(0.4550)	(0.4799)
OUTSIDE	Mean	0.1033	0.2859	0.0843
	SD	(0.3044)	(0.4519)	(0.2778)
$OUTRATIO_{-1}$	Mean	0.1828	0.1774	0.1834
	SD	(0.2354)	(0.1660)	(0.2411)
INDEP	Mean	0.0678	0.2755	0.0461
	SD	(0.2514)	(0.4468)	(0.2097)
$INDEPRATIO_{-1}$	Mean	0.0719	0.1378	0.0654
	SD	(0.1546)	(0.1483)	(0.1537)
Observations		89,912	8,247	81,665

Notes: Variables with subscript +1 are for the years 2015-2017, variables without subscripts are for the years 2014-2016, and variables with subscript -1 are for the years 2013-2015.

Table 3. Outside Directors and Investments.

	(1) All firms OLS INV_{t+1}	(2) Listed firms 2SLS INV_{t+1}	(3) Listed firms FEIV INV_{t+1}	(4) All firms OLS INV_{t+2}	(5) Listed firms 2SLS INV_{t+2}	(6) Listed firms FEIV INV_{t+2}
OUTSIDE	0.0011	-0.0032	-0.0007	0.0005	0.0002	0.0023
	(0.0008)	(0.0060)	(0.0034)	(0.0010)	(0.0069)	(0.0041)
*LISTED*OUTSIDE*	0.0000			-0.0004		
	(0.0015)			(0.0020)		
LISTED	0.0031 ***			0.0046 ***		
	(0.0007)			(0.0010)		
INV	yes	yes	yes	yes	yes	yes
Trend *INV*	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes	no	yes	yes	no
Firm FE	no	no	yes	no	no	yes
Observations	71,127	7,300	7,300	45,875	4,834	4,834
R-squared	0.2941	0.3421	0.0345	0.2350	0.2836	0.0095
(First stage)						
$OUTRATIO_{-1}$		-0.6608 ***	-2.3811 ***		-0.6727 ***	-2.7861 ***
		(0.0307)	(0.1068)		(0.0370)	(0.2029)
F-statistic		462.3 ***	496.8 ***		330.5 ***	188.5 ***

Notes: Robust standard errors in parentheses. *** indicates p<0.01.

Table 4. Outside Directors and R&D Investments.

	(1) All firms OLS $R\&D_{t+1}$	(2) Listed firms 2SLS $R\&D_{t+1}$	(3) Listed firms FEIV $R\&D_{t+1}$	(4) All firms OLS $R\&D_{t+2}$	(5) Listed firms 2SLS $R\&D_{t+2}$	(6) Listed firms FEIV $R\&D_{t+2}$
OUTSIDE	-0.0001	-0.0036	-0.0019	-0.0002	-0.0030	0.0003
	(0.0001)	(0.0026)	(0.0017)	(0.0002)	(0.0038)	(0.0018)
*LISTED*OUTSIDE*	-0.0001			0.0002		
	(0.0005)			(0.0009)		
LISTED	0.0023 ***			0.0028 ***		
	(0.0005)			(0.0007)		
R&D	yes	yes	yes	yes	yes	yes
Trend *R&D*	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes	no	yes	yes	no
Firm FE	no	no	yes	no	no	yes
Observations	71,227	7,305	7,305	45,949	4,838	4,838
R-squared	0.7738	0.8372	0.0124	0.7375	0.7773	0.0875
(First stage)						
$OUTRATIO_{-1}$		-0.6585 ***	-2.3723 ***		-0.6721 ***	-2.7867 ***
		(0.0309)	(0.1062)		(0.0372)	(0.2034)
F-statistic		454.1 ***	499.5 ***		326.9 ***	187.7 ***

Notes: Robust standard errors in parentheses. *** indicates p<0.01.

Table 5. Outside Directors and ROA.

	(1) All firms OLS ROA_{t+1}	(2) Listed firms 2SLS ROA_{t+1}	(3) Listed firms FEIV ROA_{t+1}	(4) All firms OLS ROA_{t+2}	(5) Listed firms 2SLS ROA_{t+2}	(6) Listed firms FEIV ROA_{t+2}
OUTSIDE	0.0024 ***	0.0002	0.0031	0.0019 *	-0.0070	-0.0055
	(0.0007)	(0.0054)	(0.0026)	(0.0011)	(0.0065)	(0.0038)
*LISTED*OUTSIDE*	-0.0030 ***			-0.0034 **		
	(0.0011)			(0.0016)		
LISTED	0.0010 **			0.0003		
	(0.0005)			(0.0008)		
ROA	yes	yes	yes	yes	yes	yes
Trend *ROA*	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes	no	yes	yes	no
Firm FE	no	no	yes	no	no	yes
Observations	56,495	6,157	6,157	36,203	4,076	4,076
R-squared	0.6026	0.7071	0.0021	0.4627	0.5816	.
(First stage)						
$OUTRATIO_{-1}$		-0.6679 ***	-2.3719 ***		-0.6887 ***	-2.8855 ***
		(0.0350)	(0.1281)		(0.0416)	(0.2501)
F-statistic		364.0 ***	343.0 ***		273.9 ***	133.2 ***

Notes: Robust standard errors in parentheses. ***, **, and * indicate p<0.01, p<0.05, and p<0.1, respectively.

Table 6. Outside Directors and TFP.

	(1) All firms OLS TFP_{t+1}	(2) Listed firms 2SLS TFP_{t+1}	(3) Listed firms FEIV TFP_{t+1}	(4) All firms OLS TFP_{t+2}	(5) Listed firms 2SLS TFP_{t+2}	(6) Listed firms FEIV TFP_{t+2}
OUTSIDE	0.0128 ***	-0.0454	0.0078	0.0081	0.0082	-0.0128
	(0.0039)	(0.0362)	(0.0158)	(0.0056)	(0.0413)	(0.0169)
*LISTED*OUTSIDE*	-0.0169 **			-0.0102		
	(0.0080)			(0.0113)		
LISTED	0.0247 ***			0.0264 ***		
	(0.0039)			(0.0057)		
TFP	yes	yes	yes	yes	yes	yes
Trend *TFP*	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes	no	yes	yes	no
Firm FE	no	no	yes	no	no	yes
Observations	64,296	6,943	6,943	41,340	4,584	4,584
R-squared	0.7211	0.6512	0.0264	0.6378	0.5610	0.0333
(First stage)						
$OUTRATIO_{-1}$		-0.6693 ***	-2.4133 ***		-0.6936 ***	-2.7981 ***
		(0.0320)	(0.1108)		(0.0385)	(0.2128)
F-statistic		438.9 ***	474.4 ***		325.1 ***	172.9 ***

Notes: Robust standard errors in parentheses. *** and ** indicate p<0.01 and p<0.05, respectively.

Table A1. Independent Outside Directors and Investments.

	(1) All firms OLS INV_{t+1}	(2) Listed firms 2SLS INV_{t+1}	(3) Listed firms FEIV INV_{t+1}	(4) All firms OLS INV_{t+2}	(5) Listed firms 2SLS INV_{t+2}	(6) Listed firms FEIV INV_{t+2}
INDEP	0.0023 **	-0.0028	0.0025	0.0015	-0.0040	0.0006
	(0.0012)	(0.0073)	(0.0028)	(0.0015)	(0.0087)	(0.0027)
*LISTED*INDEP*	-0.0014			-0.0023		
	(0.0018)			(0.0022)		
LISTED	0.0032 ***			0.0048 ***		
	(0.0007)			(0.0011)		
INV	yes	yes	yes	yes	yes	yes
Trend *INV*	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes	no	yes	yes	no
Firm FE	no	no	yes	no	no	yes
Observations	70,998	7,296	7,296	45,794	4,833	4,833
R-squared	0.2945	0.3424	0.0353	0.2355	0.2828	0.0103
(First stage)						
$INDEPRATIO_{-1}$		-0.5621 ***	-2.6287 ***		-0.6040 ***	-3.2358 ***
		(0.0336)	(0.1042)		(0.0419)	(0.2203)
F-statistic		280.2 ***	636.0 ***		208.2 ***	215.8 ***

Notes: Robust standard errors in parentheses. *** and ** indicate p<0.01 and p<0.05, respectively.

Table A2. Independent Outside Directors and R&D Investments.

	(1) All firms OLS $R\&D_{t+1}$	(2) Listed firms 2SLS $R\&D_{t+1}$	(3) Listed firms FEIV $R\&D_{t+1}$	(4) All firms OLS $R\&D_{t+2}$	(5) Listed firms 2SLS $R\&D_{t+2}$	(6) Listed firms FEIV $R\&D_{t+2}$
INDEP	0.0002	-0.0080 **	-0.0026	0.0000	-0.0045	0.0001
	(0.0002)	(0.0040)	(0.0018)	(0.0004)	(0.0052)	(0.0019)
*LISTED*INDEP*	-0.0004			0.0002		
	(0.0005)			(0.0009)		
LISTED	0.0023 ***			0.0028 ***		
	(0.0005)			(0.0007)		
R&D	yes	yes	yes	yes	yes	yes
Trend *R&D*	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes	no	yes	yes	no
Firm FE	no	no	yes	no	no	yes
Observations	71,096	7,301	7,301	45,866	4,837	4,837
R-squared	0.7738	0.8335	0.0106	0.7375	0.7763	0.0874
(First stage)						
$INDEPRATIO_{-1}$		-0.5690 ***	-2.6131 ***		-0.6130 ***	-3.2340 ***
		(0.0339)	(0.1036)		(0.0424)	(0.2211)
F-statistic		281.9 ***	635.5 ***		208.8 ***	214.0 ***

Notes: Robust standard errors in parentheses. *** and ** indicate p<0.01 and p<0.05, respectively.

Table A3. Independent Outside Directors and ROA.

	(1) All firms OLS ROA_{t+1}	(2) Listed firms 2SLS ROA_{t+1}	(3) Listed firms FEIV ROA_{t+1}	(4) All firms OLS ROA_{t+2}	(5) Listed firms 2SLS ROA_{t+2}	(6) Listed firms FEIV ROA_{t+2}
INDEP	-0.0003	0.0066	0.0028	-0.0023 *	0.0001	-0.0065 *
	(0.0009)	(0.0075)	(0.0025)	(0.0014)	(0.0088)	(0.0039)
*LISTED*INDEP*	-0.0003			0.0000		
	(0.0012)			(0.0019)		
LISTED	0.0008			0.0003		
	(0.0005)			(0.0008)		
ROA	yes	yes	yes	yes	yes	yes
Trend *ROA*	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes	no	yes	yes	no
Firm FE	no	no	yes	no	no	yes
Observations	56,401	6,153	6,153	36,145	4,075	4,075
R-squared	0.6031	0.7044	0.0043	0.4631	0.5825	.
(First stage)						
$INDEPRATIO_{-1}$		-0.5966 ***	-2.6661 ***		-0.6720 ***	-3.4382 ***
		(0.0373)	(0.1219)		(0.0451)	(0.2776)
F-statistic		256.0 ***	478.3 ***		222.0 ***	153.5 ***

Notes: Robust standard errors in parentheses. *** and * indicate p<0.01 and p<0.1, respectively.

Table A4. Independent Outside Directors and TFP.

	(1) All firms OLS TFP_{t+1}	(2) Listed firms 2SLS TFP_{t+1}	(3) Listed firms FEIV TFP_{t+1}	(4) All firms OLS TFP_{t+2}	(5) Listed firms 2SLS TFP_{t+2}	(6) Listed firms FEIV TFP_{t+2}
INDEP	-0.0039	-0.0229	0.0009	-0.0137 *	0.0814	-0.0319 *
	(0.0049)	(0.0495)	(0.0146)	(0.0072)	(0.0555)	(0.0179)
*LISTED*INDEP*	-0.0029			0.0084		
	(0.0086)			(0.0121)		
LISTED	0.0242 ***			0.0261 ***		
	(0.0038)			(0.0057)		
TFP	yes	yes	yes	yes	yes	yes
Trend *TFP*	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes	no	yes	yes	no
Firm FE	no	no	yes	no	no	yes
Observations	64,193	6,940	6,940	41,274	4,583	4,583
R-squared	0.7210	0.6527	0.0270	0.6378	0.5521	0.0286
(First stage)						
$INDEPRATIO_{-1}$		-0.5742 ***	-2.6702 ***		-0.6352 ***	-3.2888 ***
		(0.0348)	(0.1090)		(0.0433)	(0.2374)
F-statistic		271.9 ***	600.3 ***		215.8 ***	191.8 ***

Notes: Robust standard errors in parentheses. *** and * indicate p<0.01 and p<0.1, respectively.