PRELIMINARY AND INCOMPLETE

Foreign Portfolio Investment and Corporate Innovation

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Abstract

We investigate whether foreign institutional investors foster or hinder corporate innovation. Using firm-level data from 30 countries in 2001-2010, we find that firms with higher foreign institutional ownership invest more in R&D and generate more patents. Using an exogenous increase in foreign institutional holdings that follows a firm's inclusion in the MSCI index, we argue that the effect of foreign institutional ownership on corporate innovation is causal. The evidence suggests that monitoring by foreign institutions leads managers to exploit increase innovation productivity and firm value. These findings challenge the conventional wisdom that foreign portfolio investment is "hot money" that is motivated by short term profits and detrimental to long-term investment.

JEL classification: G31, G32, O32

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"We support those companies, who act in interest of their future and in interest of their employees against irresponsible locust swarms, who measure success in quarterly intervals, suck off substance and let companies die once they have eaten them away."

Franz Müntefering, German Social Democratic Party Chairman

1. Introduction

Corporate innovation is a driving force in today's economies. Research and development (R&D) expenditures are at record levels worldwide and firms compete in developing new technologies. U.S. firms lead in terms of innovation intensity as measured by R&D-to-assets and patent grants per firm, but the combined R&D spending and patent counts by non-U.S. firms exceeds that of U.S. firms over the last decade (see Figure 1). Investing in new technologies, products and services is risky and it requires both manager effort and also shareholders that are willing to bear these risks and maintain a long term perspective. Thus, it is important to study the link between corporate ownership and innovation.

In this paper we examine the rise in institutional ownership across the world and the implications for corporate innovation. Over the last decade, there has been a trend away from the "stakeholder capitalism" and concentrated ownership model (historically predominant in most of continental Europe and Japan) to the Anglo-Saxon "shareholder capitalism" and dispersed ownership model (Tirole (2001), Carlin and Mayer (2003), Allen, Carletti, and Marquez (2013)). Companies in Europe and Asia are starting to have foreign institutional investors among their largest shareholders. Unlike other stakeholders, shareholders are the residual claimants and their convex claim exposes them to the upside payoff that potentially comes from pursuing more risky innovation corporate strategies. Does pressure from foreign institutional ownership lead to more managerial short-termism, undermining corporate innovation? Or does it instead mitigate managerial entrenchment, making managers more willing to act in the interests of shareholders and exploit innovative growth opportunities?

We entertain two hypotheses. The first hypothesis is that the presence of foreign institutional investors as shareholders may lead managers to reduce firm innovative efforts. This view argues that foreign portfolio flows are "hot money" in search of short-term profits and have no concern about the long term prospects of the firm.[1] In a comment that made front page news, the chairman of a major political party in Germany compared foreign (mostly Anglo-Saxon) investors with an invasion of "locusts" stripping companies bare. This stance against foreign activist investors is part of a more general phenomenon of protectionism towards foreign capital flows. For example, Dinc and Erel (2013) show widespread economic nationalism in mergers and acquisitions in Europe where governments prefer that target companies remain domestically-owned rather than foreign-owned.

Corporate innovation is a particularly interesting setting to study the role of foreign institutional investors. Foreign institutional investors may induce a short term focus by increasing managerial focus on efficiency-seeking strategies that may help quarterly earnings but dampen long-run returns. Ferreira, Manso and Silva (2010) argue that stock market pressure may lead managers to select incremental projects that may be more easily communicated to investors.[2] Managers may then forgo innovation and try to acquire ready-made technologies as this strategy is more transparent to the stock market. Additionally, foreign institutions may increase the risk of executives being fired, which could lead to career concerns and less tolerance for failure. Both of these factors may dissuade risk-averse managers from long-term investing and promoting innovation. There are also wider implications as the investment of scarce corporate resources in innovation activities may have positive spill-overs to the local economy

[1] Brennan and Cao (1997) argue that foreign investors, less informed about the prospects of local stocks, may react more strongly rebalancing their portfolios and amplify the stock reaction to negative public news.
[2] See also Stein (1988, 1989) for a general discussion of managerial decision making when facing irrational stock markets.

and governments may have a preference to promote "national champions" in innovation.

The second hypothesis is that foreign institutional investors actually foster innovation in publicly-traded companies. Large institutions may be better at monitoring managers and influencing strategic decision making in terms of firm innovative efforts. This positive impact derives from the disciplinary effect of institutions on "lazy" managers. Additionally, large portfolio investors are more sophisticated and may be better able to tolerate the high risk/high return trade-off of innovation activities as they have the ability to diversify these risks across their international portfolios.

The presence of institutions may also boost innovation by increasing tolerance for failure and reducing managers' career concerns and risks. A recent study by Aghion, Van Reenen, and Zingales (2013) find a positive causal impact of institutional ownership on innovation in U.S. firms through reducing career concerns rather than reducing managerial entrenchment. They find that the relation between institutional ownership and innovation is more pronounced when CEOs are less entrenched (i.e., a firm has fewer takeover defenses) and that CEO turnover is less sensitive to poor performance.[3]

There are reasons to believe that the channel by which institutional ownership fosters innovation is different outside of the United States. Aggarwal, Erel, Ferreira, and Matos (2011) establish a direct link between international portfolio investment and the adoption of better corporate governance practices that promote corporate accountability and empower shareholders Domestic institutional investors have less of an arm's-length relation because they are more likely to have business ties with local corporations. This implies that domestic institutional

[3] In related evidence, Francis and Smith (1995) find a positive relation between institutional ownership concentration and R&D expenditures. Bushee (1998) finds that U.S. firms with greater institutional ownership are less likely to cut R&D investment in order to reverse a decline in earnings. In terms of private equity investors, Lerner, Sorensen, and Stromberg (2011) find that LBO targeted firms do not cut on patenting activity.

money managers are more sympathetic to incumbent management and can act less as external monitors (Gillan and Starks (2003)). Management and controlling shareholders are likely to pursue their own interests at the expense of outside investors (Stulz (2005)). In contrast, foreign institutions, less encumbered by ties with management or by private benefits, can promote innovation and investment in riskier growth opportunities. Foreign institutional investors can affect act in the interest of shareholders either through "voice" (e.g. using quiet diplomacy in persuading management, voting their shares or through confrontational proxy fights) or by threatening to "exit" (e.g. selling and depressing stock prices which can hurt managers).

To answer these questions, we use a panel data set of portfolio equity holdings by institutional investors and innovation covering over 30,000 publicly-listed firms from 30 countries over the 2001-2010 period . We use two firm-level proxies of innovation activity. The first innovation proxy is R&D expenditures, an input-oriented measure of innovation. There are potentially sample selection issues due to the voluntary nature of R&D disclosure since there has historically been some variation in national accounting standards (Hall and Oriani (2006)).[4] However, R&D disclosure standards have improved in the last decade and our data shows that R&D investment is now well distributed across countries (see Figure 2) with a number of European and Asian firms in the top 10 firms worldwide as measured by total R&D dollars (see Figure 3). Several industries engage in R&D, namely computers and electronics, healthcare and auto (see Figure 4).

The second innovation proxy is the number of patents, an output-oriented measure of innovation. Patents are a measure of innovative output since firms have increasingly recognized

[4] International Accounting Standards "IAS 38 Intangible Assets" became effective in 1998 and it outlines the accounting requirements for intangible assets such as R&D. Despite the move by many firms to use International Financial Reporting Standards (IFRS) there is still some diversity in R&D reporting across countries. Hall and Oriani (2006)) conclude that even though reporting R&D is not required in some countries in continental Europe, in fact, a fairly large share of major R&D-doers actually reports it.

the need to patent their innovations to protect their rights to use their intellectual property. Research argues that patent counts are the most important measure of firms' innovation output (Griliches (1990)). The distribution of patent filing across countries illustrates the truly global nature of innovation. Over the last decade, the number of United States Patent and Trademark Office (USPTO) patents granted to Asia Pacific firms have surpassed those granted to U.S. firms (see Figures 2 and 3). European firms have much lower innovation levels based on USPTO patents. [5.6] While patent counts per se do not necessarily measure the economic value of patents, there is evidence of a positive relation between patents and firm value both in the United States (Hall, Jaffe, and Trajtenberg (2005)) and in Europe (Hall, Thoma, and Torrisi (2007)).[7]

We find a robust positive association between foreign institutional ownership and innovation. In contrast, domestic institutional ownership is not consistently associated with innovation measures. Firms with higher foreign institutional ownership have higher R&D-to-assets ratios and generate more patents, The effects are both statistically and economically significant. A ten percentage point increase in foreign institutional ownership is associated with a 0.4 percentage points increase in the R&D-to-assets ratio (about one-third of the average R&D of 1.5% for non-U.S. firms) and an 8% increase in patent counts. These results hold even after controlling for several firm characteristics, including foreign sales and insider ownership, and also firm fixed effects. We also find a positive effect of foreign institutional ownership on the productivity of R&D (as measured by the ratio between number of patents and R&D dollars spent) and firm

[5] We discuss the use of USPTO as a data source for innovation for international companies in Section 2 below but it has been used by previous studies (e.g. Acharya, Baghai and Subramanian (2013)) typically at the country or industry level and not at the firm-level as in the present study.

[6] Patent counts may be a biased measure of innovation as it is concentrated in computers and electronics with firms in this industry being awarded well over half of all USPTO patents in the last decade. In our tests, we address this issue by using a patent count measure that takes into account technological class effects.

[7] Since we are using very recent data (2001-2010) we do not use citation-weighted patents in our study because we would need to allow at least 3 to 5-year window for citations to arrive.

valuation (Tobin's Q). Thus, our results indicate that the presence of foreign institutions has a positive impact on both input- and output-based measures of innovation, and contribute to the maximization of shareholder value.

Next we investigate the channel through which foreign institutions promote corporate innovation around the world. We find that the effect of foreign institutional ownership on innovation activities is strongest in firms with lower corporate governance standards, where the monitoring by foreign institutions is more beneficial. This finding indicates that foreign institutions act as effective monitors of managers and forcing them to exert effort and innovate instead of enjoying a "quiet life" (Bertrand and Mullainathan (2003)). These findings are consistent with prior evidence that foreign institutions are effective monitors (Ferreira and Matos (2008)), promote better corporate governance standards that align the interests of shareholders, and increase CEO-turnover performance sensitivity (Agarwal, Erel, Ferreira, and Matos (2011)). The evidence does not support that the career concern hypothesis drives the positive relation between foreign institutional ownership and innovation. The monitoring channel is different from the career concern channel that explains the role of domestic institutions in U.S. corporate innovation (Aghion, Van Reenen, and Zingales (2013)).[8] The monitoring channel for foreign portfolio investment also differs from the channel through which foreign direct investment (FDI) has been shown to impact innovation in local firms, typically a technology and know-how transfer associated with controlling stakes.[9]

An important concern with our findings is that foreign institutional ownership is endogenous. More innovative firms may simply attract higher investment by foreign institutions and this

[8] Although Aghion, Van Reenen, and Zingales (2013) do not study separately the role domestic and foreign institutions in U.S. companies, the weight of domestic institutions is overwhelming in the U.S. market.
[9] Guadalupe, Kuzmina, and Thomas (2012) show the positive effect of FDI on total factor productivity and the adoption of new technology following controlling foreign ownership stakes in Spanish manufacturing firms either via acquisitions or greenfield investments.

could explain the positive association with innovation. We address this concern using instrumental variable methods to estimate the exogenous variation in foreign institutional ownership. We use a firm's index membership in the MSCI All Country World Index (ACWI), the most commonly used international stock benchmark, as an instrument for foreign institutional ownership. The identification assumption is that MSCI membership is uncorrelated with a firm's innovation activities, except indirectly through foreign institutional ownership. We show that the exogenous increase in foreign institutional ownership that follows the addition of a stock to the MSCI ACWI has a positive effect on innovation, suggesting that the correlation between institutional ownership and innovation is causal and not due to self-selection. Importantly, we find no similar effect following MSCI ACWI deletion events.

This paper contributes to the literature that studies the role of different stakeholders in the innovation process, such as shareholders, labor and creditors. Using country-level data, Acharya, Baghai and Subramanian (2013) show that employee-friendly laws (stringent laws governing the dismissal of employees) promote innovation, and Acharya and Subramanian (2009) show that creditor-friendly bankruptcy codes hinder innovation. Hsu, Tian, and Xu (2013) show that equity market development positively affects aggregate innovation levels. Our paper explores the cross-country variation in ownership structures to study the role of foreign institutions in the innovation process using firm-level data. We find that foreign institutions promote innovation, which challenge the conventional wisdom that foreign investors increase short-termism. Furthermore, we show that the effect of foreign institutions on corporate innovation worldwide is explained by a monitoring channel rather than through reducing career risks and increasing tolerance for failure documented in the U.S. by Aghion, Van Reenen, and Zingales (2013).

2. Data and Variables

In this section, we describe the sample and variables used in this study. The initial sample includes all firms in the Worldscope database in the 2001-2010 period. We exclude financial firms (SIC codes 6000-6999) and utilities (SIC codes 4900-4999) because they tend to be regulated. We restrict the sample to countries with at least 10 patents granted by the USPTO and $10 billion of total stock market capitalization. Panel A of Table 1 shows the resulting list of 30 countries, which we group into four geographical regions: North America, Europe, Asia Pacific and Other. Although we focus on non-U.S. companies, we also repeat our analysis including U.S. companies. Panel A of Table 1 shows that the total number of non-U.S. firms with both innovation and institutional ownership data consists of 22,295 unique firms for a total of 132,834 firm-year observations. The sample contains 8,657 unique U.S. firms for a total of 48,339 observations.

2.1 R&D as a Measure of Innovation Input

The first proxy of innovation is R&D expenditures as reported in Worldscope. Panel A of Table 1 shows that a total of $4.7 trillion was collectively invested in R&D by the sample firms over the 2001-2010 period. Over the last decade, growth in R&D exceeded the rate of growth of firm revenues or assets (Booz & Co (2013)). We measure a firm's innovation intensity using the ratio of R&D expenditures-to-assets. R&D is set to zero for firms that do not report R&D expenditures.

U.S. firms have the highest average R&D ratio at 5.1%, which well exceeds the average of 1.5% for non-U.S. firms. The U.S. also has the highest number of unique firms reporting positive R&D, but Canadian have the highest average R&D ratio in the sample of firms with positive R&D. Panel A of Figure 2 shows that R&D investment is well distributed across countries, but the share of R&D dollars of U.S. firms in the world shrunk from 47% to 37% during the 2000s. There was a significant increase in the share of R&D dollars of Asian firms. These statistics suggest an increased in the internationalization of corporate innovation activity. Panel A of Figure 3 illustrates the rise of Toyota as the top R&D spender in the last three years of the sample period surpassing major U.S. firms such as Ford and Pfizer. Several European firms are in the top ten firms as measured by R&D dollars spent.[10]

Panel B of Table 1 illustrates the R&D intensity across firms using the Fama-French 12 industry classification.[11] The industries with higher R&D intensity are "Healthcare" (medical equipment and drugs), followed by "Business Equipment" (computers, software and electronic equipment) and "Telecom". Panel A of Figure 4 shows that "Healthcare" has increased in importance in terms of total R&D dollars, while "Business Equipment" has dropped slightly.

2.2 Patent Count as a Measure of Innovation Output

The second proxy of innovation focuses on the output of R&D activity as measured by patents, the exclusive rights over an invention of a product or a process. We collect information from the complete set of patent grant publications issued weekly by the United States Patent and Trademark Office (USPTO) from January 1990 to June 2013.[12] In this way, we obtain the universe of patents awarded by USPTO to U.S. and international companies, individuals, and other institutions.

For each patent, we identify patent assignees listed on the patent grant document, the country of these assignees, and the indicator of whether each assignee is a U.S. corporation, a non-U.S. corporation, or an individual or government. Using this information, we match patents to firms in

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[10] These rankings are consistent with those in European Commission (2010).

[11] The industry classification is based on four-digit SIC codes and it is available on Ken French's online data library.

[12] USPTO is the raw source for the commonly used NBER patent database developed by Hall, Jaffe, and Trajtenberg (2001).

the Worldscope database. Our matching algorithm involves two main steps. First, we standardize patent assignee names and firm names – focusing on unifying suffices and dampening the non-informative parts of firm names. Second, we apply multiple fuzzy string matching techniques to identify the firm, if any, to which each patent belongs. Using this procedure, we match 1,411,376 patents to 13,045 unique firms for patents applied in the period 1990-2010.[13] Of these patents, close to half of the assignees of the patents are foreign corporations. Details of the matching algorithm are provided in Appendix A.

There are several reasons to focus on USPTO patents to measure innovation output in our international setting. First, the large publicly-listed companies in the sample commonly protect their innovations by simultaneously applying for patents at USPTO, the European Patent Office (EPO), and the Japanese Patent Office (JPO). The use of USPTO patents therefore does not underestimate innovation output. Second, we follow a common approach to calculate patent indicators based on information from the most important patent office. Patent regulations (affecting, for example, the scope of patent protection) and practices followed by patent offices (affecting, for example, processing and publishing of patent filing documents) in different countries are not compatible, which makes the aggregation of patent statistics across different patent offices and over time difficult. Third, for non-U.S. firms, patents in the sample arguably reflect relatively more important innovations as these firms are willing to accept additional costs of patenting abroad. Therefore, we address the common criticism that there is an excessive heterogeneity in the quality of patents, mainly, that there are many "useless" patents.[14]

[13] We stop our sample period in 2010 because of the 2 to 3-year lag between the patent application and award date. So for many patents with applications filed after December 2010, we do not know yet by the end of 2013 whether they are awarded.

[14] In our regressions, we always include country and year fixed effects that remove a possible "home" advantage bias by U.S. firms as well as any foreign country-level bias of applying for patents at USPTO. We also perform the analysis on subsamples of U.S. and non-U.S. firms and the results are unchanged.

We use two main measures of firm-level innovation output: $PATENTS_t$ and $PATENTS\_WEIGHTED_t$. In the tests we use log ($PATENTS_t$) which is the natural logarithm of one plus the number of patents applied by firm *i* in year *t*. We include firms with zero patents in our main analysis and assume that the patent count is zero for firms with missing USPTO information. Following Bena and Li (2013), log($PATENTS\_WEIGHTED_t$) is the logarithm of one plus the patents counts applied by firm *i* in year *t*, adjusted by the average number of patents in each technology class and period. The innovation output measures are based on dates when each patent application is filed, i.e., at the point in time closest to when the innovation was created. Since our institutional ownership data starts in 2000 and we lag the independent variables by one year, the measures of innovation output span the period 2001-2010.[15]

Panel A of Table 1 shows that the sample of firms was granted a total of 686,541 patents over the 2001-2010 period. Interestingly, 388,341 of these patents were granted to non-U.S. firms. At 6.56 USPTO patents per year, Japanese firms have the highest patent count, surpassing even U.S. firms which have an average of 6.17 patents per year. Overall, non-U.S. firms have, on average, 2.92 patents per year. The U.S. has the highest number of unique firms reporting positive patents, followed by Japan, Taiwan, South Korea and Germany. Although German firms are also productive, overall European firms filed USPTO patents than Asian or North American (see Panel B of Figure 1). Panel B of Figure 2 shows the geographical distribution of total patents over time and illustrates that there was a significant increase in the share of patents by Asian firms. Panel B of Figure 3 illustrates the rise of Asian firms in the top 10 innovator firms.

Panel B of Figure 3 illustrates the rise of Asian firms mostly in the "Business Equipment"

[15] USPTO patents are awarded, on average, two to three years after applications are filed. If not yet granted, the patent applications are published (i.e., revealed to public) 18 months after filing. Patents start to receive citations after they are awarded or their applications are published. Since one needs to allow at least three to five-year window for citations to arrive, we cannot use citation-weighted patents in the context of our study.

sector (computers, software and electronic equipment). Panel B of Table 1 shows that "Business Equipment" (computers, software and electronic equipment) accounts for over 50% of all patents. It is followed by "Consumer Durables" (cars, TV's, furniture and household appliances). This highlights one bias of using patents as a measure of firm innovation. Some scholars have argued that computer, electronics and software patents may be applied merely to build patent portfolios rather than for protection of real inventions. In our tests, we address this issue by using *PATENTS_WEIGHTED*, which that takes into account technological class effects.

2.3. Institutional Ownership

We draw institutional holdings data from the FactSet/LionShares database for the period 2000-2009. The institutions in the database are professional money managers such as mutual funds, pension funds, bank trusts, and insurance companies (see Ferreira and Matos (2008) for more details).

We define *IO_TOTAL* as the sum of the holdings of all institutions in a firm's stock divided by its total market capitalization at the end of each calendar year.[16] Following Gompers and Metrick (2001), we set institutional ownership variables to zero if a stock is not held by any institution in FactSet/LionShares.[17] We also separate total institutional ownership by the nationality of the institution. Domestic institutional ownership (*IO_DOM*) is the sum of the holdings of all institutions domiciled in the same country in which the stock is listed divided by the firm's market capitalization. Foreign institutional ownership (*IO_FOR*) is the sum of the holdings of all institutions domiciled in a country different from the one in which the stock is listed divided by the firm's market capitalization.

[16] In calculating institutional ownership, we include ordinary shares, preferred shares, American Depositary Receipts (ADRs), Global Depositary Receipts (GDRs), and dual listings.
[17] When we repeat the empirical analysis using only firms with positive holdings, our main results are not affected.

Panel A of Table 1 shows that the countries with the highest average total institutional ownership as of 2009 are the United States (75%), Canada (53%), Israel (48%), and Sweden (40%). The Average institutional ownership is at 43% worldwide and at 23% for non-U.S. firms in our sample in 2009.[18] While minority holders in most companies, institutions are the most influential group in terms share of trading (being the marginal investors for share pricing purposes) and shareholder activism (in terms of 'voice' and 'threat of exit'). Aggarwal, Erel, Ferreira and Matos (2011) show that foreign institutional investors play a role in exporting corporate governance practices outside the U.S. In most countries, the holdings of foreign institutions exceed those of domestic institutions. Some exceptions are the United States, Canada and Sweden.

2.4. Firm Characteristics

We obtain firm characteristics from the Worldscope database. Table 2 shows summary statistics and Appendix B provides variable definitions and data sources. We use several firm-specific control variables in our regressions. First, we control for insider ownership, which is measured by the percentage of shares closely held (*CLOSE*). As we argued in the introduction, the interests and risk-taking incentives of blockholders are likely to diverge from those of institutional owners. Second, we control for foreign sales to total sales (*FXSALES*) since firms that sell internationally may be more likely to innovate and patent their products and services with the USPTO. Finally, we use the same firm-level controls as in Aghion, Van Reenen and Zingales (2013), namely the log of the ratio of capital to labor (*K/L*), the log of total sales in U.S. dollars (*SALES*) and the cumulative research and development expenditures to assets (*R&D_*

[18] We show statistics for 2009 as our sample period ends in 2010 and we employ a one-year lag in the explanatory variables in our tests.

STOCK). Following Aghion, Van Reenen and Zingales (2013), we define *R&D_STOCK* using a depreciation rate of knowledge of 15% per year. We winsorize variables defined as ratios at the bottom and top 1% levels.

3. Foreign Institutional Ownership and Innovation

In this section, we test the main hypotheses on the relation between institutional ownership and corporate innovation using both innovation input (*R&D*) and output (*PATENTS*). We then proceed to examine the robustness of the positive relation between innovation and foreign institutional ownership to alternative specifications and omitted variables bias. We also address the concern that the positive relation between innovation and foreign institutional ownership is driven by selection. Finally, we explore the channel through which the effect takes place.

3.1. Main Results

Table 3 shows estimates of panel regressions of corporate innovation on institutional ownership for both U.S. and non-U.S. firms. In Panel A the dependent variable is the R&D expenditures-to-assets ratio (*R&D*) and in Panel B it is the natural logarithm of one plus the patent count (*log(PATENTS)*). All explanatory variables are lagged by one period so that we can examine the effect of the explanatory variables on subsequent innovation. Regressions include country, industry, and year dummies to control for time-invariant unobserved heterogeneity. Standard errors are clustered at the country level, i.e., we assume that observations are independent across countries, but not within countries.[19]

Column (1) of Panel A shows that total institutional ownership (*IO_TOTAL*) is positively associated with R&D intensity when we include both U.S. and non-U.S. firms. In column (2) we

[19] In unreported results, we find that standard errors clustered at the firm level are lower than standard errors clustered at the country level. We thus adopt the most conservative estimates of standard errors.

find the same result (but the magnitude is higher) when we limit our analysis to the sample of non-U.S. firms. In columns (3)-(5) we split institutional investors based on their nationality relative to the firm's nationality (*IO_FOR* and *IO_DOM*). We find that foreign institutional ownership fosters firm-level innovation as measured by the R&D-to-assets ratio, unlike domestic institutional ownership. The effect is both statistically and economically significant. A ten percentage point increase in foreign institutional ownership is associated with a 0.4% increase in the R&D-to-assets ratio, which corresponds to about one-third of the average R&D of 1.5% for non-U.S. firms. While foreign institutional ownership is dominant outside of the United States, domestic institutional ownership is dominant in the United States. Column (6) shows that there is no statistical significant effect of total institutional ownership on R&D in the sample of U.S. firms.

Panel B of Table 3 shows a positive relation between institutional ownership and patent counts. Columns (1) and (2) show that the *IO_TOTAL* coefficient is positive and significant in the sample of all firms and in the sample of non-U.S. firms. When we split by the geographical origin of institutional investors in columns (3)-(5), we find that only foreign institutional ownership is positively related to patent counts in the sample of non-U.S. firms. The coefficient on domestic institutional ownership is negative and significant in the sample of non-U.S. firms. The effect is both statistically and economically significant with a ten percentage point increase in foreign institutional ownership implying an 8% increase in patent counts. Column (6) shows a positive and significant effect of total institutional ownership in the sample of U.S. firms, which is consistent with the findings of Aghion, Van Reenen and Zingales (2013).

In short, our results are consistent with the presence of foreign institutions as shareholders of corporations promoting innovation as measured by R&D expenditures or patent counts. In contrast, domestic institutions seem to play a detrimental role in the innovation process of firms outside of the U.S. The results are not consistent with foreign investors hindering innovation activities as the “locust” characterization suggests.

3.2. Robustness

Panel A of Table 4 examines the robustness of the results on R&D expenditures using the specification in column (5) of Table 3 for the sample of non-U.S. firms. In column (1) we introduce firm fixed effects using the pre-sample mean scaling method proposed by Blundell, Griffith, and Van Reenen (1999). Essentially, we exploit the fact that we have a long pre-sample history on patenting behavior to construct the pre-sample average, $R\&D_0$, defined as the average *R&D* in the 1990-1999 period. This controls for time-invariant unobserved firm heterogeneity.

We then check the robustness of the results to alternative specifications. Column (2) shows estimates of a probit regression model of the probability that a firm reports positive R&D expenditures in a given year, rather than using a linear regression model for R&D. The *IO_FOR* coefficient is positive and significant, which indicates that foreign institutional ownership is positively related with firms engaging in R&D activities. Column (3) shows estimates of a probit regression model of a firm increasing R&D in year *t* versus year *t*-1. We find that foreign institutions are associated with a higher likelihood of R&D increases, rather than R&D cuts.

Finally, in column (4) we examine a linear regression model where the dependent variable is the cumulative *R&D (R&D_STOCK)* instead of the annual *R&D*. Results are also consistent with foreign institutional investors promoting the accumulation of R&D to enable the development of new products, processes and services.

Panel B of Table 4 examines the robustness of the results on patent counts using the specification in column (5) of Table 3 for the sample of non-U.S. firms. In column (1) we introduce firm fixed effects using the pre-sample mean scaling method. We find a positive and significant coefficient on *IO_FOR* even after accounting for unobserved time-invariant firm heterogeneity. In column (2), we estimate a negative binomial regression where the dependent variable is patent counts (*PATENTS*) instead of using a linear regression model of the logarithm of patent counts. The positive relation between foreign institutional ownership and patents is robust when we use count data models.

Column (3) estimates a linear regression model of the logarithm of adjusted patent counts, *PATENTS_WEIGHTED*, which adjusts for each patent's technology class and application year. We use this alternative measure since technology classes differ in the nature of R&D activities and resources required in producing a patentable innovation to the extent that patent counts in two distinct classes are not directly comparable. Additionally, there are technology class-specific time trends in the number of awarded patents that may not fully reflect changes in innovation output. In particular, large increases in the number of awarded patents in some classes over time might reflect the evolution of the USPTO practices with respect to what is a patentable innovation, and hence patent counts from different years may not be time-consistent measures of innovation output even within the same technology class. This is especially relevant as one industry ("Business Equipment") which accounts for over 50% of all patents in the sample period. The results in column (3) show that foreign institutional ownership is also positively associated with the adjusted patent counts.

We conduct a few other robustness checks. Column (4) excludes the final two years of the sample period to address truncation bias concerns because patents are granted two to three years after the applications are filed. In this case the sample period is restricted to the 2001-2008 period. Column (5) shows results for the subsample of firms with positive patents counts.

Column (6) shows results using as dependent variable the patent counts measured using a three-year window. In all these specifications we still find a positive and significant relation between foreign institutional ownership and patent counts. The magnitude of the *IO_FOR* coefficient is even stronger than in the base case.

3.3. Endogeneity

An important concern with our findings is that foreign institutional ownership is endogenous. More innovative firms may simply attract higher investment by foreign institutions and this could explain the positive association between innovation and institutional ownership.

A first attempt to address this concern is to use instrumental variable methods. Following Agarwal, Erel, Ferreira, and Matos (2011), we use membership in the Morgan Stanley Capital International All Country World Index (MSCI ACWI) as an instrument for foreign institutional ownership. We use a dummy variable (*MSCI*) which takes the value of one if a firm is a member of the MSCI ACWI in year *t*, and zero otherwise. MSCI is the most commonly used benchmark index by foreign portfolio investors, but not for domestic institutions. The exclusion restriction assumption is that MSCI membership is uncorrelated with a firm's innovation activities, except indirectly through foreign institutional ownership.

Panel A of Table 5 presents the two-stage least squares (2SLS) estimates of the effect of foreign institutional ownership on *R&D*, using *MSCI* as an instrument. The first-stage regression results support the view that *IO_FOR* is positively associated with MSCI membership. The F-test reported at the bottom of the table is strongly significant (and above ten), which indicates that the hypothesis that the instrument can be excluded from the first stage regressions is rejected and that the instrument is not weak. Column (2) presents the coefficients of the second-stage regression that uses *R&D* as the dependent variable. After we take into account the endogeneity of foreign institutional ownership, we still find that the presence of foreign institutions has a positive impact on R&D intensity. This evidence supports the conclusion that there is a causal link from institutional ownership to R&D intensity.

Panel B of Table 5 then presents similar 2SLS results on the effect of foreign institutional ownership on patent counts, using *MSCI* as an instrument. Column (1) shows that the *MSCI* coefficient is positive and significant, and the F-test (reported at the bottom of the table) indicates that the instrument is not weak. Column (2) shows that the exogenous increase in foreign institutional ownership that follows a firm's inclusion in the MSCI ACWI has a positive effect on patent counts, suggesting that the effect of foreign institutional ownership on innovation is causal and not due to selection.

An alternative approach to the instrumental variables approach is to conduct an event study at the time a firm's shares is added or deleted from the MSCI ACWI. We employ a seven-year window around the year of the index re-compositions (year *t*). There are 481 additions to the MSCI ACWI in the years 2004-2007 for which we have complete institutional ownership data in the three year period before and following the event, using the sample of non-U.S. firms. Similarly, there are 155 deletion events.

Table 6 presents these event study results. *IO_FOR*, *R&D* and *PATENTS* are demeaned by their firm-level average over the full sample period 2001-2010. This provides a measure of the "abnormal change" in these variables around the MSCI ACWI re-composition events. Panel A shows that *IO_FOR* increases significantly, on average, by +7% around the addition of firm's shares to MSCI ACWI. This is followed by a positive cumulative change in *R&D* of about 1 percentage point and a change in *PATENTS* of about 5 patents. Interestingly, Panel B shows that the results are different around MSCI ACWI deletion events. We find that *IO_FOR* tends to drop and there is a similar negative trend on *PATENTS* and *R&D*.

Overall, the results of both instrumental variable and the event study of MSCI additions and deletions suggest that endogeneity is unlikely to explain the positive relation between foreign institutional ownership and corporate innovation.

3.4. Effect of Corporate Governance

So far we show evidence of a positive causal effect of foreign institutional ownership on corporate innovation. In this section, we study the channel through which managers are more willing to invest in innovative growth opportunities. A possible channel is that foreign institutions reduce managers' career concerns and risks and increase tolerance for failure. Another channel is that foreign institutions reduce managerial entrenchment and exert monitoring on managers otherwise enjoying a "quite life".

An implication of the monitoring channel is that the benefits of foreign institutional ownership should be felt most sharply when managers are more "entrenched", while under the career concern channel the impact of institutional ownership on innovation should be weaker when managers are entrenched. Managers have less ability to slack and are more disciplined when, for example, there is more board monitoring, fewer takeover defenses (i.e., the firm is more exposed to the market for corporate control via a credible threat of a hostile takeover), more equity incentives in their compensation package. We measure the quality of corporate governance using a firm-level index consisting of 41 governance attributes defined by Aggarwal, Erel, Stulz, and Williamson (2009) and Aggarwal, Erel, Ferreira and Matos (2011). This is constructed using data obtained from RiskMetrics (formerly Institutional Shareholder Services). The *GOV41* index provides a firm-level governance measure that is comparable across countries and incorporates measures of board structure, anti-takeover provisions, auditor selection, and compensation and ownership structure.[20]

We run a regression of R&D and patent counts including as main explanatory variables foreign institutional ownership (*IO_FOR*), the governance index (*GOV41*) and the interaction *IO_FOR* × *GOV41*. The interaction term coefficient measures the differential effect of foreign institutional ownership for firms with different levels of managerial entrenchment. Table 7 reports the results.[21] We find that foreign institutional ownership positively affects innovation input (*R&D* in column (1)) and output (*PATENTS* in column (2)) controlling for corporate governance. The positive association of foreign institutional ownership with stronger when the quality of corporate governance is lower in both columns (1) and (2), as indicated by the negative and significant coefficient on the interaction variable *IO_FOR* × *GOV41*. We conclude that the effect of foreign institutional ownership is more pronounced when managers are less entrenched. Thus, the findings are consistent with the monitoring channel and run contrary to the career concerns channel.

4. Effect of Foreign Institutional Ownership on Innovation Productivity and Firm Value

So far the evidence supports that foreign institutional investors actually foster more innovation in publicly-traded companies. We find these results to be robust for both an input-oriented measure (R&D expenditures) and output measure (patent counts). However, more innovation intensity does not necessarily equate to better innovation, in the sense that these not all innovative activities necessarily enhance shareholder value. We examine this issue by

[20] *GOV41* is similar in spirit to the GIM index of Gompers, Ishii and Metrick (2003) but the scale is reversed (a higher *GOV41* means more shareholder-friendly governance standards).

[21] The sample of firms in these tests is significantly smaller because of the coverage in the GOV41 measure which is limited to largest market capitalization firms in each country. More details on this governance measure are available in Aggarwal, Erel, Ferreira and Matos (2011.

performing some additional tests.

We examine whether foreign institutional ownership is associated with shareholder value-increasing corporate innovation. We run a regression where the dependent variable is firm valuation, as measured by Tobin's Q (*TOBIN_Q*) and main explanatory variables are patent counts (PATENTS) and foreign institutional ownership (*IO_FOR*). Table 8 presents the results. We find that the *PATENTS* coefficient is positive and significant, indicating that higher patent output is valued by capital markets in the form of higher valuation.[22] We also find that ownership by foreign institutions is positively associated with *TOBIN_Q*, unlike ownership by domestic institutions.

Next we examine the effect of foreign institutional ownership on the productivity of R&D as measured by patent counts per and R&D dollar (in thousands) spent ($PATENTS_t/R\&D\_STOCK_t$). So instead of focusing on either the input (R&D) or the output (patents) of innovation, this measure captures productivity of R&D investment. We run a regression where the dependent variable is $PATENTS_t/R\&D\_STOCK_t$ and the main explanatory variable is *IO_FOR*. Table 9 shows that there is a positive effect of foreign institutional ownership on the productivity of R&D. This finding suggests that the main effect of foreign institutional ownership is to alter the quality and productivity of R&D rather than simply stimulating more R&D spending.

5. Conclusion

This paper studies the link between the rise in the internationalization of corporate innovation and ownership structures. Contrary to the view that foreign institutional ownership induces a

[22] This is consistent with related findings on the market value of patent citations by Hall, Jaffe, and Trajtenberg (2005) for U.S. firms and Hall, Thoma and Torrisi (2007) for European firms. As mentioned above, we are using very recent data (2001-2010) and we do not use citation-weighted patents in our study because and we would need to allow at least 3 to 5-year window for citations to arrive.

short-term focus in managers, we find that their presence fosters innovation in firms outside the U.S. This finding is robust even when we account for the potential endogeneity of foreign institutional ownership using the exogenous increase in foreign institutional holdings that follows a firm's inclusion in the MSCI World index. We also provide evidence that higher foreign institutional ownership is associated with higher innovation productivity and firm valuation. This positive impact derives from the disciplinary and monitoring effects of foreign institutions when managers are entrenched, rather than the reduction in managers' career concerns risk.

To the best our knowledge, this paper is the first to establish a direct link between international portfolio investment and innovation by local firms. Overall, our results go against popular fears that label foreign investors as 'locusts' interested in short-term gains preventing firms from making long-term investments. In fact, we conclude that the globalization of the shareholder base of firms is a positive force for innovation by local companies.

Our findings have wider implications as corporate innovation is an important driver not only of their own business success, but also of local economic growth because of positive spill-overs. Instead of "economic nationalism" to protect "national champions" from foreign capital, our findings suggest that openness to international portfolio investment generates positive externalities to the local economy by promoting new technologies, products and services.

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Figure 1
Corporate Innovation by Geographical Region

This figure shows the intensity of corporate innovation in terms of R&D expenditures (Panel A) and USPTO patent-filing activity (Panel B) by publicly-listed firms headquartered in each geographical region over the period from 2001 to 2010. The countries that comprise each region and the country-level totals are provided in Panel A of Table 1.

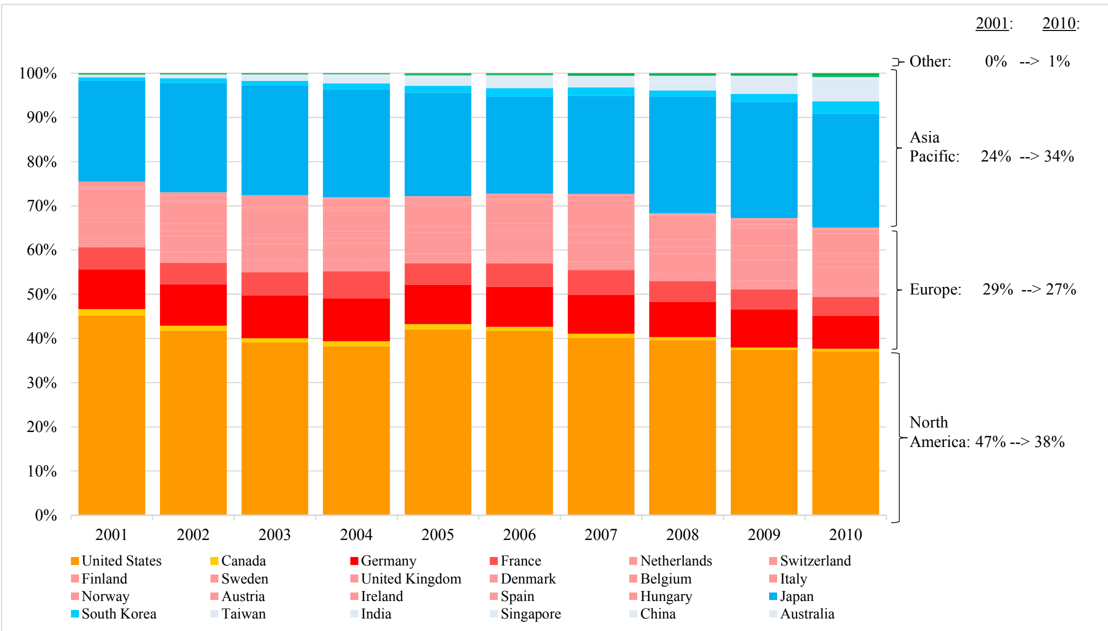
Panel A: R&D total (US$ billions, 2001-2010)

Panel B: Total number of filed patents with USPTO (2001-2010)

Figure 2
Corporate Innovation by Country and Year

This figure shows the percentage of corporate innovation by country and year. Panel A presents the level of R&D expenditures by publicly-listed firms headquartered in each country as a fraction of the total in each year. Panel B presents the number of patents applied by publicly-listed firms headquartered in each country with the USPTO as a fraction of the total in each year. Countries are grouped into 4 geographical regions. The countries that comprise each region are listed in Panel A of Table 1.

Panel A: Percent of total R&D



Panel B: Percent of total number of filed patents

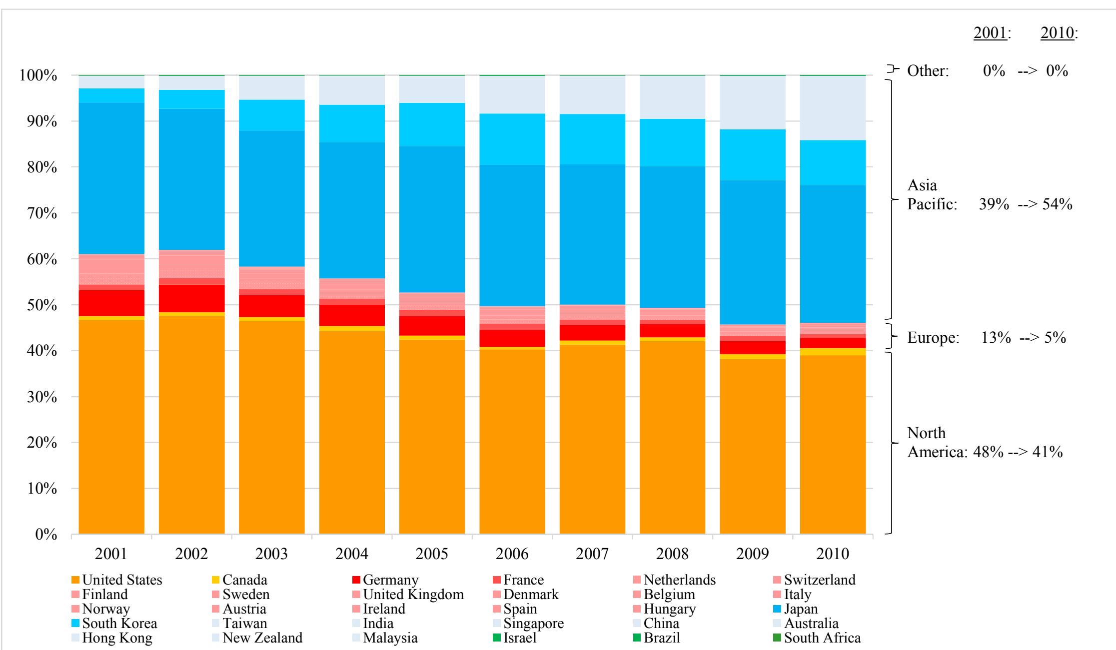


Figure 3
Top Firms Worldwide in Terms of Innovation

This figure lists the top 10 publicly-listed firms in terms of R&D expenditures (Panel B) and number of filed patents (Panel C) by year. Cells are colored by geographical region according to the scheme in Panel A. The countries that comprise each region are listed in Panel A of Table 1.

Panel A: Coloring by geographical region

North America	Europe	Asia-Pacific	Other

Panel B: Top 10 firms worldwide by level of R&D expenditures (in US$ billions)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1	Ford (US,$7)	Ford (US,$7)	Ford (US,$8)	Ford (US,$8)	Sanofi (FR,$10)	Ford (US,$8)	Pfizer (US,$7)	Toyota (JP,$8)	Toyota (JP,$9)	Toyota (JP,$10)
2	Daimler (DE,$6)	Siemens (DE,$6)	Daimler (DE,$6)	Pfizer (US,$7)	Microsoft (US,$8)	Pfizer (US,$7)	Ford (US,$7)	J&J (US,$8)	Microsoft (US,$8)	Roche (CH,$9)
3	Siemens (DE,$5)	IBM (US,$5)	Siemens (DE,$6)	Daimler (DE,$7)	Daimler (DE,$8)	Daimler (DE,$7)	J&J (US,$7)	Pfizer (US,$8)	Roche (CH,$8)	Microsoft (US,$9)
4	IBM (US,$5)	Daimler (DE,$5)	Pfizer (US,$5)	Siemens (DE,$6)	Pfizer (US,$8)	Toyota (JP,$6)	Daimler (DE,$7)	Ford (US,$8)	J&J (US,$8)	Pfizer (US,$8)
5	Panasonic (JP,$5)	Pfizer (US,$5)	Toyota (JP,$5)	Toyota (JP,$6)	Ford (US,$7)	J&J (US,$6)	Toyota (JP,$7)	Roche (CH,$7)	Pfizer (US,$8)	Novartis (CH,$8)
6	Ericsson (SE,$4)	Cisco (US,$5)	Panasonic (JP,$5)	Panasonic (JP,$5)	Siemens (DE,$7)	Microsoft (US,$6)	GlaxoSK (UK,$7)	Microsoft (US,$7)	Novartis (CH,$7)	Nokia (FI,$7)
7	Motorola (US$4)	Ericsson (SE,$4)	GlaxoSK (UK,$4)	GlaxoSK (UK,$5)	Toyota (JP,$7)	Siemens (DE,$6)	Siemens (DE,$7)	Nokia (FI,$7)	Ford (US,$7)	J&J (US,$7)
8	Pfizer (US,$4)	Microsoft (US,$4)	Microsoft (US,$4)	J&J (US,$5)	Panasonic (JP,$6)	IBM (US,$6)	Microsoft (US,$7)	Novartis (CH,$7)	Nokia (FI,$7)	Sanofi (FR,$7)
9	Lucent (US,$4)	Motorola (US$4)	IBM (US,$4)	Microsoft (US,$5)	GlaxoSK (UK,$5)	GlaxoSK (UK,$5)	IBM (US,$6)	Sanofi (FR,$7)	Honda (JP,$6)	Boeing (US,$7)
10	Cisco (US,$4)	Lucent (US,$4)	Intel (US,$4)	IBM (US,$5)	J&J (US,$5)	Panasonic (JP,$5)	Intel (US,$6)	GlaxoSK (UK,$6)	Sanofi (FR,$6)	Honda (JP,$6)

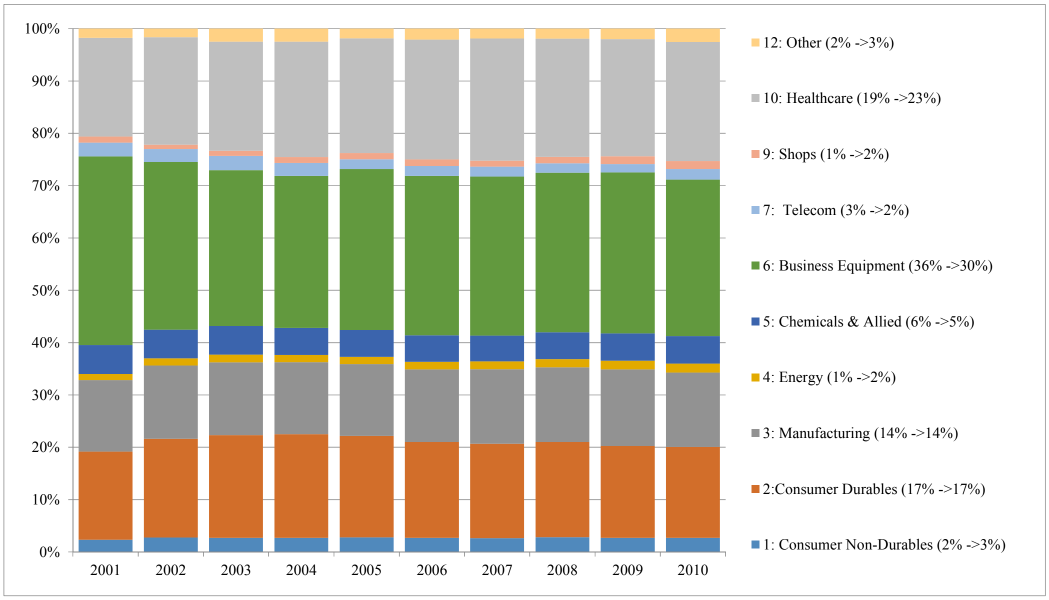
Panel C: Top 10 Firms worldwide by number of patents filed with USPTO

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1	IBM (US,4016)	IBM (US,3547)	IBM (US,3971)	IBM (US,3730)	Samsung (KR,3857)	Samsung (KR,4527)	IBM (US,5252)	IBM (US,6937)	IBM (US,2223)	Hon Hai (TW,1125)
2	HP (US,2675)	HP (US,2321)	Samsung (KR,3015)	Samsung (KR,3637)	IBM (US,3731)	IBM (US,3691)	Samsung (KR,4391)	Samsung (KR,3284)	Samsung (KR,2107)	Samsung (KR,1020)
3	Panasonic (JP,2424)	Panasonic (JP,2168)	HP (US,2685)	Microsoft (US,2918)	Microsoft (US,3382)	Panasonic (JP,2214)	Panasonic (JP,1871)	Panasonic (JP,1468)	Hon Hai (TW,1514)	IBM (US,807)
4	Hitachi (JP,2219)	Intel (US,2040)	Panasonic (JP,2355)	Panasonic (JP,2450)	Panasonic (JP,2412)	Microsoft (US,2050)	Microsoft (US,1664)	Sony (JP,1411)	Sony (JP,1106)	Panasonic (JP,552)
5	Sony (JP,1941)	Samsung (KR,2040)	Intel (US,2263)	Intel (US,1949)	Sony (JP,2168)	Sony (JP,1678)	Sony (JP,1640)	Hon Hai (TW,1354)	Panasonic (JP,956)	Sony (JP,526)
6	Micron (US,1940)	Micron (US,2021)	Microsoft (US,1762)	HP (US,1839)	Fujitsu (JP,1657)	Intel (US,1422)	Hitachi (JP,1214)	Hitachi (JP,1312)	Fujitsu (JP,859)	NEC (JP,488)
7	Intel (US,1805)	Hitachi (JP,1884)	Micron (US,1578)	Hitachi (JP,1713)	Intel (US,1642)	Micron (US,1402)	Seiko (JP,1207)	Microsoft (US,1174)	Seiko (JP,852)	Micron (US,469)
8	Philips (NL,1726)	Sony (JP,1602)	Hitachi (JP,1539)	Micron (US,1635)	HP (US,1552)	Seiko (JP,1369)	LG (KR,1128)	Seiko (JP,1121)	Hitachi (JP,668)	Seiko (JP,442)
9	Fujitsu (JP,1617)	Philips (NL,1465)	Sony (JP,1539)	Sony (JP,1610)	Seiko (JP,1372)	Hitachi (JP,1320)	Intel (US,1082)	Ricoh (JP,1059)	LG (KR,640)	Hitachi (JP,372)
10	Samsung (KR,1607)	Fujitsu (JP,1404)	Fujitsu (JP,1230)	Fujitsu (JP,1445)	Micron (US,1352)	Fujitsu (JP,1244)	Ricoh (JP,1076)	Fujitsu (JP,911)	Ricoh (JP,626)	Fujitsu (JP,370)

Figure 4
Corporate Innovation by Industry and Year

This figure shows the percentage of corporate innovation by Fama-French industry groups and year in terms of R&D expenditures (Panel A) and USPTO patent-filing activity (Panel B). The Fama-French industry groups consist of: 1) Consumer Non-Durables (food, tobacco, textiles, apparel, leather, toys); 2) Consumer Durables (cars, TV's, furniture, household appliances); 3) Manufacturing (machinery, trucks, planes, office furniture, paper); 4) Energy (oil, gas, coal); 5) Chemicals and Allied Products; 6) Business Equipment (computers, software, and electronic equipment); 7) Telecom (telephone and TV transmission); 9) Shops (wholesale, retail and some services); 10) Healthcare, Medical Equipment, and Drugs; 12) Other. Firms that belong to the other industry sectors were excluded (namely 8) Utilities and 11) Money).

Panel A: Percent of total R&D



Panel B: Percent of total number of patents filed with USPTO

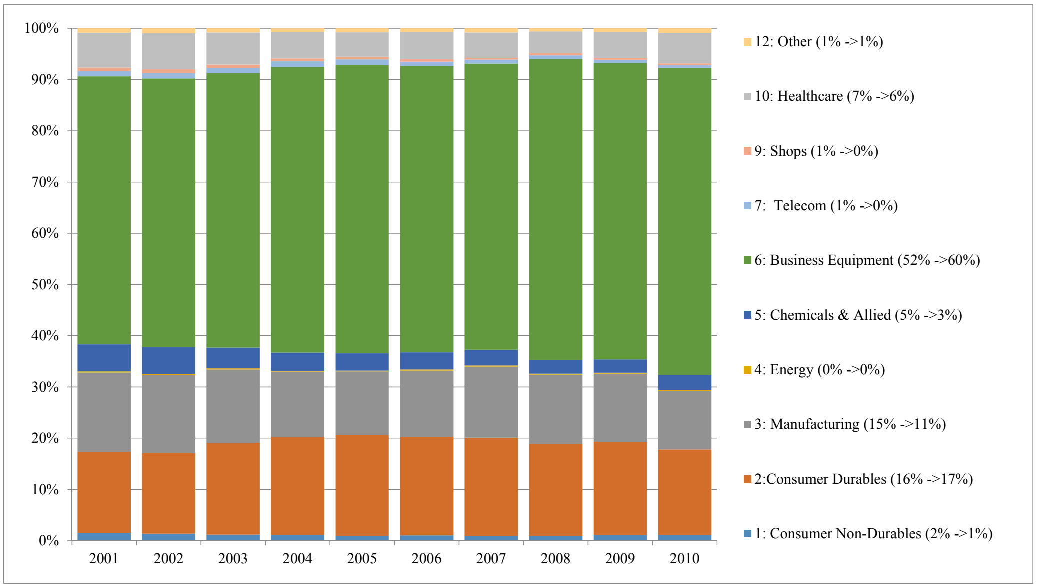


Table 1
Sample of Firms and Innovation Activity

This table shows the number of publicly-listed firms that have institutional ownership and corporate innovation data (in terms of both R&D expenditures and USPTO patent-filing activity) by country (Panel A) and industry (Panel B). The row titled “Non-U.S.” refers to the number of non-U.S. firms, which is the sample used in the main regression tests.

Panel A: Sample Statistics by Country

		Sample of firms						R&D expenditures				USPTO patent-filing activity			
Region	Country	Firm-Years	Unique Firms	Market Cap ($bln, 2009)	Foreign IO (2009)	Domestic IO (2009)	Close-Held Shares (2009)	Total R&D ($ bln, 2001-2010)	Average R&D/ Assets	Unique Firms with R&D	Firms with R&D - Average R&D/Assets	Total Patents (2001-2010)	Average Nr of Patents	Unique Firms with Patents	Firms with Patents - Average Nr of Patents
North America	United States	48,339	8,657	$10,622	8%	67%	12%	$1,873.5	5.1%	3,903	11.5%	298,200	6.17	2,679	26.78
	Canada	5,175	1,311	$834	26%	27%	12%	$40.5	3.4%	369	12.5%	5,957	1.15	214	10.11
Europe	Germany	6,022	919	$945	23%	6%	30%	$410.5	2.2%	361	6.1%	29,484	4.90	183	37.80
	France	6,207	977	$1,200	19%	8%	30%	$235.2	1.5%	275	6.1%	8,767	1.41	143	17.89
	Netherlands	1,323	192	$345	34%	3%	19%	$100.7	1.4%	67	5.4%	7,893	5.97	23	78.93
	Switzerland	1,621	224	$748	25%	4%	15%	$194.8	2.8%	123	5.5%	5,759	3.55	48	29.84
	Finland	1,148	145	$147	26%	9%	15%	$63.5	3.4%	98	6.0%	5,347	4.66	39	32.60
	Sweden	2,933	499	$323	14%	26%	26%	$76.7	2.4%	141	8.3%	4,407	1.50	67	17.91
	United Kingdom	12,427	2,199	$1,693	20%	13%	12%	$201.3	2.6%	749	8.3%	2,476	0.20	149	5.49
	Denmark	1,082	160	$147	21%	7%	35%	$22.4	2.6%	46	9.6%	1,343	1.24	23	11.38
	Belgium	882	135	$163	18%	1%	47%	$19.4	1.9%	47	6.0%	875	0.99	24	8.25
	Italy	1,810	269	$294	18%	2%	36%	$53.1	0.6%	78	3.0%	751	0.41	50	5.01
	Norway	1,398	259	$197	13%	10%	54%	$7.9	1.3%	69	6.0%	304	0.22	29	3.38
	Austria	635	107	$51	20%	2%	46%	$4.9	2.1%	43	4.9%	231	0.36	17	4.44
	Ireland	471	84	$60	39%	1%	16%	$5.1	1.7%	28	6.2%	12	0.03	3	1.71
	Spain	1,018	148	$336	18%	2%	35%	$3.4	0.3%	29	2.9%	42	0.04	14	1.56
	Hungary	229	40	$19	23%	1%	32%	$1.0	0.7%	5	5.5%	53	0.23	2	3.79
Asia Pacific	Japan	32,325	4,152	$2,222	9%	4%	30%	$1,143.5	1.3%	2,586	2.2%	212,034	6.56	1,370	33.60
	South Korea	9,635	1,691	$610	14%	0%	28%	$77.9	0.9%	1,287	1.4%	56,020	5.81	314	62.87
	Taiwan	9,601	1,573	$622	15%	2%	22%	$74.7	2.5%	1,249	3.4%	41,147	4.29	599	19.94
	India	4,199	1,121	$420	8%	3%	62%	$9.5	0.3%	410	0.9%	1,869	0.45	76	9.39
	Singapore	2,230	534	$124	13%	2%	61%	$2.9	0.2%	77	2.2%	1,289	0.58	38	16.74
	China	11,342	1,904	$2,574	9%	6%	41%	$32.2	0.2%	397	1.6%	752	0.07	65	4.88
	Australia	4,634	1,049	$603	17%	2%	30%	$7.4	1.6%	255	8.2%	372	0.08	64	2.74
	Hong Kong	5,957	857	$824	11%	3%	61%	$8.7	0.5%	288	2.4%	32	0.01	18	1.28
	New Zealand	195	49	$10	12%	3%	43%	$0.2	0.6%	10	3.5%	77	0.39	5	5.50
	Malaysia	4,471	898	$51	6%	1%	40%	$1.3	0.1%	96	0.8%	14	0.00	6	1.27
Other	Israel	1,333	298	$103	47%	1%	18%	$12.3	5.0%	143	10.2%	825	0.62	51	4.91
	Brazil	910	205	$622	24%	3%	56%	$9.0	0.1%	13	1.9%	192	0.21	13	5.05
	South Africa	1,621	296	$228	20%	4%	39%	$2.1	0.3%	72	1.2%	17	0.01	14	1.06
	Non-U.S.	132,834	22,295	$16,513	16%	7%	32%	$2,822.0	1.5%	9,411	4.1%	388,341	2.92	3,661	21.06
	All Countries	181,173	30,952	$27,136	13%	30%	24%	$4,695.5	2.4%	13,314	6.0%	686,541	3.79	6,340	27.67

Table 1 (continued)

Panel B: Sample Statistics by Industry

		Sample of firms			R&D expenditures				USPTO patent-filing activity			
Countries	Industry	Firm-Years	Unique Firms	Market Cap ($ bln, 2009)	Total R&D (US$ bln, 2001-2010)	Average R&D/ Assets	Unique Firms with R&D	Firms with R&D - Average R&D/Assets	Total Nr of Patents (2001-2010)	Average Nr of Patents	Unique Firms with Patents	Firms with Patents - Average Nr of Patents
Non-U.S. Firms	1: Consumer Non-Durables	13,913	2,244	$1,663	$97.2	0.5%	830	1.4%	5,065	0.36	223	6.48
	2:Consumer Durables	6,567	1,013	$1,070	$733.9	1.6%	625	2.9%	112,615	17.15	279	89.95
	3: Manufacturing	23,977	3,838	$2,249	$471.8	1.0%	2,036	1.9%	61,245	2.55	861	17.97
	4: Energy	3,523	831	$2,078	$46.0	0.2%	118	1.1%	762	0.22	52	4.26
	5: Chemicals and Allied Products	6,243	952	$826	$158.8	1.3%	564	2.3%	21,010	3.37	282	16.85
	6: Business Equipment	25,075	4,315	$1,477	$606.4	3.6%	2,788	6.1%	165,387	6.60	1,071	40.93
	7: Telecom	2,806	509	$1,480	$87.9	0.7%	137	3.1%	3,781	1.35	50	16.44
	9: Shops	16,644	2,622	$1,370	$40.6	0.2%	458	1.7%	2,614	0.16	201	5.25
	10: Healthcare	6,355	1,105	$1,278	$511.4	4.7%	728	7.9%	13,980	2.20	345	10.60
	12: Other	27,731	4,866	$3,023	$67.8	0.7%	1,127	3.4%	1,882	0.07	297	2.60
U.S. Firms	1: Consumer Non-Durables	2,704	474	$821	$28.5	0.9%	128	4.0%	2,664	0.99	93	6.99
	2:Consumer Durables	1,255	209	$154	$126.7	3.4%	129	5.5%	11,272	8.98	96	28.18
	3: Manufacturing	5,178	832	$842	$186.7	2.5%	453	4.6%	32,846	6.34	366	20.05
	4: Energy	2,525	472	$1,295	$25.2	0.4%	46	4.5%	580	0.23	52	3.67
	5: Chemicals and Allied Products	1,284	215	$511	$85.8	3.5%	145	5.0%	4,795	3.73	72	13.14
	6: Business Equipment	12,734	2,306	$2,559	$840.3	9.9%	1,645	13.5%	214,557	16.85	945	49.03
	7: Telecom	1,904	395	$604	$9.2	1.9%	82	10.5%	2,521	1.32	71	11.56
	9: Shops	5,438	954	$1,297	$16.6	0.5%	106	6.7%	1,073	0.20	122	3.28
	10: Healthcare	6,680	1,128	$1,399	$524.0	10.9%	813	15.9%	24,330	3.64	601	9.67
	12: Other	8,637	1,672	$1,141	$30.6	1.9%	356	11.3%	3,562	0.41	261	4.71
All Firms	1: Consumer Non-Durables	16,617	2,718	$2,484	$125.6	0.6%	958	1.7%	7,729	0.47	316	6.65
	2:Consumer Durables	7,822	1,222	$1,224	$860.7	1.9%	754	3.3%	123,887	15.84	375	74.99
	3: Manufacturing	29,155	4,670	$3,091	$658.5	1.2%	2,489	2.4%	94,091	3.23	1,227	18.64
	4: Energy	6,048	1,303	$3,373	$71.1	0.2%	164	2.0%	1,342	0.22	104	3.98
	5: Chemicals and Allied Products	7,527	1,167	$1,336	$244.6	1.6%	709	2.8%	25,805	3.43	354	16.01
	6: Business Equipment	37,809	6,621	$4,037	$1,446.7	5.8%	4,433	9.0%	379,944	10.05	2,016	45.14
	7: Telecom	4,710	904	$2,084	$97.2	1.2%	219	5.7%	6,302	1.34	121	14.07
	9: Shops	22,082	3,576	$2,667	$57.2	0.3%	564	2.5%	3,687	0.17	323	4.47
	10: Healthcare	13,035	2,233	$2,677	$1,035.4	7.9%	1,541	12.2%	38,310	2.94	946	9.99
	12: Other	36,368	6,538	$4,164	$98.4	1.0%	1,483	5.0%	5,444	0.15	558	3.68

Table 2
Summary Statistics

This table shows summary statistics for the main variables in the analysis. Appendix B provides the definitions and sources for these variables. The sample covers both U.S. and non-U.S. firms for the period from 2001 to 2010.

Countries		Mean	Standard Deviation	Minimum	Maximum	Number of Observations
Non-U.S. Firms	$R\&D_t$	1.5%	4.3%	0.0%	34.0%	132,834
	$PATENTS_t$	2.92	48.07	0	4,527	132,834
	log($PATENTS_t$)	0.19	0.69	0	8.42	132,834
	$PATENTS\_WEIGHTED_t$	4.83	57.87	0	4,809	132,834
	$PATENTS_t$ (3-year window)	7.65	132.80	0	12,775	132,834
	IO_TOTAL_{t-1}	7%	12%	0%	100%	132,834
	IO_FOR_{t-1}	3%	8%	0%	100%	132,834
	IO_DOM_{t-1}	4%	8%	0%	100%	132,834
	$CLOSE_{t-1}$	28%	28%	0%	100%	132,834
	$FXSALES_{t-1}$	16%	28%	0%	95%	132,834
	log(K_{t-1}/L_{t-1})	193	774	0	9,959	132,834
	$R\&D\_STOCK_{t-1}$	6.0%	17.5%	0.0%	149.0%	132,834
	$SALES_{t-1}$ (US$ mln)	1,184	6,676	0	357,764	132,834
	$MSCI_{t-1}$	7.7%	26.7%	0.0%	100.0%	132,834
	$GOV41_{t-1}$	44%	10%	22%	88%	11,125
U.S. Firms	$R\&D_t$	5.1%	9.3%	0.0%	34.0%	48,339
	$PATENTS_t$	6.17	80.67	0	6,937	48,339
	log($PATENTS)_t$	0.42	0.98	0	8.85	48,339
	$PATENTS\_WEIGHTED_t$	8.77	67.79	0	5,001	48,339
	$PATENTS_t$ (3-year window)	16.11	219.03	0	15,880	48,339
	IO_TOTAL_{t-1}	39%	37%	0%	100%	48,339
	IO_FOR_{t-1}	2%	3%	0%	100%	48,339
	IO_DOM_{t-1}	38%	35%	0%	100%	48,339
	$CLOSE_{t-1}$	31%	25%	0%	100%	48,339
	$FXSALES_{t-1}$	15%	24%	0%	95%	48,339
	log(K_{t-1}/L_{t-1})	189	833	0	9,959	48,339
	$R\&D\_STOCK_{t-1}$	27.2%	43.4%	0.0%	149.0%	48,339
	$SALES_{t-1}$ (US$ mln)	1,639	9,108	0	425,071	48,339
	$MSCI_{t-1}$	7.4%	26.2%	0.0%	100.0%	48,339
	$GOV41_{t-1}$	58%	11%	22%	93%	25,936
All Firms	$R\&D_t$	2.4%	6.2%	0.0%	34.0%	181,173
	$PATENTS_t$	3.79	58.59	0	6,937	181,173
	log($PATENTS)_t$	0.25	0.79	0	8.85	181,173
	$PATENTS\_WEIGHTED_t$	5.88	60.70	0	5,001	181,173
	$PATENTS_t$ (3-year window)	9.91	160.45	0	15,880	181,173
	IO_TOTAL_{t-1}	15%	26%	0%	100%	181,173
	IO_FOR_{t-1}	3%	7%	0%	100%	181,173
	IO_DOM_{t-1}	13%	25%	0%	100%	181,173
	$CLOSE_{t-1}$	29%	28%	0%	100%	181,173
	$FXSALES_{t-1}$	16%	27%	0%	95%	181,173
	log(K_{t-1}/L_{t-1})	192	790	0	9,959	181,173
	$R\&D\ STOCK_{t-1}$	11.6%	28.5%	0.0%	149.0%	181,173
	$SALES_{t-1}$ (US$ mln)	1,305	7,406	0	425,071	181,173
	$MSCI_{t-1}$	7.7%	26.6%	0.0%	100.0%	181,173
	$GOV41_{t-1}$	54%	13%	22%	93%	37,061

Table 3
Foreign Institutional Ownership and Innovation

This table shows estimates of panel regressions of corporate innovation on institutional ownership for U.S. and non-U.S. firms from 2001 to 2010. The dependent variables are the level of R&D expenditures as a fraction of firm assets (Panel A) and the logarithm of 1 plus the number of patents applied at USPTO by a given firm (Panel B) in year t. Refer to Appendix B for variables definition. All explanatory variables are lagged by one period. The table reports estimates of pooled ordinary least squares regressions with country, industry, and year dummies and standard errors corrected for country-level clustering. Robust standard errors are reported in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% levels.

Panel A: R&D-to-Assets

Model:	OLS	OLS	OLS	OLS	OLS	OLS
Dependent variable:	$R\&D_t$	$R\&D_t$	$R\&D_t$	$R\&D_t$	$R\&D_t$	$R\&D_t$
Sample of firms:	All	Non-U.S.	Non-U.S.	Non-U.S.	Non-U.S.	U.S.
	(1)	(2)	(3)	(4)	(5)	(6)
IO_TOTAL_{t-1}	0.005*	0.028***				0.016
	(0.003)	(0.010)				(0.011)
IO_FOR_{t-1}			0.042***		0.041***	
			(0.010)		(0.009)	
IO_DOM_{t-1}				0.015	0.012	
				(0.012)	(0.012)	
$CLOSE_{t-1}$	-0.002	0.002	0.002	0.002	0.002	-0.021***
	(0.005)	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)
$FXSALES_{t-1}$	0.024***	0.017***	0.017***	0.018***	0.017***	0.028**
	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)	(0.010)
$\log(K_{t-1}/L_{t-1})$	0.000	-0.001**	-0.001**	-0.001**	-0.001**	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
$\log(SALES)_{t-1}$	-0.005***	-0.003***	-0.003***	-0.003***	-0.003***	-0.009**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	No
R^2	0.24	0.18	0.18	0.17	0.18	0.26
Number of observations	181,173	132,834	132,834	132,834	132,834	48,339

Table 3 (continued)

Panel B: Patent Counts

Model:	OLS	OLS	OLS	OLS	OLS	OLS
Dependent variable:	log(*$PATENTS_t$*)	log(*$PATENTS_t$*)	log(*$PATENTS_t$*)	log(*$PATENTS_t$*)	log(*$PATENTS_t$*)	log(*$PATENTS_t$*)
Sample of firms:	All	Non-U.S.	Non-U.S.	Non-U.S.	Non-U.S.	U.S.
	(1)	(2)	(3)	(4)	(5)	(6)
IO_TOTAL_{t-1}	0.382***	0.283**				0.384***
	(0.070)	(0.110)				(0.100)
IO_FOR_{t-1}			0.813***		0.834***	
			(0.168)		(0.171)	
IO_DOM_{t-1}				-0.301**	-0.357**	
				(0.146)	(0.141)	
$CLOSE_{t-1}$	-0.027	0.020	0.025	0.002	0.018	-0.148**
	(0.065)	(0.059)	(0.061)	(0.057)	(0.058)	(0.054)
$FXSALES_{t-1}$	0.317**	0.218**	0.198*	0.239**	0.203*	0.583***
	(0.124)	(0.104)	(0.103)	(0.106)	(0.104)	(0.099)
$\log(K_{t-1}/L_{t-1})$	0.022*	0.008	0.007	0.008	0.007	0.057
	(0.013)	(0.007)	(0.007)	(0.007)	(0.007)	(0.038)
$\log(SALES)_{t-1}$	0.076***	0.082***	0.078**	0.090***	0.081**	0.059**
	(0.021)	(0.030)	(0.029)	(0.030)	(0.029)	(0.022)
$\log(R\&D\_STOCK)_{t-1}$	1.006***	1.250**	1.228**	1.277***	1.235**	0.773***
	(0.194)	(0.458)	(0.458)	(0.458)	(0.457)	(0.080)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	No
R^2	0.24	0.22	0.22	0.22	0.23	0.26
Number of observations	181,173	132,834	132,834	132,834	132,834	48,339

Table 4
Foreign Institutional Ownership and Innovation: Robustness

This table shows robustness checks of the main results. Panel A examines the robustness of the results on R&D expenditures in column (5) of Table 3. Panel B examines the robustness of the results on the number of patents in column (11) of Table 3. The sample consists of non-U.S. firms for the period from 2001 to 2010. Columns (1) and (5) control for pre-sample firm fixed effects, following the procedure in Blundell, Griffith, and Van Reenen (1999). Columns (2) and (3) look at the probability that a firm has positive R&D expenditures and R&D increases in a given year, respectively. In column (4), the dependent variable is R&D stock. Column (6) presents negative binomial regression estimates for a model using the number of patents as a count variable. Column (7) uses the scaled number of patents of firm adjusted for its technology class and application year. Column (8) excludes the last two years of the sample period because of data censoring concerns. Column (9) shows results for only firms with positive number of patents. In column (10) the dependent variable is the number of patents over a 3-year period. Refer to Appendix B for variables definition. All explanatory variables are lagged by one period. Robust standard errors corrected for country-level clustering are reported in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% levels.

Panel A: R&D-to-Assets

Model:	Firm Fixed Effects	Probit	Probit	OLS
Dependent variable:	$R\&D_t$	$R\&D_t > 0$	$R\&D_t > R\&D_{t-1}$	$R\&D\_STOCK_t$
Sample of firms:	Non-U.S.	Non-U.S.	Non-U.S.	Non-U.S.
	(1)	(2)	(3)	(4)
IO_FOR_{t-1}	0.028***	2.007***	1.131***	0.153***
	(0.009)	(0.559)	(0.356)	(0.031)
IO_DOM_{t-1}	0.011	0.440	0.386**	0.060
	(0.011)	(0.306)	(0.190)	(0.046)
$CLOSE_{t-1}$	0.003*	0.253	0.127	0.012*
	(0.001)	(0.169)	(0.125)	(0.006)
$FXSALES_{t-1}$	0.012***	0.669***	0.400***	0.067***
	(0.003)	(0.115)	(0.074)	(0.013)
$\log(K_{t-1}/L_{t-1})$	-0.001**	-0.044*	-0.017	-0.004**
	(0.001)	(0.024)	(0.016)	(0.002)
$\log(SALES)_{t-1}$	-0.004***	0.039*	0.029***	-0.010***
	(0.001)	(0.023)	(0.011)	(0.003)
$R\&D_0$	0.946***			
	(0.076)			
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
R^2	0.22	0.31	0.14	0.24
Number of observations	132,834	128,178	132,834	132,834

Table 4 (continued)

Panel B: Patent Counts

Model:	Firm Fixed Effects	Negative Binomial	OLS	OLS	OLS	OLS
Dependent variable:	log($PATENTS_t$)	log($PATENTS_t$)	log($PATENTS\_WEIGHTED_t$)	log($PATENTS_t$)	log($PATENTS_t$)	log($PATENTS_t$) 3-year window
Sample of firms:	Non-U.S.	Non-U.S.	Non-U.S.	Non-U.S. 2001-2008	Non-U.S.	Non-U.S.
	(1)	(2)	(3)	(4)	(5)	(6)
IO_FOR_{t-1}	0.476***	4.403***	1.012***	0.942***	1.145**	1.107***
	(0.101)	(1.430)	(0.193)	(0.178)	(0.442)	(0.208)
IO_DOM_{t-1}	-0.123	1.593*	-0.342**	-0.385**	-0.750**	-0.390**
	(0.088)	(0.891)	(0.154)	(0.146)	(0.359)	(0.183)
$CLOSE_{t-1}$	0.028	0.760***	0.035	0.031	-0.055	0.040
	(0.024)	(0.261)	(0.072)	(0.062)	(0.134)	(0.076)
$FXSALES_{t-1}$	0.056*	1.541***	0.262**	0.215*	0.464*	0.274**
	(0.029)	(0.337)	(0.123)	(0.109)	(0.269)	(0.126)
log(K_{t-1}/L_{t-1})	0.002	0.100	0.006	0.009	-0.022	0.009
	(0.002)	(0.069)	(0.007)	(0.007)	(0.040)	(0.008)
log($R\&D\_STOCK$)$_{t-1}$	0.359***	6.825***	1.495**	1.451**	2.414***	1.640***
	(0.113)	(1.328)	(0.562)	(0.548)	(0.514)	(0.574)
log($SALES$)$_{t-1}$	0.022**	0.387***	0.100**	0.087**	0.347***	0.102***
	(0.009)	(0.131)	(0.036)	(0.032)	(0.055)	(0.036)
$PATENTS_0$	0.848***					
	(0.016)					
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.60	0.00	0.22	0.24	0.39	0.26
Number of observations	132,834	132,834	132,834	103,259	13,680	132,834

Table 5
Foreign Institutional Ownership and Innovation: Instrumental Variables

This table shows estimates of two-stage least squares (2SLS) regressions using panel data for non-U.S. firms from 2001 to 2010. Foreign institutional ownership is instrumented with MSCI (a dummy variable that equals one if a firm is a member of the MSCI All Country World Index, and zero otherwise). Refer to Appendix B for variables definition. All explanatory variables are lagged by one period. Standard errors corrected for country-level clustering are reported in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% levels.

Panel A: R&D-to-Assets

	First-stage regression	Second-stage regression
Dependent variable:	IO_FOR_t	$R\&D_t$
Sample of firms:	Non-U.S.	Non-U.S.
	(1)	(2)
IO_FOR_{t-1}		0.1708***
		(0.031)
IO_DOM_{t-1}	0.0847*	0.0031
	(0.045)	(0.018)
$CLOSE_{t-1}$	-0.0122	0.0047***
	(0.009)	(0.002)
$FXSALES_{t-1}$	0.0406***	0.0104***
	(0.008)	(0.002)
$\log(K_{t-1}/L_{t-1})$	0.001*	-0.0015***
	(0.001)	(0.001)
$\log(SALES)_{t-1}$	0.0067***	-0.0049***
	(0.001)	(0.001)
$MSCI_{t-1}$	0.076***	
	(0.012)	
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
Country fixed effects	Yes	Yes
R^2	0.31	
Number of observations	132,834	
F-test of instruments	37.73	
(p-value)	0.000	
Anderson-Rubin χ^2-statistic		84.40***
(p-value)		0.000

Table 5 (continued)

Panel B: Patent Counts

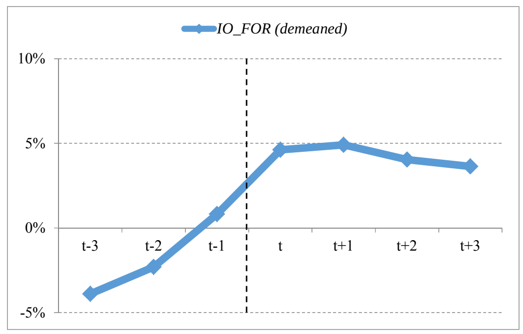
	First-stage regression	Second-stage regression
Dependent variable:	IO_FOR_t	log($PATENTS_t$)
Sample of firms:	Non-U.S.	Non-U.S.
	(1)	(2)
IO_FOR_{t-1}		7.9207***
		(3.238)
IO_DOM_{t-1}	0.0819*	-0.8341
	(0.047)	(0.544)
$CLOSE_{t-1}$	-0.0126	0.1538
	(0.009)	(0.114)
$FXSALES_{t-1}$	0.0383***	-0.1069
	(0.008)	(0.072)
log(K_{t-1}/L_{t-1})	0.0012**	-0.0065
	(0.001)	(0.01)
log($R\&D\_STOCK)_{t-1}$	0.0348***	0.8772***
	(0.011)	(0.323)
log($SALES)_{t-1}$	0.007***	-0.0033
	(0.001)	(0.013)
$MSCI_{t-1}$	0.0744***	
	(0.012)	
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
Country fixed effects	Yes	Yes
R^2	0.32	
Number of observations	132,834	
F-test of instruments	37.42	
(p-value)	0.000	
Anderson-Rubin χ^2-statistic		14.35***
(p-value)		0.000

Table 6
Event Study: Effect of Being Added and Deleted to the MSCI

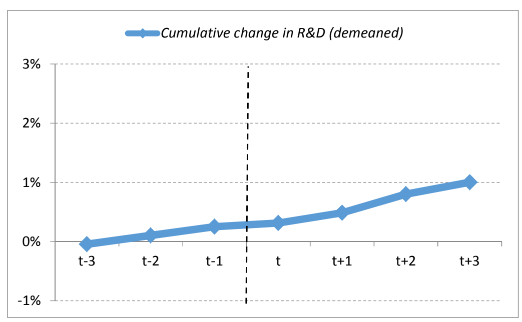
This table presents the results of event study of firm inclusions and deletions from the MSCI ACWI index. The sample consists of all non-U.S. firms added and removed from the MSCI ACWI index between 2004 and 2007 and with institutional ownership data in the three year period before and after the events. Year *t* refers to the year-end after the index addition and deletion events and event time is measured in years surrounding the events. All variables (*IO_FOR*, *R&D* and *PATENTS*) are demeaned by their firm-level average over the full sample period from 2001 to 2010.

Panel A: MSCI Addition Events

		t-3	*t*-2	*t*-1	*t*	*t*+1	*t*+2	*t*+3
IO_FOR	Observations	481	481	481	481	481	481	481
(demeaned)	Mean	-3.9%	-2.3%	0.8%	4.6%	4.9%	4.0%	3.6%



Cumulative change in *R&D*	Observations	266	266	266	266	266	266	266
(demeaned)	Mean	-0.04%	0.10%	0.25%	0.31%	0.48%	0.80%	1.00%



Cumulative change in *PATENTS*	Observations	481	481	481	481	481	481	481
(demeaned)	Mean	-1	-1	-1	1	4	5	5

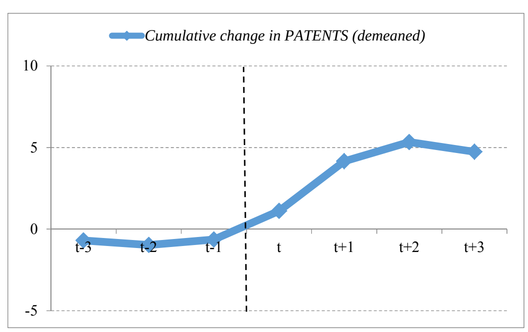
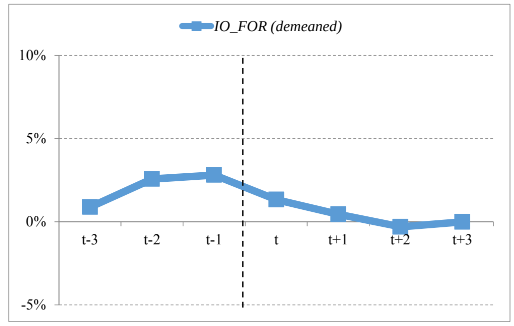


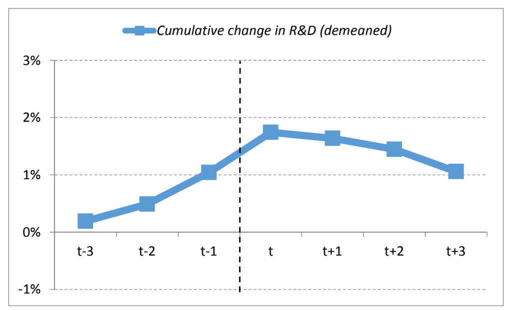
Table 6 (continued)

Panel B: MSCI Deletion Events

		t-3	*t*-2	*t*-1	*t*	*t*+1	*t*+2	*t*+3
IO_FOR	Observations	155	155	155	155	155	155	155
(demeaned)	Mean	0.9%	2.6%	2.8%	1.3%	0.4%	-0.3%	0.0%



		t-3	*t*-2	*t*-1	*t*	*t*+1	*t*+2	*t*+3
Cumulative change in *R&D*	Observations	93	93	93	93	93	93	93
(demeaned)	Mean	0.19%	0.49%	1.04%	1.74%	1.64%	1.44%	1.06%



		t-3	*t*-2	*t*-1	*t*	*t*+1	*t*+2	*t*+3
Cumulative change in *PATENTS*	Observations	155	155	155	155	155	155	155
(demeaned)	Mean	0	1	1	2	2	1	-1

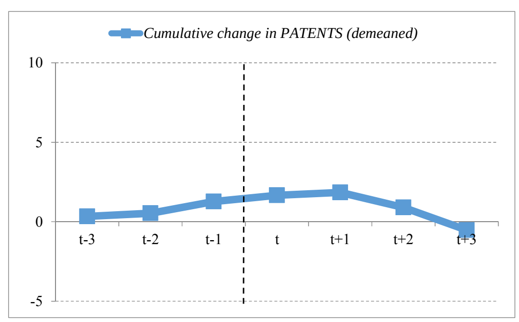


Table 7
Foreign Institutional Ownership and Innovation: Effect of Corporate Governance

This table tests for the interaction between foreign institutional ownership and corporate governance on innovation intensity. Corporate governance is measured using the *GOV41* index. The sample consists of non-U.S. firms from 2001 to 2010. Refer to Appendix B for variables definition. All explanatory variables are lagged by one period. Standard errors corrected for country-level clustering are reported in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% levels.

Model:	OLS	OLS
Dependent variable:	$R\&D_t$	log($PATENTS_t$)
Sample of firms:	Non-U.S.	Non-U.S.
	(1)	(2)
IO_FOR_{t-1}	0.072**	3.265*
	(0.030)	(1.650)
IO_DOM_{t-1}	-0.017**	0.142
	(0.007)	(0.364)
$CLOSE_{t-1}$	-0.011**	0.181
	(0.005)	(0.115)
$FXSALES_{t-1}$	0.014***	0.342
	(0.004)	(0.282)
log(K_{t-1}/L_{t-1})	-0.001	0.012
	(0.001)	(0.039)
log($SALES$)$_{t-1}$	-0.005**	0.253***
	(0.002)	(0.059)
log($R\&D\_STOCK$)$_{t-1}$		3.130***
		(0.802)
$GOV41_{t-1}$	0.006	1.096*
	(0.026)	(0.583)
$GOV41_{t-1} \times IO\_FOR_{t-1}$	-0.113**	-5.091*
	(0.042)	(2.897)
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
Country fixed effects	Yes	Yes
R^2	0.33	0.47
Number of observations	11,125	11,125

Table 8
Foreign Institutional Ownership, Innovation and Firm Valuation

This table tests whether foreign institutional ownership is associated with shareholder value-increasing corporate innovation. The dependent variable in these regressions is *Tobin's Q*. The sample consists of non-U.S. firms from 2001 to 2010. Refer to Appendix B for variables definition. All explanatory variables are lagged by one period. Standard errors corrected for country-level clustering are reported in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% levels.

Model:	OLS	OLS	OLS
Dependent variable:	$TOBIN\_Q_t$	$TOBIN\_Q_t$	$TOBIN\_Q_t$
Sample of firms:	Non-U.S.	Non-U.S.	Non-U.S.
	(1)	(2)	(3)
log($PATENTS_{t-1}$)	0.127***	0.145***	0.127***
	(0.036)	(0.040)	(0.037)
IO_FOR_{t-1}	1.990***		1.994***
	(0.437)		(0.460)
IO_DOM_{t-1}		0.066	-0.069
		(0.748)	(0.727)
$CLOSE_{t-1}$	0.347**	0.308**	0.345**
	(0.144)	(0.143)	(0.147)
$FXSALES_{t-1}$	-0.047	0.036	-0.046
	(0.054)	(0.054)	(0.053)
log(K_{t-1}/L_{t-1})	-0.115***	-0.111***	-0.115***
	(0.022)	(0.021)	(0.022)
log($R\&D\_STOCK$)$_{t-1}$	1.847***	1.926***	1.849***
	(0.244)	(0.258)	(0.257)
log($SALES$)$_{t-1}$	-0.223***	-0.200***	-0.222***
	(0.035)	(0.038)	(0.036)
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes
R^2	0.09	0.09	0.09
Number of observations	127,642	127,642	127,642

Table 9
Foreign Institutional Ownership and Innovation Productivity

This table tests whether foreign institutional ownership is associated more innovative efficiency. The dependent variable in these regressions is the ratio *PATENTS*/*R&D stock*. The sample consists of non-U.S. firms from 2001 to 2010. Refer to Appendix B for variables definition. All explanatory variables are lagged by one period. Standard errors corrected for country-level clustering are reported in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% levels.

Model:	OLS	OLS	OLS
Dependent variable:	log($PATENTS_t$/$R\&D\_STOCK_t$)	log($PATENTS_t$/$R\&D\_STOCK_t$)	log($PATENTS_t$/$R\&D\_STOCK_t$)
Sample of firms:	Non-U.S.	Non-U.S.	Non-U.S.
	(1)	(2)	(3)
IO_FOR_{t-1}	0.125***		0.127***
	(0.039)		(0.039)
IO_DOM_{t-1}		-0.050**	-0.057*
		(0.023)	(0.029)
$CLOSE_{t-1}$	-0.013	-0.018	-0.014
	(0.011)	(0.011)	(0.011)
$FXSALES_{t-1}$	0.032*	0.039*	0.033*
	(0.018)	(0.019)	(0.018)
log(K_{t-1}/L_{t-1})	-0.003	-0.003	-0.003
	(0.003)	(0.003)	(0.003)
log($R\&D\_STOCK$)$_{t-1}$	0.042*	0.047*	0.042*
	(0.023)	(0.023)	(0.023)
log($SALES$)$_{t-1}$	0.006*	0.008**	0.006*
	(0.003)	(0.003)	(0.003)
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes
R^2	0.05	0.05	0.05
Number of observations	51,008	51,008	51,008

Appendix A

This appendix describes the algorithm we use to match USPTO patent assignees to firms in the Worldscope database. Using historical data, for each firm in Worldscope, we compile the list of all names used by the firm currently and in the past (we use both name and extended name variables), and we also collect the firm's country of incorporation. For each patent, we obtain the set of assignees listed on the patent grant publication document issued by the USPTO. For each assignee, we collect assignee's country and the indicator of its status: U.S. corporation, non-U.S. corporation, or other. We use only patents, where USPTO indicates that at least one patent assignee is a U.S. corporation or non-U.S. corporation.

In the first step, we standardize patent assignee names and firm names using regular expression language. Our standardization focuses on three main aspects of firm names:

a) We ensure that firm names only contain a-z, A-Z, and 0-9 characters. For example, we replace "â" to "a", "ü" to "u", "Ó" to "O", "Ü" to "U", "È" to "E" etc. We do 292 such character replacements. We also replace endings added to firm name strings by data vendors, for example, "- ARD", "- CONSOLIDATED", "- PRO FORMA" etc. We use 46 regular expressions to perform these removals.

b) We unify the way suffices of firm names appear in the data. For example, German suffices "GmbH", "G.M.B.H.", "G. M. B. H.", "g m b h", "G m b H", "G m. b. H" etc. are replaced by the same unified string "GMBH". There are 817 different suffices we process according to this scheme. To minimize the probability of mistakenly changing a non-suffix part of the firm name, this procedure is country-specific, i.e., we only make the above replacements if the respective suffice is used by firms incorporated in a given country.

c) We shorten non-unique parts of firm names that have low relevance for matching. For example, the word "CORPORATION" appears in many firm names and hence cannot be used to distinguish one firm name from another. Therefore, we abbreviate it to "CORP" taking into account all possible misspellings of this word, e.g., "COPRPORATION", " CORPOIRATION", "CORPORTATION", "COROPORTION" or "CORPOORATION". Another example is Japanese "KABUSHIKI KAISHA", which we abbreviate to "KAB KSHA" using regular expressions like "K[K]*ABUSH[IS]*KI[\.&-]*KAISH[I]*A" or "KAB[UA]SHI[KN]I[\.&-]*[KH]AIS[HY]A". Overall, we abbreviate 302 terms like "CORPORATION" using 1,212 different regular language expressions. This step makes unique elements of firm names longer relative to their overall length, which increases the efficiency of the matching procedure we describe next.

In the second step, we create a dataset that contains all pairwise combinations of standardized patent assignee names and Worldscope firm names. There are 156,609 different standardized Worldscope firm names and 405,666 different standardized patent assignee names, leading to approximately 63.5 billion pairs. We match the name pairs using the Bigram string comparison algorithm. Bigram algorithm compares two strings using all combinations of two consecutive characters within each string. For example, the word "bigram" contains the following bigrams: "bi", "ig", "gr", "ra", and "am". We coded the Bigram comparison function to return a value between 0 and 1, which accounts for the total number of bigrams that are in common between the two strings divided by the average number of bigrams in the strings. Bigram is extremely effective for our purposes since it handles very well misspellings, omission of characters, as well as the swapping of words in the string. For name pairs with the Bigram score above 0.5, we also compute the Levenshtein distance between the two names. Intuitively, the Levenshtein distance between two strings is the minimum number of single-character edits (insertion, deletion, substitution) required in order to change one string into the other. Using the Bigram score, Levenshtein distance, and the length of the strings in the name pairs, we identify the closest Worldscope firm name for each patent assignee. For each patent assignee, we then decide whether the assignee was matched to a Worldscope firm or not. We also impose a condition that the firm's country of incorporation obtained from Worldscope is the same as the assignee's country recorded in USPTO data. These steps result in a database that links USPTO patent numbers to Worldscope firm codes.

We perform extensive checks on our standardization-matching algorithm. Specifically, first, to find closest matches, we use different thresholds for Bigram score and Levenshtein distance. Second, instead of standardizing suffices of firm names, we eliminate them from the firm name and we perform matching on so-called "stem" name. These alterations, even for rather extreme parameter values, have limited impact on the matching outcome: assignments of less than 5% of patents in our data are affected. Last, using random subsamples of patents, we manually check the results of the standardization-matching algorithm and compute the Type I and Type II errors. We find that both errors are lower than 1%.

Appendix B

Variable	Definition
R&D	Research and development expenditures (Worldscope item 01201) divided by total assets (Worldscope item 02999).
PATENTS	Number of patents applied by firm in year t (USPTO).
PATENTS_ WEIGHTED	Scaled number of patents of firm i in technology class k with application period t divided by the corresponding mean value for the technology class (USPTO). The measure is constructed in three steps. First, for each "technology class" *k* (defined below) and patent application period $t \rightarrow t+\tau$, we compute the mean value of the number of patents applied in technology class *k* with application period $t \rightarrow t+\tau$ across all firms in our sample. Second, we scale the number of patents of firm *i* in technology class *k* with application period $t \rightarrow t+\tau$ by the corresponding (technology class-application period-specific) mean value from the first step. Third, we use the natural logarithm of one plus the scaled number of number patents. Parameter τ is set to 0, 1, or 2. To measure technology class, we rely on the International Patent Classification (IPC) system (January 2009 version). The IPC system is a hierarchical patent classification system created under the Strasbourg Agreement (1971) and updated on a regular basis by a committee of experts, consisting of representatives of the contracting states of this agreement. The structure of the IPC classification is made up of a section, class, subclass, main group, and subgroup. We use the subclass-level of the IPC classification to differentiate innovations from different technology classes, i.e., different technology areas of innovation. Based on our definition, there are 1,050 different technology classes in our USPTO-to-Worldscope matched data.
PATENTS (3 year window)	The number of patents applied by firm i in the 3-year period starting in year t (USPTO).
IO_TOTAL	Holdings (end-of-year) by all institutions as a fraction of market capitalization (FactSet/LionShares).
IO_FOR	Holdings (end-of-year) by institutions located in a different country from the where the stock is listed as a fraction of market capitalization (FactSet/LionShares).
IO_DOM	Holdings (end-of-year) by institutions located in the same country where the stock is listed as a fraction of market capitalization (FactSet/LionShares).
CLOSE	Number of shares held by insiders (shareholders who hold 5% or more of the outstanding shares, such as officers and directors and immediate families, other corporations or individuals), as a fraction of the number of shares outstanding (Worldscope item 08021).
FXSALES	International annual net sales (Worldscope item 07101) as a proportion of net sales (Worldscope item 01001).
R&D_STOCK	R&D stock is defined as $G_t = R_t + (1 - \delta) G_{t-1}$ where R is the R&D expenditure in year t and $\delta = 0.15$, the private depreciation rate of knowledge (Worldscope).
K/L	Ratio between property, plant and Equipment net (Worldscope item 02501) and employees (Worldscope item 07011).
SALES	Sales in thousands of US$ (Worldscope item 01001).
MSCI	Dummy that equals one if a firm is a member of the MSCI All Country World Index, and zero otherwise (Bloomberg/MSCI).
GOV41	Following Aggarwal, Erel, Stulz and Williamson (2009) we use a composite corporate governance index that measures the compliance with 41 governance attributes (RiskMetrics/ISS)
TOBIN_Q	Total assets (Worldscope item 02999) plus market value of equity (Worldscope item 08001) minus book value of equity (Worldscope item 03501) divided by total assets (Worldscope item 02999).