External Governance and Internal Resource Allocation*

James F. Albertus
Andrew Bird
Stephen A. Karolyi
Thomas G. Ruchti

April 2019

Abstract

Internal capital markets are important determinants of investment and economic growth in the modern economy. We exploit a regulatory experiment on short selling restrictions and microdata on multinationals' foreign operations to test whether external governance pressure from short selling disciplines internal resource allocation. Firms treated with short selling pressure shift 30% more capital toward foreign subsidiaries with strong recent performance. Subsidiaries that receive capital experience no subsequent decline in productivity, suggesting the reallocation may be productive. Our results provide new evidence on the scope and potential benefits of short selling and the importance of cross-border spillovers of capital markets regulation.

JEL Classifications: D22, G23, G28, G34, M5
Keywords: short selling restrictions, external governance, investment, internal capital markets

*We thank Yashar Barardehi, Sudipta Basu, Daniel Bergstresser, David C. Brown, Chris Clifford, John Chalmers, Shaun Davies, Andy Fodor, Andy Koch, Steve McKeon, Sébastien Michenaud (discussant), Florian Muenkel (discussant), Mitchell Petersen (discussant), Jonathan Reuter, and Luke Stein, as well as conference and seminar participants at the 2017 Northern Finance Association, 2017 Oregon Summer Finance Conference, Ohio University, Conference on Financial Economics and Accounting. We are especially grateful to Vivian Fang for assistance with the Regulation SHO data. The statistical analysis of firm-level data on multinationals was conducted at the Bureau of Economic Analysis, U.S. Department of Commerce under arrangements that maintain legal confidentiality requirements. The views expressed are those of the authors and do not reflect official positions of the U.S. Department of Commerce. Albertus, Bird, Karolyi, and Ruchti are at Tepper School of Business, Carnegie Mellon University (albertus@cmu.edu; apmb@andrew.cmu.edu; skarolyi@andrew.cmu.edu; ruchti@andrew.cmu.edu).

1 Introduction

Three-quarters of investment by non-financial enterprises is funded with internal capital, making internal resource allocation an important feature of the modern economy (Mayer 1990; Gorton and Winton 2002; Stein 2003; Maksimovic and Phillips 2007). By showing that within-firm dispersion in investment exceeds across-firm investment dispersion, Kehrig and Vincent (2017) provide further evidence that internal capital markets are not only responsible for funding most investment opportunities but also directing capital across investment opportunities. This makes internal resource allocation and its corresponding frictions important determinants of investment and economic growth.

The theoretical literature has developed two different viewpoints on the effects of internal capital markets. The "bright side" view, as in Stein (1997), suggests that managers are better able to allocate capital than financial markets because they have stronger control rights and superior information. The "dark side" view, as in Scharfstein and Stein (2000), points out that internal capital markets suffer from multi-layered agency motives and that CEOs pursuing their private interests via empire building may engage in inefficient cross-subsidization of subsidiaries. Since these models focus on whether internal capital markets improve or exacerbate agency problems, they are key to understanding whether and how external governance pressure affects the internal workings of firms. While the literature has provided considerable evidence that different forms of external governance affect aggregate firm outcomes, as well as

documented the importance of internal capital markets, whether external governance can discipline internal resource allocation remains an important unresolved question.

There are two critical empirical challenges to answering this question: internal capital and labor allocation data are scarce, and governance is potentially endogenous to resource allocation efficiency. We address the first challenge with unique data on the foreign subsidiaries of U.S. multinational firms from the Bureau of Economic Analysis (BEA), which allow us to see how resources are reallocated within the firm in response to a governance shock. To address the second challenge, we exploit an exogenous shock to external governance through short selling pressure based on the pilot program of Regulation SHO, which randomly selected a set of firms to trade with fewer short sale restrictions. Prior work has shown that these firms experienced an increase in short selling activity (Alexander and Peterson 2008; Diether, Lee, and Werner 2009; Grullon, Michenaud, and Weston 2015). This increase in short selling activity is likely to be associated with an increase in external governance for several reasons.

First, increased short selling activity increases price efficiency (Boehmer and Wu 2013), which may lead to a feedback effect on corporate decisions (Holmström and Tirole 1993; Edmans, Goldstein, and Jiang 2015). Further, activist short sellers may increase their monitoring of manager activities (Fang, Huang, and Karpoff 2015) such as earnings management (Massa, Zhang, and Zhang 2015), leading to improved incentive contracting for executives (De Angelis, Grullon, and Michenaud 2017). Moreover, Alexander and Peterson (2008) find that increased short selling leads to shorter execution times, increasing the incentive

of traders to engage in information gathering about the firm (Mendelson and Tunca 2004). These potential mechanisms suggest that short selling restrictions could affect firm outcomes through a corporate governance channel in a variety of ways that need not correspond to, for example, average responses in the level of stock price. We use a difference-in-differences design to study the effect of improved external governance from inclusion in the Regulation SHO pilot program on capital and labor reallocation.

We first confirm in our sample of multinational companies that the increased threat of short selling does not affect aggregate investment, on average, consistent with the findings of Grullon, Michenaud, and Weston (2015). However, these null effects could mask a disciplining effect of external governance if capital markets frictions produce heterogeneity in over- and under-investment among treated firms.[1] We thus investigate within-firm dispersion in changes in investment and find evidence of a capital reallocation response to short selling pressure. This initial finding is consistent with external governance disciplining managers who are interested in the quiet life to take action. This reallocation is not random, but rather results in an increase in investment in high performing subsidiaries at the expense of poorly performing subsidiaries. Compared to productive subsidiaries at control firms, productive subsidiaries at treated firms experience 30% higher investment, roughly corresponding to a 200% increase in the

[1] Estimating the effects of Regulation SHO on investment levels is a joint test of the optimality of pre-program investment levels and the effects of short sellers. External governance may simultaneously lead to increases in investment for underinvesting firms and decreases in investment for overinvesting firms. This aspect of the joint test may explain the null findings of Grullon, Michenaud, and Weston (2015). In contrast, estimating the effects of Regulation SHO on within-firm investment allocation is not a joint test because changes in allocations reflect investment activity rather than investment levels.

productivity-sensitivity of investment for treated firms. Giroud and Mueller (2015) document a similar pattern of intrafirm spillovers in response to a shock to a subsidiary's investment opportunities, which is associated with a firm-wide increase in productivity. Their conclusion is that headquarters can create value by reallocating scarce resources, consistent with Stein (1997).[2] Given the nature of our shock, our reallocation evidence suggests that there is also merit to the "dark side" theories of internal capital markets (Scharfstein and Stein 2000), since it is the opportunity for rent-seeking highlighted in these models that creates the scope for external governance pressure to exert an effect. Moreover, because our focus is the foreign subsidiaries of multinational corporations, these results imply that short selling pressure incentivizes managers to expend costly effort to oversee distant subsidiaries (Harford, Wang, and Zhang 2016).

Importantly, we also show that there is no differential reversal or mean reversion in subsidiary performance between treated and control firms. This means that high performing subsidiaries remain so even after receiving incremental investment, just as poorly performing subsidiaries remain poorly performing after losing investment. Given the likelihood of diminishing returns to investment, this supports the interpretation that the reallocation induced by the increased short selling pressure is efficient. A benefit of this test is that it implicitly eliminates measurement error and mean reversion in productivity as alternative explanations for

[2] This point remains somewhat contentious. For example, both Lamont (1997) and Shin and Stulz (1998) use segment data to study how investment at one segment depends on the performance of the firm's other segments and find evidence contrary to the hypothesis that internal capital markets allocate resources efficiently.

our reallocation results. Overall, this suggests that capital reallocation induced by short selling pressure can help solve within-firm misallocation problems.

Despite the random selection of pilot companies for Regulation SHO, one may still be concerned that trends in various characteristics across treated and control subsidiaries differ before assignment to the pilot program.[3] We investigate the parallel trends assumption using a dynamic specification of our difference-in-differences estimator, and find that the assumption of parallel trends is not rejected at any conventional significance level prior to Regulation SHO. We also show that treatment-induced reallocation goes in the direction of high performing subsidiaries for a variety of different definitions of performance, including those based on subsidiary-specific characteristics, such as return on assets or asset turnover, and those based on characteristics of the industry or country in which the subsidiary operates, such as equity market returns. Finally, we study an alternative but similar mechanism, related to research and development (R&D) expenditures, to provide further and likely orthogonal evidence for the economic mechanism suggested by the within-firm investment effects on treated firms. Relative to control firms, treated firms reallocate R&D expenditures toward R&D centers, allowing them to take advantage of economies of scale in R&D activities (Romer 1986; Carlino and Kerr 2015). This result thus provides additional evidence that external governance pressure can and does affect internal resource allocation, even for the large multinational firms in our sample.

[3] We verify covariate balance for the multinational firms in our sample in Section 3.

Our results demonstrate that market-based corporate governance relates to the profitability of U.S. multinational firms' operations, including their operations abroad. To the extent that they imply a potential dark side to internal capital markets, these findings may help explain the puzzling investment returns differential discussed in Curcuru, Dvorak, and Warnock (2008) and Curcuru and Thomas (2014). Policies, such as Regulation SHO, may thus provide scope for investors to influence the management of multinational firms to mitigate frictions inhibiting optimal capital allocation.

This paper also contributes to the literatures on the governance effects of short sellers, and the causal effect of stock prices on firm decisions (Bond, Edmans, and Goldstein 2012). The extant literature on the external governance role of short sellers suggests that short seller activism and short selling threats both discipline managers. In particular, both Karpoff and Lou (2010) and Dyck, Morse, and Zingales (2010) find that short sellers play an important role in the detection of fraud. A long literature documents the negative impact of short selling on stock prices (Jones and Lamont 2002; Saffi and Sigurdsson 2010; Bris, Goetzmann, and Zhu 2007; Boehmer and Wu 2013) which, in theory, leads to a reduction in investment (Gilchrist, Himmelberg, and Huberman 2005). To combat the identification challenge that short sellers select targets of activism events, several other papers have also used the Regulation SHO pilot program setting. Fang, Huang, and Karpoff (2015) and Massa, Zhang, and Zhang (2015) show that short selling threats lead to reduced earnings management. In contrast, Li and Zhang (2015) find that short selling pressure causes managers to reduce the precision of bad news

forecasts and the readability of their annual reports, and Hope, Hu, and Zhao (2017) find an increase in audit fees and an increase in the incidence of auditor switching. Collectively, these findings suggest that the Regulation SHO experiment may have affected the corporate information environment, though it is not clear how these informational changes would affect internal resource allocation. Most recently, De Angelis, Grullon, and Michenaud (2017) show that the increase in short selling pressure for pilot firms led to more stock option grants to managers and an increase in the prevalence of anti-takeover provisions. This highlights a potential mechanism underlying the internal resource allocation results we document.

We contribute to the literature on internal resource allocation with novel international evidence that managers reallocate capital across borders in response to an external governance stimulus.[4] Previous research in this area has focused on domestic resource allocation by divisional managers (Duchin and Sosyura 2013; Duchin, Goldberg, and Sosyura 2016), across plants (Bertrand and Mullainathan 2003; Ersahin, Irani, and Le 2015; Giroud and Mueller 2015), and across states (Jayaratne and Strahan 1996), due to changes in investment opportunities, taxes, or regulation. Prior work documents correlations between internal governance proxies and measures of relative investment levels at conglomerates' disclosed segments (e.g., Chen and Chen 2012). Perhaps the closest paper to ours in this literature is a contemporaneous working paper, Demiroglu, Iskenderoglu, and Ozbas (2018), that uses the

[4] While the literature has studied intrafirm transactions within multinationals, the typical focus is on financial policies, rather than the real economic activity addressed in this paper. For example, Desai, Foley, and Hines (2004) study lending within multinational firms, and its responsiveness to tax policy. Perhaps more closely related to our paper, Desai, Foley, and Hines (2007) show that agency problems influence the responsiveness of intrafirm dividend policy to taxes within multinationals.

state-level adoption of antitakeover laws to test whether managerial agency conflicts affect allocative efficiency. Although state-level antitakeover laws may not provide exogenous variation in agency problems (Karpoff and Wittry 2018), the paper finds evidence that investment-Q sensitivity decreases more for conglomerate firms than standalone firms after the adoption of antitakeover laws, which suggests that acquisition threats may discipline managers. We differ from the existing literature in that we study a shock to external governance rather than internal governance or investment opportunities, and reallocation across borders rather than across plants. In particular, our methodological approach benefits from the fact that the treatment – regulatory action in the U.S. – is geographically remote from the outcomes under study – investment by the foreign subsidiaries of U.S. multinationals. Lastly, our work also contributes to the literature that studies financial markets regulation; we find that financial market regulations have cross-border spillover effects through intrafirm resource allocation.

Our results are also consistent with the finding in the literature that agency conflicts can lead to value-destroying resource misallocation within diversified firms (Denis, Denis, and Sarin 1997; Ozbas and Scharfstein 2010). This issue is arguably most pronounced when governance is poor (Chen and Chen 2012; Hoechle, Schmid, Walter, Yermack 2012; Holod 2012) and when firms' segments have diverse opportunities (Rajan, Servaes, and Zingales 2000), such as those arising from international operations, as considered here. One interpretation of our results is that weak external governance may underpin the surprising reliance of firms' segments on their own cash flow (Shin and Stulz 1998).

2 Data

We construct a panel on the direct investment activities of U.S. multinationals using data collected through BEA's annual surveys on U.S. Direct Investment Abroad.[5] For the purposes of BEA's surveys, and consistent with international conventions, direct investment is defined as the ownership or control, direct or indirect, by a legal person of 10 percent or more of the voting securities of an incorporated foreign business enterprise, or an equivalent interest in an unincorporated foreign business enterprise. A multinational is the combination of a single legal entity that undertakes the direct investment, termed the parent company, of at least one foreign business enterprise, known as the foreign affiliate.

The surveys provide detailed data on respondents' financial and operating characteristics.[6] Among other items, these include information on the balance sheet, income statement, employment, and R&D activities of the respondent. Data are reported in accordance with U.S. generally accepted accounting principles and any currency translation adjustments are made in accordance with Financial Accounting Standard 52 (Foreign Currency Translation).[7]

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[5] These data are collected for the purpose of producing publicly available aggregate statistics on the activities of multinational enterprises.

[6] Subsidiaries may report on a consolidated basis if they are residents of the same country, as determined by their physical location, and are classified within the same four-digit International Surveys Industry. International Surveys Industry classifications are similar to NAICS codes.

[7] The reporting requirement thresholds for survey questions vary according to the size of the subsidiary and the ownership stake of the parent; rules for specific years can be found in BEA's benchmark data reports, such as BEA (2013). BEA imputes values for some data items of some subsidiaries to calculate direct investment universe totals. Imputed data comprise a minuscule portion of direct investment activity. In the 2004 data, for example, 99.8 percent of subsidiary net income was reported. Nevertheless, to rule out concerns related to the data estimated by BEA, the analysis in this paper relies only on the reported data. A further discussion of BEA's data on multinational firms can be found in Faulkender,

BEA's surveys are conducted pursuant to the International Investment and Trade in Services Act (hereafter the Act). The Act stipulates that the "use of an individual company's data for tax, investigative, or regulatory purposes is prohibited." Willful noncompliance with the Act may result in imprisonment for up to one year. For these reasons, in addition to their monitoring of corporate actions and a system of internal data integrity checks, BEA believes the surveys accurately capture virtually complete data on the universe of all U.S. direct investment abroad.

The sample is selected as follows. We begin with the members of the Russell 3000 in 2004. Excluded from this list are stocks that went public or had spin-offs after April 30, 2004 and stocks not previously subject to price tests because they were listed on an exchange other than the Nasdaq, NYSE, and AMEX. These firms were matched to BEA's data using their names, industry codes, and consolidated total assets, sales, and net income. We limit the sample of U.S.-owned foreign affiliates in BEA's data to U.S.-owned foreign subsidiaries, that is, affiliates in which the U.S. parent's equity share exceeds 50%. Our analysis requires changes in subsidiary level financials at an annual frequency, as well as observations prior to, during, and after the implementation of Regulation SHO. This leaves a sample of 376 firms. These firms have 5,575 subsidiaries, or roughly 15 subsidiaries per firm. The baseline reallocation analysis includes subsidiaries from 130 countries. Summary statistics are contained in Table 1. All

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Hankins, and Petersen (2018). More detailed information is included in the methodology sections of BEA's various benchmark data reports; BEA (2013) is the most recent finalized version.

variables are winsorized at the 5% and 95% thresholds of their empirical distributions to ensure outliers do not drive out results.[8]

3 Identification

We face two key challenges in identifying the effect of external governance on resource allocation within firms. The first challenge is that the paucity of data on intrafirm resource allocation makes measuring resource allocation within firms difficult. We focus on the allocation of capital and labor among foreign subsidiaries of multinational firms because detailed microdata are available from the Bureau of Economic Analysis. Foreign operations constitute an ideal setting to explore corporate governance for at least three reasons. First, monitoring and bonding costs are high (Doukas and Travlos 1988). Multinationals have complex organizational structures (Creal, Robinson, Rogers, and Zechman 2014). They also face information frictions from distance (Shroff, Verdi, and Yu 2014) and contracting frictions due to the reliance on local market knowledge (Edlin and Reichelstein 1995). Second, due to financial reporting regulation, disclosure about foreign operations is opaque, making internal and external monitoring difficult (Hope and Thomas 2008). Third, foreign operations have greater variation in productivity than domestic operations (Lucas 1990), which suggests that not only are foreign operations an ideal setting to explore governance effects but also that there is enough within-firm variation to do so.

Consistent with the notion that foreign operations are an important source of agency problems, foreign operations appear to be a significant point of focus of short sellers—the source

[8] We show in Table 8 that our baseline result is economically and statistically similar if we do not winsorize at all.

of external governance that we study. For example, in the recent short campaign by Muddy Waters against American Tower Corporation, wasteful foreign investment was one of the key arguments. In its publicly available research, Muddy Waters suggested that American Tower had engaged in a "value destroying investment binge overseas" which had destroyed "at least $1B of value."[9]

The second challenge we face in this setting is that causal inference is typically limited due to the lack of exogenous variation in external governance. Without such exogenous variation, one may be concerned that, in the short selling setting, managers anticipate discipline by short sellers or that unobservable characteristics that determine external governance by short sellers simultaneously affect governance by shareholders or regulators. We address this challenge by focusing on exogenous variation in the cost of short selling as a shock to short selling threats. We exploit the experimental nature of the pilot program of Regulation SHO, which reduced the cost of short selling by eliminating short sale price tests for a randomly selected set of firms (Diether, Lee, and Werner 2009). As the cost of short selling decreased for pilot firms relative to nonpilot firms, short selling threats therefore increased for pilot firms relative to nonpilot firms.

The structure of Regulation SHO's pilot program provides an ideal setting to study the effect of short selling threats on corporate policies. The program, which focused exclusively on Russell 3000 index members, selected pilot firms based on exchange listing status and trading volume. In particular, from each of the NYSE, NASDAQ, and AMEX, the pilot program chose

[9] http://www.muddywatersresearch.com/research/amt/initiating-coverage-amt-slide-deck/

every third firm based on trading volume rank. Selection by rank within each exchange ensures that Russell 3000 index members were likely unable to manipulate their way into or out of the pilot program and that pilot firms are a stratified subsample based on trading volume. Moreover, prior studies that have utilized the Regulation SHO setting for identification have demonstrated that pilot and nonpilot firms are balanced on observable characteristics (Diether, Lee, and Werner 2009; Grullon, Michenaud, and Weston 2015) and that potential participants did not lobby for or against participation (Fang, Huang, and Karpoff 2016). To support a causal interpretation of our findings, we illustrate that the behavior of nonpilot firms represent a valid counterfactual for pilot firms with a test of covariate balance and a dynamic test of the parallel trends assumption.

Since we are using a subset of the randomized sample – only multinational firms – we verify covariate balance in Table 2. We focus on observations at the parent-year level, as this is the level at which the randomization occurs. The columns under "Treatment" and "Control" correspond to pilot and control firms, respectively. The columns under "Difference" show the differences in means between the treatment and control firms for each variable, as well as *t*-statistics indicating whether each difference is statistically different from zero. None of these differences is statistically significant at any conventional level. These results suggest that, in the sample analyzed in this paper, covariates are balanced and randomization was effectively achieved.

Another nice feature of the pilot program is that the starting and ending dates were unlikely to have been anticipated by potential participants. The official start and end dates for the program were May 2, 2005 and August 6, 2007, respectively, but these differed from the originally announced and scheduled dates of January 3, 2005 and December 31, 2005.[10] Because the pilot program had a clear end date, it provides us with an opportunity to confirm our findings by studying whether the difference between the treatment and control groups disappears after the pilot program ends. Tests of whether or not the treatment effect reverses at the conclusion of the pilot program can also be informative about whether the governance pressure has persistent or transient effects.

The reduction in short selling costs induced by Regulation SHO is likely to have affected external governance of parent firms in the pilot program through a least two mechanisms. One mechanism is the direct effect of the regulation-induced short selling on stock prices. Regulation SHO increased short selling for pilot stocks, which lowered prices, and led, for a subset of affected firms, to decreases in investment and equity issuance (Grullon, Michenaud, and Weston 2015). Another mechanism concerns the implicit threat of short selling, which, for example, led pilot firms to convexify their incentive contracts with CEOs by increasing stock option grants (De Angelis, Grullon, and Michenaud 2017). These investment and contracting changes may in turn affect internal resource allocation decisions. Managers may alternatively respond to short selling pressure by fighting the short sellers themselves with lawsuits and other anti-shorting

[10] Securities Exchange Act Release No. 50104, July 28, 2004, and Securities Exchange Act Release No. 53684, April 20, 2006.

actions (Lamont 2012). In fact, top executives appear to strongly favor restrictions on short selling, as evidenced by a 2008 NYSE survey of CEOs and CFOs in which 89% of respondents supported reinstatement of the uptick rule in the post-Regulation SHO period. This policy position is consistent with the fact that 59% thought that short selling was harmful versus only 4% who thought it was helpful.

4 Short Selling Pressure and Firm-level Outcomes

4.1 Consolidated investment and employment

We begin by exploring the relationship between Regulation SHO and firms' consolidated investment and employment. Specifically, we estimate the following regression specification using ordinary least squares.

$$Investment_{it} = \alpha_i + \alpha_t + \beta \times SHO_i \times Post_t + \gamma' X_{it} + \varepsilon_{it} \tag{1}$$

The unit of observation is the firm-period, where firm-years are averaged within the period prior to the institution of Regulation SHO, and the period after the regulation is in place. The subscripts i and t index firms and periods, respectively. $Investment_{it}$ is the natural logarithm of the period average of annual consolidated capital expenditures.[11] The employment outcome variable, which is the count of the number of employees at the firm on a consolidated basis, is measured analogously. The terms α_i and α_t denote firm and period fixed effects, respectively. SHO_i is an indicator variable that equals one if a firm is a member of the Regulation SHO pilot

[11] An alternative measure of investment would be the ratio of capital expenditures to the capital stock. Unfortunately, this alternative is not feasible due to data limitations. In particular, data on the capital stock are not available during the pilot period, 2005-2006.

group. $Post_t$ is an indicator variable that equals one once Regulation SHO has been implemented. X_{it} represents the age control, which is measured as the natural logarithm of the average number of years over the period since the parent first appears in the data. Finally, ε_{it} is the usual error term. Reported standard errors are robust (heteroskedasticity-consistent).

Table 3 presents our results on the effects of Regulation SHO on consolidated investment and employment. Column (1) shows that pilot firms experience a statistically insignificant increase in investment relative to control firms (those that are not in the pilot group). In column (2), we show a similarly statistically insignificant effect of short selling threats on employment. These results are in keeping with the aggregate results in Grullon, Michenaud, and Weston (2015), and show that, on net, the Regulation SHO pilot program does not yield strong evidence for an effect of short selling threats on overall investment or employment at the firm level. However, this does not imply that internal resource allocation is unaffected by external governance pressure. For example, these null aggregate effects could mask a disciplining effect of external governance if capital markets frictions produce heterogeneity in over- and under-investment among treated firms.

4.2 Investment and Employment Reallocation Activity

Since within-firm investment dispersion is quantitatively large relative to cross-firm investment dispersion (Kehrig and Vincent 2017), looking only at firm aggregates and not variation within the firm may mask significant economic effects. Thus, having established that Regulation SHO does not have a statistically significant association with either consolidated

investment or consolidated employment, we turn to the issue of reallocation within firms by looking at dispersion in investment changes across a firm's subsidiaries. Such an investigation allows for the possibility that short selling pressure can cause investment to decrease in some parts of the firm, and increase in others. Specifically, we estimate the following regression equation using ordinary least squares.

$$SD(\Delta Investment_{it}) = \alpha_i + \alpha_t + \beta \times SHO_i \times Post_t + \gamma' X_{it} + \varepsilon_{it} \tag{2}$$

Terms also appearing in the preceding specification are unchanged. $SD(\Delta Investment_{it})$ measures the dispersion in investment changes, and is calculated as follows. First, we take the first difference of investment for each subsidiary to focus on changes in investment plans that cannot be explained by persistent differences in subsidiary size or reinvestment plans based on depreciation of the capital stock. These sources of variation would be included in the measure if we instead focused on dispersion in investment levels across subsidiaries. Then, for all of a firm's subsidiaries, we calculate the standard deviation of the changes in a given year. Finally, we average the standard deviations—observed at the firm-year level—over each period. The employment dispersion measure is calculated analogously. Following Bertrand, Duflo, and Mullainathan (2004), we report robust and heteroscedasticity-consistent standard errors.

Table 4 presents our results on dispersion in investment, or the effect on intrafirm investments among subsidiaries. As reflected in the first column, we find that pilot firms see an economically significant increase in the dispersion of their intrafirm investments among subsidiaries, which suggests that their investment strategies are changing substantially relative

to other firms unaffected by the incremental governance pressure from short sellers. While intrafirm capital allocation policy appears to be responsive to the pilot program, hiring and firing decisions across subsidiaries does not, as the second column indicates. This is in some ways not surprising as capital adjustment costs may be lower than labor adjustment costs. For this reason, in all of the following analysis, we focus on firms' investment choices.

4.3 Dynamic specification

We next turn to the dynamic impact of Regulation SHO on investment before, during, and after the pilot program. This analysis provides insight into whether treated and untreated firms behaved similarly prior to treatment, which is key to our identification strategy. It also provides an additional check on the validity of the design by letting us check whether any differences between the treatment and control groups reverse at the conclusion of the program. To investigate these issues, we estimate the following specification using ordinary least squares.

$$\begin{aligned} SD(\Delta Investment_{iy}) = \beta_1 \times SHO_i \times \mathbb{I}_{2004} + \beta_2 \times SHO_i \times \mathbb{I}_{2005} \\ +\beta_3 \times SHO_i \times \mathbb{I}_{2006} + \beta_4 \times SHO_i \times \mathbb{I}_{2007} \\ +\beta_5 \times SHO_i \times \mathbb{I}_{2008} + \beta_6 \times SHO_i \times \mathbb{I}_{2009} \\ +\beta_7 \times SHO_i \times \mathbb{I}_{2010} + \alpha_i + \alpha_y + \gamma' X_{iy} + \varepsilon_{iy} \end{aligned} \tag{3}$$

The unit of observation is the firm-year. The definitions of terms also appearing in the initial (static) specification are unchanged. The subscript y indexes years (not periods, since here we are focused on the dynamics of the treatment effect). α_y are year fixed effects. $\mathbb{I}_{2004}$ is an indicator variable that equals one in 2004. $\mathbb{I}_{2005}$, $\mathbb{I}_{2006}$, $\mathbb{I}_{2007}$, $\mathbb{I}_{2008}$, $\mathbb{I}_{2009}$, and $\mathbb{I}_{2010}$ are defined

analogously. $SD(\Delta Investment_{iy})$ and X_{it} are no longer averaged over each period, but rather measured each year. Standard errors are clustered by firm.

We present the estimates from the dynamic specification in Table 5. One may be concerned that our results could be driven by some other trend among pilot firms, despite the covariate balance demonstrated in Table 2. One could also investigate whether or not pilot firms appear to be affected following the pilot program. We see, when breaking up the program into year pilot effects, that there is a statistically and economically meaningful effect in the years of the program (2005 and 2006) but not in the year prior, or in the years subsequent. This suggests that not only is selection of pilot firms not driving our results, but that the effect is not lingering. As soon as the difference in short selling pressure between the two groups of firms is eliminated, their cross-subsidiary investment dispersion converges as well. We discuss this point further in Section 5.2.

5 Short Selling Pressure and Subsidiary-level Outcomes

5.1 Cross-subsidiary reallocation

The implications of the connection between external governance pressure and investment dispersion depend critically on the nature of the capital reallocation it captures. For example, if this dispersion were driven by a random reallocation of resources across firms, the above results would not be particularly informative about the workings of internal capital markets or the operational or welfare consequences of external governance pressure. However, if this governance pressure were associated with value-enhancing changes in within-firm investment choices, we

would learn both that there is scope within the average internal capital market for improvements driven by external pressure (Scharfstein and Stein 2000), and that, despite informational and agency frictions, external governance pressure, in the guise of pressure from short sellers, can indeed affect these quantitatively important capital allocation decisions.

We thus explore the nature of internal capital reallocation implied by our aggregate firm results by investigating whether firms reallocate investment from underperforming to outperforming subsidiaries in response to Regulation SHO. To do so, we estimate the following specification.

$$Investment_{ijt} = \alpha_{ij} + \alpha_t + \beta_1 \times SHO_i \times Post_t \times OutPerform_{ij} + \beta_2 \times SHO_i \times Post_t \\ + \beta_3 \times Post_t \times OutPerform_{ij} + \gamma' X_{ijt} + \varepsilon_{ijt} \tag{4}$$

The unit of observation is the subsidiary-period. The subscripts i, j, and t index firms, subsidiaries, and periods, respectively. The definitions of terms also appearing in our initial specification are unchanged. α_{ij} denotes subsidiary fixed effects. Note that subsidiary fixed effects subsume both parent and country fixed effects. $OutPerform_{ij}$ is a subsidiary-level indicator variable calculated as follows. For all subsidiaries, the average ratio of net income to assets is calculated from 2000-2004. Subsidiaries for which this calculation exceeds the median relative to its parent's other subsidiaries are deemed to outperform. For these subsidiaries,

$OutPerform_{ij}$ takes the value 1.[12] Finally, ε_{ijt} is the usual error term. Reported standard errors are robust (heteroskedasticity-consistent).

With the more granular (subsidiary-period) level of observation, we can include an expanded set of control variables without the concern of introducing endogeneity. Specifically, X_{ijt} controls for subsidiary age, parent age, and parent size. Subsidiary age is the natural logarithm of the number of years since the subsidiary first appears in the data, averaged over each subperiod. Parent age is defined analogously. Parent size is the natural logarithm of the average of parent assets during the period. We do not control for subsidiary size given that it may be endogenously related to the outcome variable, $Investment_{ijt}$. However, the estimates in column (1) of Table 8 indicate any bias the inclusion of a control for subsidiary size may introduce is minimal.

In Table 6, we present our core results on reallocation. In column (1), we omit the controls and present subsidiary-level analyses on the effects of Regulation SHO and profitability on investment among subsidiaries. First, we show that investment increases by 13-14% at subsidiaries of non-pilot firms with above median ROA relative to those below the median. This finding supports our choice to measure outperforming subsidiaries—those worthy of incremental investment—using the accounting performance of the subsidiary and further suggests that internal capital markets are indeed responsive to such incentives, consistent with the "bright

[12] Some strands of the literature rely on forward-looking Q-based measures of firm performance. Unfortunately, such a measure is not possible in our setting, as market values are not available at the subsidiary level.

side" of internal capital markets (Stein 1997). However, relative to non-pilot firms, pilot firms increase investment at outperforming subsidiaries by an *additional* 30% on average. This means that while all firms invest more heavily in recently more profitable subsidiaries, firms under the Regulation SHO pilot program reinvest almost two times as much in outperforming subsidiaries as do other firms. This suggests that external governance pressure leads to increased performance sensitivity of investment, and is preliminary evidence that the induced capital reallocation may be efficient. In column (2), where we include the controls, our results are quantitatively the same.

While we investigate and expand on this result in the subsequent subsections, we make several comments on the interpretation of our baseline result. First, an implicit assumption underlying our tests is that the subsidiary/country is the level at which capital allocation decisions are made. This may not always be true, since some firms are instead organized by business unit or segment, and these business units may not perfectly overlap with particular subsidiaries. On the other hand, even in such a case, investment should still optimally respond to variation in country-level investment incentives. This means that despite the apparent decision making structure of the firm, investment decisions might nonetheless be effective at the subsidiary level. Nonetheless, we believe that these organizational structure issues should attenuate our findings, to the extent that we are not properly measuring the relevant unit of the business for decision making purposes.

Second, while for data reasons we are somewhat restricted to measuring efficient capital reallocation using the (recent) historical performance of the subsidiary, there may be alternative theoretical explanations for our result. Perhaps the most relevant such alternative explanation is short-termism, which is itself often associated with governance pressure. If treatment firms are pushed to prioritize short-term results, they may have an incentive to reallocate investment in just the way we have shown. If so, and in combination with diminishing returns to investment, we would expect the profitability of the subsidiaries receiving the incremental investment to fall. We show that this is not the case in Section 5.4.

5.2 Treatment reversal

While we showed in Section 4.3 that the difference in investment dispersion between treatment and control firms disappeared at the conclusion of the Regulation SHO pilot program, we investigate in Table 7 whether this is also true of the increased performance sensitivity of investment. We use a similar specification as in equation (4), though with the time period of interest now being the period following the Regulation SHO pilot program (2007-2010). In column (1), using the same specification as in Table 6 with the controls omitted, we find that in this post pilot period firms invest 14-16% more in above median ROA subsidiaries, just as we found during the pilot period. However, the policy effect reverses for Regulation SHO pilot firms, as we see the incremental effect for these subsidiaries becomes insignificant. These results are again quantitatively similar if we include the controls in column (2).

Since the uptick rule was removed for the control firms at the end of the pilot period, effectively both groups of firms become treated with a heightened threat of short selling, notwithstanding any general equilibrium effects. However, this new treatment effect is confounded by secular time trends and by the ensuing financial crisis. For that reason, we cannot draw particularly strong inferences about the transience or persistence of the effect of short selling pressure, though given the results in Table 5, it appears that the effect may be relatively persistent.

5.3 Robustness

We have shown that external governance pressure led to an increase in investment dispersion within firms and particularly towards more productive subsidiaries. In this subsection, we investigate the robustness of this finding to alternative ways of measuring outperformance. To mitigate concerns about measurement error and to better understand the nature of the reallocation, in Table 8 we look at outperformance measures that depend on subsidiary characteristics (as in our baseline result) and on measures that are driven by characteristics of the industry or country in which that subsidiary operates.

In column (1) we show that our baseline result is quantitatively unchanged when controlling for subsidiary size, in addition to the usual controls for subsidiary age, parent age, and parent size. Subsidiary size is measured as the natural logarithm of average subsidiary assets during the period. In column (2) we do not winsorize investment, and we obtain virtually

the same coefficients as in the baseline, which suggests that the tails of the subsidiary distribution are not meaningfully driving or attenuating our baseline results.

More interestingly, in column (3) we measure subsidiary performance as above median asset turnover rather than above median ROA, where asset turnover is the ratio of subsidiary sales to subsidiary assets. We find qualitatively similar estimates. This indicates that the results are not specific to top versus bottom line (of the income statement) measures of performance, which is reassuring given the different measurement issues involved in calculating these two measures. For example, intrafirm transactions undertaken for tax reasons are much more likely to affect profitability than sales.

In column (4), we consider the first of the external performance measures. Here, *Outperform* is an indicator variable that equals one if a subsidiary is located in a country with an average annual equity market return above the median of that quantity in 2000-2004, and zero otherwise. We nonetheless find a similar pattern of reallocation. This is reassuring since *Outperform* does not depend on any characteristics of the subsidiary itself, which means that it is not subject to any of the same measurement problems or endogeneity issues as in our baseline measurement. This result also points to an interesting, potentially forward-looking, component of reallocation, as firms increase investment in locations where the past performance of the stock market implies the presence of strong future growth opportunities.

Next, in column (5), we sort subsidiaries into those located in industries with above and below median market-to-book ratios. Market-to-book is calculated for each 2-digit SIC code using all Compustat firms in 2000-2004. We find that treated firms allocate investment toward

subsidiaries in outperforming industries, which suggests another possible factor in efficient resource allocation decisions.[13] As above, this approach has the benefit of not relying for its performance measure on anything in the direct control of the firm, but still relies on accounting performance rather than equity market returns.

Finally, in column (6) we combine aspects of the measurement of outperformance from the previous two columns. Specifically, we use an indicator that equals one if average profitability of the foreign subsidiaries of U.S. firms exceeds the median in that industry and country in 2000-2004. We find a similar degree of incremental performance sensitivity for treatment firms, consistent with a sophisticated decision making process which incorporates information on both the type and location of the subsidiary's activity. Overall, the results in Table 8 support our initial inferences about the pattern of capital reallocation in response to external governance pressure.

5.4 Subsidiary profitability

If more profitable subsidiaries receive more investment, and this is particularly true for those subsidiaries held by firms subject to stronger short selling pressure, then we might expect that those subsidiaries become less profitable. This could either be a mechanical consequence of diminishing marginal returns to capital or could be due to the reallocation reflecting something other than efficiency considerations. In Table 9, we present results that examine *ROA* of those subsidiaries that received increased investment during the Regulation SHO period (column 1)

[13] The sample size is reduced due to unobserved industry codes among subsidiaries.

and following the Regulation SHO period (column 2). ROA is the ratio of net income to assets and is the same measure of subsidiary performance that we used to define $OutPerform$ in our baseline results. We find that the subsidiaries of treatment firms do not experience economically or statistically reduced profitability *relative to* control firms, either during the Regulation SHO pilot program or after its conclusion.

However, treated firms invest more in productive subsidiaries and less in unproductive subsidiaries relative to control firms, which shifts the expected profitability of the marginal investment in any given subsidiary. With diminishing returns to marginal investment at the subsidiary level, we would expect productive (unproductive) subsidiaries that received additional (less) investment to experience lower (higher) subsequent profitability, on average. Instead, we find that productive subsidiaries at treated and control firms do not experience different profitability trends during and after the program despite differential investment responses. Assuming that diminishing returns to marginal investment holds in our context, our finding suggests scope for short selling pressure to increase value by improving internal resource allocation. This economic reasoning suggests an ex ante resource misallocation, consistent with the presence of empire building or quiet life incentives (Scharfstein and Stein 2000; Bertrand and Mullainathan 2003). This finding also pushes against the alternative explanation that the capital reallocation reflects incentives for myopic behavior, such as the possibility of window dressing by increasing investment in already profitable parts of the business.

5.5 Reallocation of research and development

We have shown that potentially increased attention leads to reallocation across subsidiaries, and that this reallocation goes to more productive subsidiaries. In our final empirical test, we study an alternative but similar economic mechanism—the agglomeration of research and development expenditures in R&D centers. The economics literature documents a positive association between agglomeration and productive innovation (Romer 1986; Carlino and Kerr 2015). Reallocation of research and development to an R&D center would also allow firms to take advantage of scale benefits (Ciftci and Cready 2011). This mechanism involves both a different resource being reallocated as well as a completely different pattern of reallocation. Thus, the test should not be subject to the same measurement concerns that could affect the interpretation of our main result on capital reallocation.

In Table 10, we present the results of this R&D test, which follows a similar specification to equation (4), though with *RDCent*, an indicator that equals one if a subsidiary reports average R&D intensity during 2000-2004 above the median among the subsidiaries of its parent, in place of *OutPerform*. We find suggestive, though statistically weak, evidence that firms subject to the incremental external governance pressure of the Regulation SHO pilot program reallocate their R&D expenditures toward R&D centers.[14] This result, combined with the finding in the literature that agglomeration of R&D activities leads to greater productive innovations, demonstrates that external governance pressure may lead to more productive internal resource allocation.

[14] The sample size is somewhat reduced since *R&D Intensity* is not observed for all subsidiaries.

6 Conclusion

In this paper, we investigate whether and how *external* governance pressure affects *internal* resource allocation. We do so using exogenous variation in short selling pressure due to the pilot program of Regulation SHO. While, consistent with the extant literature, we find no effect on aggregate investment or employment, we uncover quantitatively important effects on within-firm capital reallocation. This reallocation follows a clear pattern—investment flows from relatively poorly performing to successful subsidiaries, and this result holds whether we measure performance using the subsidiary's own productivity or the characteristics of the industry or country in which it operates. Despite the likely effects of diminishing returns to capital, the subsidiaries that receive increased investment experience no subsequent decline in productivity, which suggests that the capital reallocation induced by external governance pressure is efficient. Overall, our findings are consistent with a middle ground between the bright side and dark side views of internal capital markets (Stein 1997; Scharfstein and Stein 2000) and highlight the possibility for financial market regulations to create spillover effects across borders.

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Table 1. Summary Statistics

This table presents summary statistics for the parents and subsidiaries that comprise the sample. In Panel A, the unit of observation is the parent-period. In Panel B, the unit of observation is the subsidiary-period. Period is defined as *Pre* (2000-2004) or *Post* (2005-2006) Regulation SHO. *Investment* is the natural logarithm of capital expenditures. *Employees* is the natural logarithm of employee count. $SD(\Delta Investment)$, dispersion in subsidiary investment growth, is calculated in three steps. First, the first difference in subsidiary capital expenditures is calculated. Second, for a given parent and year, the standard deviation of the changes is calculated. Third, the average of the standard deviations is calculated over each period. $SD(\Delta Employees)$, dispersion in subsidiary employment growth, is calculated analogously, except using subsidiary employment instead of subsidiary capital expenditures. *Age* is the natural logarithm of the number of years since the entity (parent or subsidiary) first appears in the data. *Assets* is the natural logarithm of total assets. *R&D intensity* is the ratio of R&D expenditures to total sales. *ROA* is the ratio of net income to assets. Here and throughout the paper, all currency denominated variables are recorded in millions of 2009 U.S. dollars.

Panel A: Parent Summary Statistics			
	Observations	Mean	Std. dev.
Investment	752	11.9	1.5
Employees	752	9.3	1.3
$SD(\Delta Investment)$	752	10,023.7	14,707.3
$SD(\Delta Employees)$	752	145.1	186.4
Age	752	1.5	0.4
Panel B: Subsidiary Summary Statistics			
	Observations	Mean	Std. dev.
Investment	11,150	7.0	2.6
Age	11,150	1.2	0.6
Assets	11,150	11.6	1.2
R&D intensity	11,006	0.006	0.012
ROA	11,150	0.067	0.099

Table 2. Covariate Balance

This table presents statistics on covariate balance between the treatment and control groups prior to treatment (2000-2004). *Investment* is the natural logarithm of capital expenditures. *Employees* is the natural logarithm of employee count. $SD(\Delta Investment)$, dispersion in subsidiary investment growth, is calculated in three steps. First, the first difference in subsidiary capital expenditures is calculated. Second, for a given parent and year, the standard deviation of the changes is calculated. Third, the average of the standard deviations is calculated over each period. $SD(\Delta Employees)$, dispersion in subsidiary employment growth, is calculated analogously, except using subsidiary employment instead of subsidiary capital expenditures. *Age* is measured as the natural logarithm of the number of years since the parent first appears in the data. T-statistics are heteroskedasticity robust.

	Treatment			Control			Difference	
Variable	Obs.	Mean	Std. dev.	Obs.	Mean	Std. dev.	Mean	t-stat.
Investment	130	12.0	1.4	246	11.8	1.5	0.2	1.02
Employees	130	9.4	1.3	246	9.3	1.3	0.1	0.85
$SD(\Delta Investment)$	130	11305.9	15709.5	246	9624.3	14232.3	1681.5	1.02
$SD(\Delta Employees)$	130	153.8	187.5	246	140.7	179.8	13.1	0.65
Age	130	1.3	0.3	246	1.3	0.3	0.0	0.15

Table 3. Short Selling Pressure and Consolidated Investment and Employment

This table presents difference in differences estimates of consolidated firm investment and employment on Regulation SHO pilot program participation. The unit of observation is parent-period. Period is defined as either *Pre* (2000-2004) or *Post* (2005-2006) Regulation SHO. *Investment* is the natural logarithm of consolidated firm capital expenditures. *Employment* is the natural logarithm of consolidated firm employee count. *SHO* is an indicator variable that equals one if the parent is included in the Regulation SHO pilot program, and zero otherwise. *Post* is an indicator that equals one during the active period of the Regulation SHO pilot program (2005-2006), and zero otherwise. X_{it} controls for parent age, which is measured as the natural logarithm of the number of years since the parent first appears in the data. Parent and year fixed effects are included. Robust standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable:	*Investment*	*Employment*
$SHO \times Post$	0.09	0.01
	(0.06)	(0.03)
X_{it}	Yes	Yes
Parent fixed effects	Yes	Yes
Period fixed effects	Yes	Yes
Observations	752	752
R^2	0.96	0.99

Table 4. Short Selling Pressure and Within-firm Investment Dispersion

This table presents difference in differences estimates of dispersion in subsidiary investment and employment growth on Regulation SHO pilot program participation. The unit of observation is the parent-period. Period is defined as either *Pre* (2000-2004) or *Post* (2005-2006) Regulation SHO. Dispersion in subsidiary investment growth is calculated in three steps. First, the first difference in subsidiary capital expenditures is calculated. Second, for a given parent and year, the standard deviation of the changes is calculated. Third, the average of the standard deviations is calculated over each period. Dispersion in subsidiary employment growth is calculated analogously, except using subsidiary employee count instead of subsidiary capital expenditures. *SHO* is an indicator variable that equals one if the parent is included in the Regulation SHO pilot program, and zero otherwise. *Post* is an indicator that equals one during the active period of the Regulation SHO pilot program (2005-2006), and zero otherwise. X_{it} controls for parent age, which is measured as the natural logarithm of the number of years since the parent first appears in the data. Parent and year fixed effects are included. Robust standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable:	$SD(\Delta Investment)$	$SD(\Delta Employees)$
$SHO \times Post$	2,666.8**	9.1
	(1,187.6)	(14.8)
X_{it}	Yes	Yes
Parent fixed effects	Yes	Yes
Period fixed effects	Yes	Yes
Observations	752	752
R^2	0.87	0.88

Table 5. Dynamic Specification

This table presents estimates from a dynamic specification of dispersion in subsidiary investment growth on Regulation SHO pilot program participation. The unit of observation is the parent-year. Dispersion in subsidiary investment growth is calculated in two steps. First, the first difference in subsidiary capital expenditures is calculated. Second, for a given parent and year, the standard deviation of the changes is calculated. *SHO* is an indicator variable that equals one if the parent is included in the Regulation SHO pilot program, and zero otherwise. $\mathbb{I}_{2004}$ is an indicator that equals one in 2004 and is zero otherwise. $\mathbb{I}_{2005}$, $\mathbb{I}_{2006}$, $\mathbb{I}_{2007}$, $\mathbb{I}_{2008}$, $\mathbb{I}_{2009}$, and $\mathbb{I}_{2010}$ are defined analogously. Column (1) omits controls, while column (2) includes them. X_{iy} controls for parent age, which is measured as the natural logarithm of the number of years since the parent first appears in the data. Parent and year fixed effects are included. Standard errors are clustered by parent and are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable:	$SD(\Delta Investment)$	
	(1)	(2)
$SHO \times \mathbb{I}_{2004}$	406.0	403.8
	(254.5)	(255.1)
$SHO \times \mathbb{I}_{2005}$	2,800.7**	2,792.6**
	(1,197.5)	(1,199.9)
$SHO \times \mathbb{I}_{2006}$	2,232.6*	2,221.4*
	(1,174.9)	(1,178.3)
$SHO \times \mathbb{I}_{2007}$	592.5	573.6
	(1,287.2)	(1,289.7)
$SHO \times \mathbb{I}_{2008}$	665.4	645.4
	(1,370.1)	(1,376.7)
$SHO \times \mathbb{I}_{2009}$	763.0	742.6
	(1,367.3)	(1,374.0)
$SHO \times \mathbb{I}_{2010}$	1,077.9	1,056.2
	(1,399.6)	(1,347.6)
X_{iy}	No	Yes
Parent fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	3,745	3,745
R^2	0.85	0.85

Table 6. Short Selling Pressure and Cross-subsidiary Investment Reallocation

This table presents difference in differences estimates of subsidiary investment on Regulation SHO pilot program participation allowing for heterogeneous effects based on subsidiary performance. The unit of observation is subsidiary-period. Period is defined as either *Pre* (2000-2004) or *Post* (2005-2006) Regulation SHO. *Investment* is the natural logarithm of capital expenditures. *SHO* is an indicator variable that equals one if the subsidiary's parent is included in the Regulation SHO pilot program, and zero otherwise. *Post* is an indicator that equals one during the active period of the Regulation SHO pilot program (2005-2006), and zero otherwise. *Outperform* is an indicator variable that equals one if a subsidiary's average *ROA* is above the median of that quantity for a parent's subsidiaries in 2000-2004, the five years prior to the implementation of Regulation SHO, and zero otherwise. *ROA* is measured as the ratio of subsidiary net income to subsidiary assets. X_{ijt} controls for subsidiary age, parent age, and parent size. Subsidiary age is the natural logarithm of the average number of years during the period since the subsidiary first appears in the data. Parent age is defined analogously. Parent size is the natural logarithm of one plus the average of parent assets during the period. Subsidiary and period fixed effects are included. Subsidiary fixed effects subsume both country- and parent-level fixed effects. Robust standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable:	*Investment*	
	(1)	(2)
$SHO \times Post \times Outperform$	0.30**	0.31***
	(0.12)	(0.12)
$SHO \times Post$	-0.20**	-0.19**
	(0.09)	(0.09)
$Post \times Outperform$	0.14**	0.13*
	(0.07)	(0.06)
X_{ijt}	No	Yes
Subsidiary fixed effects	Yes	Yes
Period fixed effects	Yes	Yes
Observations	11,150	11,150
R^2	0.84	0.85

Table 7. Treatment Reversal

This table presents difference in differences estimates of subsidiary investment following Regulation SHO pilot program participation allowing for heterogeneous effects based on subsidiary performance. The unit of observation is the subsidiary-period. Period is defined as either *Pre*, for the years preceding Regulation SHO (2000-2004), or *Reversal*, for the years following the conclusion of the Regulation SHO pilot program (2007-2010). *Investment* is defined as the natural logarithm of capital expenditures. *SHO* is an indicator variable that equals one if the subsidiary's parent is included in the Regulation SHO pilot program, and zero otherwise. *Reversal* is an indicator that equals one following the active period of the Regulation SHO pilot program until the end of the sample (2007-2010), and zero otherwise. *Outperform* is an indicator variable that equals one if a subsidiary's average *ROA* is above the median of that quantity for a parent's subsidiaries in 2000-2004, the five years prior to the implementation of Regulation SHO, and zero otherwise. *ROA* is the ratio of subsidiary net income to subsidiary assets. X_{ijt} controls for subsidiary age, parent age, and parent size. Subsidiary age is the natural logarithm of the average number of years during the period since the subsidiary first appears in the data. Parent age is defined analogously. Parent size is the natural logarithm of one plus the average of parent assets during the period. Subsidiary and period fixed effects are included. Subsidiary fixed effects subsume both country- and parent-level fixed effects. Robust standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable:	*Investment*	
	(1)	(2)
$SHO \times Reversal \times Outperform$	0.02	0.03
	(0.11)	(0.11)
$SHO \times Reversal$	-0.14	-0.19**
	(0.08)	(0.08)
$Reversal \times Outperform$	0.16**	0.13**
	(0.06)	(0.06)
X_{ijt}	No	Yes
Subsidiary fixed effects	Yes	Yes
Period fixed effects	Yes	Yes
Observations	13,868	13,868
R^2	0.83	0.83

Table 8. Cross-subsidiary Investment Reallocation Robustness

This table presents difference in differences estimates of subsidiary investment on Regulation SHO pilot program participation allowing for heterogeneous effects based on subsidiary performance. The unit of observation is subsidiary-period. Period is defined as either *Pre* (2000-2004) or *Post* (2005-2006) Regulation SHO. *Investment* is defined as the natural logarithm of capital expenditures. *SHO* is an indicator variable that equals one if the subsidiary's parent is included in the Regulation SHO pilot program, and zero otherwise. *Post* is an indicator that equals one during the active period of the Regulation SHO pilot program (2005-2006), and zero otherwise. In columns (1) and (2), *Outperform* is an indicator variable that equals one if a subsidiary's average *ROA* is above the median of that quantity for a parent's subsidiaries in 2000-2004, the five years prior to the implementation of Regulation SHO, and zero otherwise. *ROA* is the ratio of subsidiary net income to subsidiary assets. In column (1), X_{ijt} controls for subsidiary size, subsidiary age, parent size, and parent age. Subsidiary size is measured as the natural logarithm of average subsidiary assets during the period. Subsidiary age is measured as the natural logarithm of the average number of years during the period since the subsidiary first appears in the data. Parent size and age are defined analogously. In columns (2) through (6), X_{ijt} controls for subsidiary age, parent age, and parent size only. In column (2), the outcome variable is not winsorized. In column (3), *Outperform* is an indicator variable that equals one if a subsidiary's average asset turnover is above the median of that quantity for a parent's subsidiaries in 2000-2004, the five years prior to the implementation of Regulation SHO. Asset turnover is the ratio of subsidiary sales to subsidiary assets. In column (4), *Outperform* is an indicator variable that equals one if a subsidiary is located in a country with an average annual equity market return above the median of that quantity in 2000-2004. In column (5), *Outperform* is an indicator variable that equals one if a subsidiary is in an industry with an above median market-to book ratio. Market-to-book is calculated for each 2-digit SIC code using all Compustat firms in 2000-2004. In column (6), *Outperform* is an indicator that equals one if average profitability of the foreign subsidiaries of U.S. firms exceeds the median in that industry and country in 2000-2004. All specifications include subsidiary and period fixed effects. Subsidiary fixed effects subsume both country- and parent-level fixed effects. Robust standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable:	*Investment*					
	Alternative Measures			Country/Industry		
	(1)	(2)	(3)	(4)	(5)	(6)
$SHO \times Post \times Outperform$	0.30**	0.31***	0.20*	0.21*	0.28**	0.26**
	(0.12)	(0.12)	(0.12)	(0.12)	(0.14)	(0.12)
$SHO \times Post$	-0.21**	-0.18**	-0.13	-0.14*	-0.18*	-0.16*
	(0.08)	(0.09)	(0.08)	(0.08)	(0.10)	(0.09)
$Post \times Outperform$	0.07	0.14**	0.00	0.12*	-0.04	0.02
	(0.07)	(0.07)	(0.06)	(0.07)	(0.08)	(0.06)
X_{ijt}	Yes	Yes	Yes	Yes	Yes	Yes
Subsidiary fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Period fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,150	11,150	11,150	11,150	7,520	11,150
R^2	0.85	0.85	0.85	0.85	0.84	0.85

Table 9. Reallocation and Future Subsidiary Profitability

This table presents difference in differences estimates of subsidiary *ROA* on Regulation SHO pilot program participation allowing for heterogeneous effects based on subsidiary performance. The unit of observation is subsidiary-period. Period is defined as either *Pre* (2000-2004) or *Post* (2005-2006) Regulation SHO. *ROA* is defined as the ratio of subsidiary net income to subsidiary assets. *SHO* is an indicator variable that equals one if the subsidiary's parent is included in the Regulation SHO pilot program, and zero otherwise. In column (1), *Post* is an indicator that equals one during the active period of the Regulation SHO pilot program (2005-2006), and zero otherwise. Instead, in column (2), *Post* denotes the post-SHO period (2007-2010). $Outperform$ is an indicator variable that equals one if a subsidiary's average *ROA* is above the median of that quantity for a parent's subsidiaries in 2000-2004, the five years prior to the implementation of Regulation SHO, and zero otherwise. X_{ijt} controls for subsidiary age, parent age, and parent size. Subsidiary age is the natural logarithm of the average number of years during the period since the subsidiary first appears in the data. Parent age is defined analogously. Parent size is the natural logarithm of one plus the average of parent assets during the period. Subsidiary and period fixed effects are included. Subsidiary fixed effects subsume both country- and parent-level fixed effects. Robust standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable:	*ROA*	
	(1)	(2)
$SHO \times Post \times Outperform$	0.01	-0.01
	(0.01)	(0.01)
$SHO \times Post$	-0.00	-0.00
	(0.00)	(0.00)
$Post \times Outperform$	-0.06***	-0.08***
	(0.00)	(0.00)
X_{ijt}	Yes	Yes
Subsidiary fixed effects	Yes	Yes
Period fixed effects	Yes	Yes
Observations	11,150	13,876
R^2	0.79	0.74

Table 10. Short Selling Pressure and R&D Agglomeration

This table presents difference in differences estimates of subsidiary R&D intensity on Regulation SHO pilot program participation allowing for heterogeneous effects based on prior R&D activity. The unit of observation is subsidiary-period. Period is defined as either *Pre* (2000-2004) or *Post* (2005-2006) Regulation SHO. *R&D Intensity* is the ratio of R&D expenditures to sales. *SHO* is an indicator variable that equals one if the subsidiary's parent company is included in the Regulation SHO pilot program, and zero otherwise. *Post* is an indicator that equals one during the active period of the Regulation SHO pilot program (2005-2006), and zero otherwise. *RDCent* is an indicator that equals one if a subsidiary reports average R&D intensity during 2000-2004 above the median among the subsidiaries at its parent. Column (1) omits controls, while column (2) includes them. X_{ijt} controls for subsidiary age, parent age, and parent size. Subsidiary age is the natural logarithm of the average number of years during the period since the subsidiary first appears in the data. Parent age is defined analogously. Parent size is the natural logarithm of one plus the average of parent assets during the period. Subsidiary and period fixed effects are included. Subsidiary fixed effects subsume both country- and parent-level fixed effects. Robust standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable:	*R&D Intensity*	
	(1)	(2)
SHO × *Post* × *RDCent*	0.0011*	0.0012*
	(0.0006)	(0.0006)
SHO × *Post*	-0.0012**	-0.0012**
	(0.0006)	(0.0006)
Post × *RDCent*	-0.0023***	-0.0023***
	(0.0004)	(0.0004)
X_{ijt}	No	Yes
Subsidiary fixed effects	Yes	Yes
Period fixed effects	Yes	Yes
Observations	11,006	11,006
R^2	0.89	0.89