Lawyering and Lobbying: Why Banks Shape Rules

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February 27, 2017

Abstract

Why do firms lobby executive agencies? Are firms able to use administrative procedures to influence the regulatory environment in which they operate? We explore these questions by analyzing the participation of financial entities in Dodd-Frank related rulemaking at the Federal Reserve. Using intra-day event-study methods, we find significant evidence that favorable market reactions around rule announcements are associated with participation in rule-making. In response to a rulemaking event, and compared to non-participants, commenting banks obtain asset price returns at the 56th percentile of ranked returns. Observed Federal Reserve rulemaking participation by publicly-traded banks accounts alone for $6 billion in excess returns in the post-Dodd-Frank era.

1 Introduction

The canonical theory of the firm in economics and industrial organization excludes most political activity, save for the theory of capture, which is itself often divorced from the organizational or contractual theory of the firm. Political activity can take manifold forms. Firms “lobby up” by spending time, money, reputational capital, energy and expertise in an attempt to influence policy.

Yet as much as firms lobby up, they “lawyer up.” They hire attorneys internally, in offices of general counsel and in compliance departments, and they establishing consulting arrangements with external law firms. In these activities, firms spend hundreds of millions, indeed billions of dollars every year. Indeed, firms’ activities often elide the distinction between legal work and lobbying, insofar as much of what legal experts do for firms is to navigate and shape their regulatory environments.

In this paper, we will begin investigation of firm activities at the intersection of lawyering and lobbying. We investigate how financial firms shape rulemaking in the United States. Our empirical strategy proceeds in two stages. First, we use event study methods on intra-day trading data to estimate the effect of new rules on the expected future profitability of firms. Second, we explore the relationship between the rules’ effect and a firm’s decision to participate in the rulemaking process.

We find that firms which participate in the rulemaking process experience substantially higher returns both at the rule proposal and at the final rule announcement stage. We test for significance using both

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The authors gratefully acknowledge the support of the Washington Center for Equitable Growth and Social Policy Program, the Kauffman Foundation, and the Radcliffe Institute for Advanced Study at Harvard. We also gratefully acknowledge our research assistant Eric Fegan, as well as substantive feedback from Pamela Ban, Daniel Moskowitz, Jon Rogowski, Neil Shephard, Ken Shepsle, Jim Snyder and Margaret Tahyar, as well as participants at the American Politics Research Workshop at Harvard.
conventional regression methods and through bootstrapping against a set of randomly selected times. Using our regression estimates we calculate the total market value of excess returns associated with participation as $5.9 billion.

Our key intuition is that participation in rulemaking processes constitutes a form of lawyerly-lobbying, and that existing theories of the firm have lawyers in them only to the extent to which contracts need to be smoothed and legal uncertainty needs to be reduced. We do not offer a new model here, but we offer some intuitions and descriptions of the rulemaking process by which it might be further modeled. Empirically, by showing that there are plausible returns to rulemaking participation by banks, and that there is abundant participation, (likely of a sort that involves considerable cost), we can show that significant activity is occurring at the level of rulemaking. Indeed, insofar as banks are considered firms, we think that the political theory of the firm cannot be understood without reference to rulemaking and firms’ attempts to influence it, attempts which occur primarily through the mobilization of legal expertise.

Illuminating the phenomenon of lawyerly-lobbying sheds further light on special interest influence or “capture” in regulation (Bernstein 1955; Stigler 1971; Carpenter and Moss 2013). Scholars have long recognized that regulation can be shaped by regulated entities in ways that push policy outcomes and benefits away from the public interest and toward that of the industry. Overwhelmingly, however, the activities of industry and firms in these studies – whether theoretical or empirical – are focused upon the electoral and legislative realms, and are focused on how firms exploit either their size or incumbency and the assets (monetary and relational) that these assets convey. Legal services figure little or not at all in these accounts. To the extent that existing studies of capture focus entirely upon legislative lobbying and electoral influence activity, they may vastly underestimate the degree of costly firm behavior in this realm.

One hitch in this approach is that we portray banks as “firms,” which they are not in all of the usual senses. As is abundantly clear, bank operations have spillover effects, such that for banks more than for non-financial firms, companies can be “too big to fail” and negative capital shocks can concatenate to affect other industries. Entry, exist, lay-up may also be different from financial firms than for traditional industrial producers. To the extent that banks do not resemble other firms in the landscape of industrial organization, our approach will be accordingly limited in what it can say about the political theory of the firm.

2 Literature Review

The empirical literature on lobbying and event study methodology are vast. Here we provide a very brief overview and highlight the contribution of a few works that inform our approach.

Lobbying may be defined as the communication of information in private venues between interest groups or their agents and government officials regarding changes to public policy (Congress 1995). In the United States, the amount spent by interest groups on lobbying activities has historically been an order of magnitude larger than the amount of campaign donation (Tripathi, Ansolabehere, and Snyder 2002). PACs for firms in the finance, insurance, and real estate donated about 79 million dollars during the 2013-2014 federal election cycle, for example, while spending close to a billion dollars on lobbying over the same years (Politics 2016). The fact that firms spend so much more on lobbying than campaign expenditures suggests that lobbying is a correspondingly more important source of influence, and indeed survey evidence indicates that firms do believe this to be the case (Baumgartner et al. 2009). There are a large number of studies showing that participation in lobbying is associated with positive policy outcomes (de Figueiredo and Richter 2014), although only two of which we are aware focus on lobbying within executive agencies (Haeder and Yackee 2013; Yackee and Yackee 2006).

It is worth remaining circumspect about how much influence firms are able to gain through lobbying. Firms may spend billions of dollars per year on lobbying, but if the gains from influencing federal policy are larger, then the real problem is explaining why firms do not spend more (Ansolabehere, de Figueiredo, and Snyder 2003). Carpenter (2013) and de Figueiredo and Richter (2014) suggest that most of the empirical
studies that measure capture or the gains from lobbying have not adequately addressed the major threats to causal identification, which they identify as endogenous selection into lobbying, high temporal autocorrelation or “stickiness”, and the issue of omitted variables. Other issues include measurement, such as the “protection without capture” phenomenon (Carpenter 2004) that occurs when policies favor firms that lobby more, but not because of their lobbying activity or special influence. Tighter integration with formal models of lobbying may also help with causal identification.

The theoretical literature on how lobbying might influence policy has for the most part addressed itself toward legislative lobbying, although there is a small and growing literature on lobbying in executive agencies. Some common explanations for how lobbying may result in influence is through “quid pro quo” exchange (Stigler 1971; Groseclose and Snyder 1996), through transfer of information about the ideal policy (Grossman and Helpman 2001), through subsidizing friendly interests (Hall and Deardorff 2006), or as a signal of commitment to future resistance (Gordon and Hafer 2005). Explicit contracts over policy are clearly illegal, but implied or informal contracts might nonetheless have force and be established during lobbying. In the bureaucratic context, the most obvious kind of implied contract involves future employment, yet every study of the revolving door of which we are aware has produced null findings (Gormley 1979; Cohen 1986; Lucca, Seru, and Trebbi 2014; DeHaan et al. 2015; Cornaggia, Cornaggia, and Xia 2016). We remain sympathetic to more nuanced theories about how the revolving door shapes information processing by regulators and thereby produces influence (e.g. Kwak 2013). Regulators may be more likely to take comments of employers past or future as raising more “salient” considerations than firms or groups that are less well-known, or may see the opinions of certain groups as more “informed” about the subject matter. Difficulties in empirical operationalization prevent a deeper engagement with such explanations here. The notion that agency lobbying is effective for informational reasons, either as a signal of optimal policy or interest group strength or threat, has been explored in several papers (Gordon and Hafer 2005; Yackee and Yackee 2006). Both articles would tend to support the “threat” view of what makes agency lobbying effective.

Scholars have added to a rich literature on rulemaking in recent years, led by Susan Yackee and colleagues who have pioneered quantitative methods that establish associations between participation at the notice-and-comment stage and changes in rules from proposal to final form. In an important article entitled “A Bias Toward Business,” Yackee and Yackee (2006) establish that comments of business entities induce rule change with higher probability (and in a more deregulatory direction) than do comments of labor and consumer groups. These results are of course observational, and the content of the initial rule is not coded in these analyses, so one interpretation of the results is that the initial rule is for some reason (perhaps strategically) tilted against business groups, and the differential commenting influence may reflect a moderation of this initial tilt.

Important recent work by You (2014) examines the phenomenon of “ex-post lobbying,” the idea that considerable lobbying activity takes place after a statute is enacted, when rulemaking, implementation and enforcement activity is ongoing, or when possible amendments to the legislation are occurring and oversight is occurring. You examines 76,641 lobbying reports that match bills from 1998 to 2012 and finds that a substantial portion of lobbying activity reflected in these reports – 51.3% of all reports (Table 2), 44.3% of single-bill reports (Table 2), and 41% of expenditures by firms and trade associations (Table 3) – targets the policymaking process after (ex post) the legislature’s passage of a bill.

It is very difficult to ascertain what benefit firms and their associations derive from these activities, especially given cross-policy comparisons. This remains an important research question.

Yet another phenomenon that has not been investigated is the vast scope of rule-shaping activity, which is not measured in existing lobbying reports. Because rulemaking is governed by the Administrative Procedures Act and the body of law developed there and in any particular field of regulation, those with legal expertise play a more pronounced role in these venues. And in the wake of several major regulatory laws passed in the past decade – the Affordable Care Act, the Credit Card Act, the Tobacco Control Act and Dodd-Frank – this legal activity is one of the most important, yet understudied, patterns of lobbying in the United States.

Event study methodology was introduced in the late 1960s in order to study how stock prices responded
to the release of new information such as income reports or stock splits (Ball, Ray; Brown 1968; Fama et al. 1969). Since then, hundreds if not thousands of event studies have been published in disciplines ranging from accounting and economics, to management, law, and so forth. MacKinlay (1997) provides a good introduction to event-study methodology, while Corrado (2011) presents an overview discussing how these methods have been applied in practice. To our knowledge event-study methodology has not previously been used to study the efficacy of lobbying (de Figueiredo and Richter 2014).

Although the majority of event studies appear to use price data aggregated at a daily level or higher, high-frequency event studies have also been used to understand how long it takes markets to assimilate new information. Early studies found that equity prices adapt within five to fifteen minutes to announcements related to earnings and dividends (Patell and Wolfson 1984; Jennings and Starks 1985), while a more recent study found that positive information revealed on cable news segments was fully incorporated after as little as one minute, although negative information took as much as fifteen minutes (Busse and Green 2002). To our knowledge, intraday returns have rarely been used in studies of the effect of regulatory or policy changes.

3 Some Patterns of Financial Rulemaking Influence After Dodd-Frank

The Dodd-Frank Financial Reform Act of 2010 is a massive statute that creates new regulations in a range of policy domains, ranging from systemic financial regulation to prudential regulation to consumer protection regulation (Moss 2009, Carpenter 2010, Carpenter 2011). The statute itself was the subject of vast lobbying activities not only in Congress but also in the Treasury Department, where much of the statute was written (Carpenter 2011). The involvement of the executive branch in Dodd-Frank is thus threefold – the drafting of the statute, the writing of rules, and the enforcement of both statutory requirements and rules. It is critical that our empirical analysis examines only the second of these, and here only the formal participation of publicly-traded banks in the rulemaking of one agency (to the exclusion of others forms of influence), and thus may severely underestimate the returns to lobbying.

Even in rulemaking alone, however, the scope of activity under Dodd-Frank is vast. The statute itself called for 398 rulemakings, and agencies will engage in many others as “interpretive” activities. Whether “substantive” and charged by Congress or whether interpretive and done after-the-fact, all of these rule-making activities are governed by the Administrative Procedure Act, all must pass through the notice-and-comment process, and all involve the deployment of legal services on the part of regulator and regulated.


• High Incremental Product Value
  – “The amount billed by Debevoise & Plimpton to write a 17-page letter on a new rule intended to rein in risky banking – around $100,000 – would make most authors jealous. That’s the fee just for parsing the proper definition of a bank-owned hedge fund. Longer and more complex regulatory missives, weighing in on who should be deemed too big to fail or how derivatives are traded, can easily cost twice as much.”
  – “Regulators from seven states — including California, New Jersey and Pennsylvania — have hired his firm, Mr. Mustafa said, and he is selectively signing up two to four new bank clients a month. Annual advisory fees start at $20,000 and can reach $100,000 or more.”
“Davis Polk & Wardwell, for example, is offering a $7,500-a-month subscription to a Web site that tracks the progress of every Dodd-Frank requirement. So far, more than 30 large financial companies have signed up.”

**High Stakes and Vast Aggregate Activity**

- “These comment letters could save Wall Street banks billions of dollars if they help persuade policy makers to adopt a more lenient interpretation of the coming rules. And white-shoe law firms like Debevoise & Plimpton are cranking them out by the dozen.”
- “No one yet is tracking all the money being spent to deal with Dodd-Frank (which in itself could be an entrepreneurial venture), but a back-of-the-envelope calculation puts it in the billions of dollars. And that’s not even counting the roughly $1.9 billion spent by companies lobbying on financial issues since the regulatory overhaul was first proposed in early 2009, according to the Center for Responsive Politics.”

**Professional Work**

- “Besides the lawyers, there are legions of corporate accountants, financial consultants, risk management advisers, turnaround artists and technology vendors all vying for their cut.”
- “It is a full-employment act,” said Gregory J. Lyons, a partner at Debevoise, where a team of a half-dozen lawyers has drafted 30-plus comment letters in the last six months. “The law is passed, but we are still reasonably early in the process,” Mr. Lyons said. “There is still a lot to be written.”

**Ex Post Lobbying**

- “The bulk of the lobbying tab was spent in the two years before Dodd-Frank took effect. Now firms are spending similarly eye-popping sums to comply with or battle against the rules emerging from the law. They are turning to existing companies that have started dedicated teams like the one at Debevoise & Plimpton, as well as start-ups like the Invictus Consulting Group.”

A full monetary accounting of lobbying and legal activity has not been completed. Yet the *Times* summary of suggests that billions of dollars may have been spent just on this one bill from 2010 to 2011. Six years have since passed, raising the possibility that according to the standard by which the *Times* aggregated $1-2 billion in legal spending in that year or two, up to $5 to $10 billion, perhaps more, has been spent on Dodd-Frank.

But does this expenditure lead to identifiable returns for those who incur such immense costs? We know of no quantitative study focused on rules that answers such a question.

### 4 Data Sources

The three major data sources used in this study are intra-day stock prices, information about the time of rule announcements, and identification of which firms participated in rulemaking procedures. All 1,013 publicly traded firms that the NASDAQ identifies as “Finance Companies” were considered eligible for inclusion in our study, although a number of these firms were so infrequently traded that inclusion was impossible.

Asset prices were derived from the National Best Bid Offer database available from Wharton Research Data Services (WRDS). Because these data are reported at higher frequency than is necessary for our purposes, we aggregated to the minute-by-minute level by separately averaging the best bids and best offers, and then taking the median between the two as the asset price. If a stock was not traded in a given minute,
this procedure is unable to measure the asset price at that time. To deal with this problem, we imputed the price of the asset be using the most recent asset price available.

Crucial to our study is precise identification of the time when rules were announced. Official publication of rules in the Federal Register typically occurs after the rule and its text have been revealed to the public via press release. Usually, the difference is a matter of days, but could be up to a few weeks. Our understanding, based on email correspondence with a Bloomberg reporter, is that such press releases are typically shared prior to the time such announcements are formally released, with the understanding that no publication may happen prior to the predetermined announcement time. If someone did make trades based on information contained in such a press release prior to the end of the embargo, it would constitute insider trading and could lead to a prison sentence of up to twenty years. For our purposes, the important task is to determine as well as possible the time at which individuals not party to inside information would have received the information. Occasionally, the press release itself contains information about when the embargo was lifted, but usually it does not. In order to determine this time, we used two strategies. First, we extracted a server imprinted publication time from RSS data originally published by the Federal Reserve and archived by either Feedly, the Wayback Machine, or the Library of Congress's Web Archive. Second, we filed a FOIA request with the Federal Reserve for information about the time their press release were published to the Web. In all cases, the two times were identical or differed by a few minutes. For the cases of disagreement, we took the earlier time. In order to ensure that these web publication times provided a good estimate of when information hit the market, we selected several rules at random and checked web publication time against the timestamp on the first story about each rule on Bloomberg.

Figure 1 provides a calendar representation of the days at which rule announcements were made. Unfortunately, not all announcements were made during active trading hours, and in these cases the announcements must be dropped. In other cases, multiple rules were announced at the same exact time, which creates confounding. All told, there were 50 proposed rules or notices of proposed rulemaking, 34 final or interim final rules, and 22 proposed-final rule pairs that could be used for our study.

Information matching firms to their participation in notice-and-comment rulemaking procedures was gleaned from the Financial Agency Rulemaking Dataverse, a collaborative effort between us and several other scholars that is still in early stages. Information about each comment submitted to the Federal Reserve as part of Dodd-Frank rulemaking was human coded by two separate individuals recruited through Amazon’s Mechanical Turk platform. An RA then compared this first wave of human data collection to the source material, made corrections as necessary, and matched firms to the SEC’s CIK identifiers. These were matched to firms using data from WRDS and RankedAndFiled.

5 Methodology

This study seeks to examine the relationship between market reactions to rule announcements and participation in rulemaking procedures. Our goal is to estimate regressions of the following forms

\[ P_{tj} = f(\hat{R}_{tj}, X_{tj}) + \epsilon_{tj} \]  
\[ \hat{R}_{tj} = f(P_{tj}, X_{tj}) + \epsilon_{tj} \]  
\[ \hat{N}_{kj} = f(P_{t1j}, X_{t1j}, X_{t0j}) + \epsilon_{tj} \]

where \( \hat{R}_{tj} \) is the effect of the rule \( t \) on firm \( j \), \( P_{tj} \) is an indicator for firm \( j \) participating in the notice-and-comment process related to rule \( t \), \( X_{tj} \) is a set of other covariates related to the firm or the rule, and \( \hat{N}_{kj} \) is the difference in market reactions between a final rule \( t_1 \) and a proposed rule \( t_0 \) that are form the same rulemaking process \( k \).
Figure 1: Calendar of Regulatory Events
We estimate $\hat{R}_{jt}$ in two stages. First, we calculate the excess market returns of each stock by regressing each asset’s price on the price of an S&P500 index fund. Second, we calculate the quantile of these returns relative to the last 100 trading days. This procedure is illustrated in much greater detail through an application to a recently published rule. For calculating excess returns, we choose an equal weighted as opposed to value-weighted index fund to decrease the influence of the financial sector as a whole and prominent firms in particular. The use of quantile returns is motivated by the need to account for the differences in volatility between assets. Under the null assumption that announcement times were selected at random, $\hat{R}_{jt}$ should follow a uniform distribution. An alternative approach to dealing with differences in between asset volatility would be to divide excess market returns by their standard deviation, however this approach would not address the problem of within asset heteroskedasticity caused by the U-shaped pattern of trading intensity over the course of the day.

A second problem with estimation of $\hat{R}_{jt}$ is whether it should reflect the difference in excess market returns after one minute, one hour, or some other time period. In general a shorter period is preferable to decrease the risk of confounding interventions, although if too short a period is taken then the information contained in the announcement will not be fully incorporated into the share price. Our review of the literature suggests that earnings announcements are fully incorporated in as little as a minute or as long as fifteen minutes. Yet we are unsure that rules are equally as interpretable as earnings announcements, although press releases and Bloomberg reports do tend to highlight the most important points. Another consideration for this study is that longer durations also have the effect of winnowing the set of eligible rules. Focusing on returns after six hours, for example, would only allow us to examine rules published between 9:30AM and 10:00AM. In the absence of strong priors, our approach is to look at a variety of time-domains: 5 minutes, 20 minutes and an hour. We also consider the average of all available intervals from 1 to 60 minutes for a particular rule, as a way of decreasing sensitivity of our rule estimates to transitory shocks.

5.1 Illustrative Example

The goal of this section is to provide an illustrative example showing how the estimation of $\hat{R}_{jt}$ works in practice. These examples also have the salutary purpose of providing a sanity check to show that rule announcements can indeed work as we expect they should.

At 12:00PM on September 23, 2016, the Federal Reserve Board published a proposed rule limiting the kind
of physical commodities that can be owned by a financial holding company. Figure 2a shows the stock price of four financial companies - Goldman Sachs, Capital One Financial, Morgan Stanley, and Met Life - around the time of the announcement. For ease of comparison, we have normalized each price path by subtracting the price of each stock at 12:00PM, and also super-imposed the path of an S&P500 index fund normalized in the same fashion. At the time of announcement, many banks were thought to participate to some degree in commodity holdings. Among the two most heavily involved were Goldman Sachs and Morgan Stanley, as a memo included with the press release notes. Another firm that may have had significant exposure was Capital One Financial. At the time of the rule announcement, over 50% of Capital One’s 88 billion dollar consumer banking portfolio involved auto loans, more than 50% of that coming from consumers with FICO scores below 660. Capital One’s exposure to sub-prime auto loans was obvious from publicly available financial statements and had received coverage in financial papers. 1 A auto loan consumer defaulted on their loan, Capital One would usually become the owner of their car. 2 Although it is hard to guess from financial statements how many cars Capital One owned at the time of the rule announcement, the rule would appear to entail potential exposure for the firm, especially as the new accounting rules would force Capital One to apply a 1250 percent risk weight to physical assets like these. 3 By contrast, insurance companies were not subject to these rules, although earlier indications from the Federal Reserve showed that they were at least considering provisions that might have applied to such companies. Met Life is one of the largest insurance companies and an officially designated systemically important financial company.

Figure 2a is suggestive of unusual downward movement for the three banks around 12:00PM, but not the insurance company. In particular, the market value of Goldman Sachs fell over one billion dollars in five minutes; the shocks to Capital One and Morgan Stanley also look unusual but less striking. In order to make this assessment more rigorous, one can compare the returns for each asset to what was observed on previous days around the same time. The comparable returns are displayed in Figure 2b. It is apparent that the precipitous declines observed on September 23rd around 12:00PM were unusual: only a few of the past hundred days were worse for these banks over the hour time frame. Yet an hour later the returns for Met Life could hardly be less remarkable. Table 1 presents the computed values of \( R_{it} \) that we would use in subsequent regressions. A careful eye could calculate the entries in the table by counting the number of grey lines below the black line, and dividing by the total number of lines in each graph.

While the mid-day changes presented here are unusual, as time marches on these movements become less surprising. The average daily change in market value for Goldman Sach’s is, at present writing, a little over one billion dollars; on a daily scale what was demonstrated in this section would not appear very unusual. One might hope that looking for a longer-term effect would work, but it seems that equally significant events from a firm standpoint happen with such frequency that disaggregating the effect of rules would be very difficult. The Federal Reserve has published over one-hundred new regulations in the past 6 years, on average once every three weeks. Over the weekend following the commodity rule announcement, Goldman announced it was laying off seventy-five of its bankers in Asia, and the decline in its stock price on September 26th

<table>
<thead>
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<th>Measure</th>
<th>MS</th>
<th>GS</th>
<th>COF</th>
<th>MET</th>
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<tr>
<td>1 Tp5</td>
<td>0.01</td>
<td>0.00</td>
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<tr>
<td>2 Tp20</td>
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</table>

2The proposed rule itself mentions such repossession as one of the primary reasons banks might own physical commodities. “BHCs may take possession of physical commodities provided as collateral in satisfaction of debts previously contracted in good faith”

3We do feel it is important to mention that application of the rule to automobiles does require an act of legal interpretation. In making this rule, the Federal Reserve Board was apparently seeking to ensure that firms make adequate preparation for exposure to costly environmental disasters. Although it is hard to envision how cars sitting on a lot could pose Exxon-Valdez level environmental risk, the rule was drafted in such a way as to cover not only hazardous physical commodities but also those physical commodity that contain “components” which are hazardous. A car battery alone contains many such chemicals, and there are still other car components which are environmentally hazardous (Barry 2012).
was similar to that it experienced on September 23rd, the day of the rule announcement. Figure 3a shows trends in each stock price over a time-scale typically used in the daily event study literature. There was no apparent level-shift around September 23rd, and in the Appendix we present a regression table showing that there was not one. By contrast, around the date of the Presidential election there was a clear level-shift for both these particular firms and the market as a whole.

These results suggest that intra-day returns can sometimes capture the expected effect of a rule on a firm, where using daily returns would not. A single illustration can hardly prove that this measurement strategy is valid in all cases. Rather the goal at this stage is to give some flavor of the content analysis methods underlying the regressions we present in the following section. One important caveat is that we will use excess market returns wherever possible, although most of the illustrations have used simple returns that do not control for market movement in any way. In Figure 3b we illustrate the benefit of controlling for market by presenting detrended data: the effect on Goldman Sachs is more pronounced and stable than in the previous figures, while the effect for Met Life is less. We also show that standardized returns and quantile returns are substantially similar.

It is also worth dwelling for a moment on the threat of leaks and what the rising and falling pattern in the bottom panel of Figure 3b reveal. The proposed physical commodity rule was released by the Federal Reserve at 12:00PM September 23rd and for this reason we measure all returns relative to this time $t_0$. According to our research, none of the major financial news outlets such as Bloomberg or the Federal Reserve itself released the news until noon. If this adverse regulatory news were to be released earlier, however, and the sell-off began $\epsilon$ minutes before, one would have that $P_{t_0} < P_{t_0-\epsilon}$. As the graphs in all cases show $P_t - P_{t_0}$, if an abnormal downturn started before the time we expect, we would have $P_{t_0-\epsilon} - P_{t_0}$ be large and positive. Indeed, this is the case both for Met Life and for Goldman. Thus, the effect on both Met Life and Goldman appears to have been attenuated by our decision to use the official publication time rather than, say, a few minutes earlier when the sell-off apparently began. It is not clear how to address this problem in a principled way so that the p-values we report remain meaningful, however. Principled strategies for dealing with this problem seem to us an appropriate avenue for future research.
Table 2: Market Reaction to Rule Proposal Does Not Predict Participation

<table>
<thead>
<tr>
<th>Dependent variable:</th>
<th>Tp5</th>
<th>Tp20</th>
<th>Tp60</th>
<th>Mean</th>
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<td>Positive Response</td>
<td>−0.001</td>
<td>0.0003</td>
<td>0.001</td>
<td>−0.003</td>
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<td>(0.004)</td>
<td>(0.004)</td>
<td>(0.004)</td>
<td>(0.005)</td>
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<tr>
<td>Negative Response</td>
<td>−0.001</td>
<td>0.001</td>
<td>0.016***</td>
<td>0.014**</td>
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<td></td>
<td>(0.004)</td>
<td>(0.004)</td>
<td>(0.006)</td>
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<tr>
<td>Firm Fixed Effects</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Rule Fixed Effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
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<td>19,324</td>
<td>25,515</td>
</tr>
<tr>
<td>R²</td>
<td>0.101</td>
<td>0.101</td>
<td>0.124</td>
<td>0.103</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.075</td>
<td>0.075</td>
<td>0.091</td>
<td>0.077</td>
</tr>
<tr>
<td>Residual Std. Error</td>
<td>0.086 (df = 25449)</td>
<td>0.086 (df = 25449)</td>
<td>0.087 (df = 18608)</td>
<td>0.087 (df = 24788)</td>
</tr>
<tr>
<td>F Statistic</td>
<td>3.923*** (df = 728; 25449)</td>
<td>3.923*** (df = 728; 25449)</td>
<td>3.689*** (df = 715; 18608)</td>
<td>3.912** (df = 726; 24788)</td>
</tr>
</tbody>
</table>

Note: *p<0.1; **p<0.05; ***p<0.01

Table 3: Participation in Rulemaking Predicts Superior Market Reaction to Final Rule

<table>
<thead>
<tr>
<th>Dependent variable:</th>
<th>Tp5</th>
<th>Tp20</th>
<th>Tp60</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participated</td>
<td>0.025</td>
<td>0.057*</td>
<td>0.106***</td>
<td>0.053**</td>
</tr>
<tr>
<td>(0.035)</td>
<td>(0.031)</td>
<td>(0.032)</td>
<td>(0.024)</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>18,911</td>
<td>18,413</td>
<td>11,635</td>
<td>18,911</td>
</tr>
<tr>
<td>R²</td>
<td>0.00004</td>
<td>0.0002</td>
<td>0.001</td>
<td>0.0003</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>−0.036</td>
<td>−0.037</td>
<td>−0.059</td>
<td>−0.036</td>
</tr>
<tr>
<td>F Statistic</td>
<td>0.662 (df = 1; 18251)</td>
<td>3.357* (df = 1; 17753)</td>
<td>8.910*** (df = 1; 10980)</td>
<td>4.708** (df = 1; 18251)</td>
</tr>
</tbody>
</table>

Note: *p<0.1; **p<0.05; ***p<0.01

6 Results

Here we present some results from our study. Our first regression in Table 2 shows an OLS regression of participation on market reactions with firm and rule fixed effects. It is desirable to consider that returns may be of two types, favorable and unfavorable, and therefore we measure the magnitude of these deviations separately. \(^4\) We find that positive reactions are significantly associated with an increased tendency to participate, but the result is not stable over various time domains. Our second regression examines whether there is a relationship between participation and final rule outcomes. We find that there is such an association, and it is relatively consistently sized over the period. All tests of significance use Huber-White standard errors.

Because stock returns are noisy and cross-sectionally correlated, a natural concern is that the standard errors from these regressions may be underestimated and therefore the deviations reported are not truly as surprising as appears. To protect against this possibility, and also provide a kind of placebo test, we bootstrap using the following strategy. First, we select trading times at random since the passage of Dodd-Frank and imagine that our announcements had been taken from this pool instead of their true times. Next, we replace the true participants at random from the pool of financial sector stocks. This two stage randomization procedure preserves the clustering that is present in the real data. Thereafter, we calculate

\[^4\]Formally, positive response is defined as \(\max(0, R_{it} - 0.5)\) while negative response is defined as \(\max(0, 0.5 - R_{it})\). Here \(R_{it}\) is the return for firm \(i\) and \(t\) is given separately in each column
the mean return for these “pseudo-participants.” The histograms are displayed in Figure 4. One of the most noteworthy features of this is that the significance of proposed rules is apparently much greater and more stable than the initial regressions suggested.

7 Discussion

The regressions described in the previous section demonstrate correlations between participation in financial rulemaking and outcomes in the equity markets. One possible interpretation is causal, that if a firm decides not to participate it receives a less favorable market reaction than if it had participated. A number of considerations make us wary about over-interpreting our results in this fashion, especially absent further investigation into possible alternative mechanisms.

Prior studies examining the gains from participating in rulemaking have struggled with the fact that only those who decide to participate are observed (Haeder and Yackee 2015). Although our design observes the effect of rules on both participants and non-participants, strategic considerations and selection effects still pose threats to causal identification. For example, we initially considered it possible that firms most adversely affected by certain rules would be more likely to participate, and that the first order effect for the market would be how soon the enabling statute provisions would be enforced rather than the details of how that enforcement would work. If this were so, one might expect that announcements, which necessarily hasten the date of enforcement, might trigger participation and negative market reactions to both proposed and final rules, even if the effect of participation were net positive. This particular story is not consistent with our evidence. If anything it seems that firms participate in response to rules that create expected benefits. Yet other selection stories might bias our results in one way or another. More work modeling the participation decision itself is necessary to address such reasonable concerns.

Another problem clouding inference is that regulators may position their rules strategically. Some formal models of regulatory policy-making suggest that the regulator should take an extreme position to one side of the regulated firms, in order to provoke a reaction and generate the greatest incentives for firms to reveal private information (Grossman and Helpman 2001). Our discussion with lawyers active in this space...
suggested that regulators may also take an extreme position with an eye toward the courts, since the regulator may feel that the appearance of having “compromised” with the affected parties will better protect the rule. Whatever strategy the regulators use, if their approach is predictable, the market may account for it to some degree. If it does not perfectly account for this information then there are plausible explanations for how strategic positioning could explain positive correlations between participation and regulatory outcomes.

Finally, we have the problem of confounding due to leaks. We have already discussed the problem of unofficial leaks and insider-trading and how that might cause attenuation bias. A second problem, potentially even more serious, is that officials occasionally make public statements about the content of the rules that are being announced. In some cases the market reaction we estimate may not reflect the difference between rule and no rule, but rather the difference between early indications and final draft. The set of such public statements is ascertainable, but we have not collected sufficient data on it to provide a thorough accounting.

In any event, even despite these concerns, it is worth characterizing what the impact of commenting on market returns would be if the regression coefficients did capture the causal impact of participation. The regression coefficients and bootstrap estimates suggest that participants on average had a 60th quantile return after a rule-announcements while non-participants received on average a 50th quantile return. A back-of-the-envelope calculation can be conducted as follows: take the difference between the 60th quantile of excess returns after an hour and the 50th quantile return at a typical time of day for each company we observe participating, multiply that quantity by the number of shares each company has, and multiply that quantity by the number of comments each firm sends. Doing this yields a grant total of $5.9 billion. The biases mentioned above could of course lower that estimated impact of commenting, while consideration of the fact that we only observe a subset of rules where announcements happened during trading hours would suggest a higher figure. These estimates are also restricted only to publicly traded firms commenting on their own, not including trade association activity, nor the activity of private firm.

8 Conclusion

This paper has considered the relationship between market reactions to rule announcements and participation in financial rulemaking. It has used an intra-day event study methodology in order to establish several findings: proposed and final rules often provoke a statistically significant market reaction on participant firm. More assessment of possible mechanisms is needed in order to justify the claim that participation has caused firms to receive these benefits, but nevertheless the evidence is consistent with the intuitive explanation that firms participate in rulemaking because it helps them secure more favorable regulatory outcomes.

The “participation” we describe here is the result of banks and bank holding companies hiring lawyers (within or outside of the firm) to offer comments on regulations and to shape rules. An important implication of our results is that markets expect firms to gain from rulemaking comments. this is different from saying that commenting firms do in fact realize these gains. Our study has implications for organizational theory and agency politics, in particular it contributes to scholarly research on the following questions:

• What rationale is there for firms to hire lawyers beyond that of smooth contracts, or reducing legal uncertainty? Does the political firm need lawyers, and why?
• Why is so much lobbying “ex post lobbying” (You 2015), that is, targeted toward policymaking after statutes are passed?
• If post-statute lobbying involves lawyers, how much do customary measures undercount or underestimate firm political activity in this domain?
• Are lobbying and lawyering complements or substitutes, and what are their equilibrium convex combinations in different sub-industries?
• How do firms engage in the “make or buy” decision with respect to shaping national-level financial regulatory rules?

• Given the increasing “financialization” of economic activity in advanced industrial economies, do financial firms differ from non-financial firms in their influence over rulemaking, and in their reliance upon lawyers for lobbying and shaping rules?

Two clear next steps are to examine rules changes and ask whether among those firms that participate, whether those whose comments moved the rules more experience differentially larger asset returns, and second, whether these commenting activities are associated with other, non-commenting activities as measurable in lobbying and contact data. Once these political and legal mechanisms are described and outlined, scholars can begin to address the question of how lawyerly lobbying is organized in ways different from that of other lobbying and that of other legal service activity in industries.

9 Technical Appendix

10 Proof of non-monotonicity of Optimal Window

An investor observes the unfolding of asset value on a space \( \Omega \) (with elements or experimental realizations \( \omega \)), which is structured by a set of \( \sigma \)-algebras \( \mathcal{F} \), and a probability measure \( \mathbb{P} \). In addition, \( \mathcal{F} \) can be ordered and expressed as a filtration \( (\mathcal{F}_t)_{0 \leq t \leq \infty} \), which is a family of \( \sigma \)-algebras that is increasing in its index, hence \( \mathcal{F}_s \subset \mathcal{F}_t \) if \( s \leq t \). The filtration sequentially collects and orders all realizations \( \omega = \omega_t \) on a time dimension from 0 to \( t \). The collection \( (\Omega, \mathcal{F}, \mathcal{F}_t, \mathbb{P}) \) constitutes a filtered probability space. This filtered probability space supports a standard one-dimensional Brownian motion \( Z(t) \), and we assume that a set of “usual hypotheses” hold. These hypotheses are standard in the analysis of stochastic differential equations see Protter (2005: Chapter I, esp. pp. 34–36) for a clear explanation).

10.1 Lévy Asset Price Process

The investor observes a stochastic process \( \{X_t\}_{t \geq 0} \) with a deterministic trend (with slope \( m \in \mathbb{R} \)) and with three random components, a continuous diffusion (a Brownian motion \( B(t) \)) and the combination of two jump processes, one \( (J^+) \) positively valued and the other \( (J^-) \) negatively valued. For each jump process, we represent the jumps with a compound Poisson process, such that arrival time of events is exponentially distributed, with parameters \( \lambda^+ \) and \( \lambda^- \), respectively. This implies that the number of events that have occurred by time \( t \), \( J^+(t) \) and \( J^-(t) \), are each Poisson distributed with rate parameter \( \lambda^+ t \) and \( \lambda^- t \). Conditional on an event occurring, we suppose that the size of the jump is a draw from a concomitant distribution \( G^+(Z) \) for the positive shocks and \( G^-(Z) \) for the negative ones. For the positive shocks, let the expected size of this jump be given by \( \phi^+ = \int_{\mathbb{R}^+} ZdG^+(Z) \), and for negative jumps the (possibly asymmetric) reflection obtains, \( \phi^- = \int_{\mathbb{R}^-} ZdG^-(Z) \) If \( G^+(Z) \) and \( G^-(Z) \) are degenerate, placing all probability on one value of \( Z \), then the shocks arrive according to a standard Poisson process. Then the density of the jump distribution is given by \( h(z) \), where

\[
h(z) = \frac{\lambda^+}{\lambda^+ + \lambda^-} g^+(z) \mathbf{1}_{\{z > 0\}} + \frac{\lambda^-}{\lambda^+ + \lambda^-} g^-(z) \mathbf{1}_{\{z < 0\}}
\]

\[\text{(4)}\]

Suppose that \( G^+(Z) \) and \( G^-(Z) \) have support for \( Z \neq 0 \). Further, suppose that a finite first moment exists. Our proofs require no other assumptions.

For similar but distinct set-ups, see Mordecki (2002), Section 4.1, and, later, Boyorchenko and Levendorskii (2014), equation (2.2).
We then compose the stochastic fundamental process as

\[ X_t = mt + \sigma B_t + \sum_{k=1}^{\infty} Z_k \]  

(5)

The process is thus a Lévy process, with the variable \( X_t - X_s \) independent of the \( \sigma \)-field \( \mathcal{F}_s \) for \( 0 \leq s \leq t \) and with a distribution that depends upon \( (t - s) \) alone.

10.2 Lévy Market

We follow other scholars (Mordecki 2002; Boyarchenko 2004; Abbring Econometrica 2012; Boyarchenko and Levenduskii 2014) in modeling a simple Lévy market, so called because its stochastic asset is driven by a Lévy process \[ X(t) \]. The financial market has two assets, one a deterministic savings account \( D = \{ D_t \}_{t \geq 0} \) and the other a stock \( S = \{ S_t \}_{t \geq 0} \). Valuations are given by

\[ D_t = e^{rt}, \quad r \geq 0 \]  

(6)

\[ S_t = S_0 e^{X_t}, \quad S_0 > 0 \]  

(7)

We consider a derivative asset introduced to this market with a perpetual American option. The holder of this option purchases the right to receive from the seller, at time \( \tau \), an amount \( G(S_\tau) \). The investor can call the option with reward function given by \( R_c(S) = (S - K)^+ \) and can put the option with reward \( R_p(S) = (K - S)^+ \) respectively, where \( K > 0 \) is a fixed and invariant cost, symmetric to both put and call options.

Consider then \( \mathcal{T} \) the class of all stopping times relative to \( \mathcal{F}_t \), and let \( \tau \) be a stopping time if \( \tau : \Omega \rightarrow [0, +\infty] \) and \( \{ \tau \leq t \} \in \mathcal{F}_t \) \( \forall t \geq 0 \). Let the reward function \( R \) be a Borel function incorporating the Lévy process \( X(t) \), and let the discount rate be \( r \geq 0 \). Then the investor faces an optimal stopping problem, which consists in finding a real function \( V \) and a stopping time \( \tau^* \) such that

\[ V(S_0) = \sup_{\tau \in \mathcal{T}} \mathcal{E}(e^{-r\tau} R(S_\tau)) = \mathcal{E}(e^{-r\tau^*} R(S_{\tau^*})) \]  

(8)

This model has been solved elsewhere (Mordecki 2002), and for generalized Lévy process, the solution for the case with \( r > 0 \) and existing stopping times \( \tau^* < 0 \) is as follows. Define \( \theta(r) \) as an exponential random variable independent of \( X_t \) (with \( \theta(0) = \infty \)) and

\[ M = \sup_{0 \leq t \leq \theta(r)} X_t \quad \text{and} \quad I = \inf_{0 \leq t \leq \theta(r)} X_t \]  

(9)

Then the optimal policy for a call option is
\[ V_c(S_0) = \frac{\mathcal{E}[S_0e^M - K\mathcal{E}(e^M)]}{\mathcal{E}(e^M)} \]

and that for the put option is

\[ V_p(S_0) = \frac{\mathcal{E}[K\mathcal{E}(e^f) - S_0e^f]}{\mathcal{E}(e^f)} \]

Note that by the policies (11) and (12), the option value \( V \) is increasing in the divergence of realized from expected supremum (\( e^M - \mathcal{E}(e^M) \)) and decreasing in the value of realized from expected infimum (\( e^f - \mathcal{E}(e^f) \)). This is important in the adjustment of the market value to a shock from rules.

**10.3 Introduction and Valuation of an Exogenous Rule**

We assume that a rule is released that may affect the fundamental state variable and hence the stochastic asset but not the savings account. Neither the value nor the time of realization is “anticipable” in the stochastic sense. Let the event be denoted by \( A_t \), which is the agency rule, which occurs at \( t^A \). The rule may have positive or negative effects, and these value implications are given \( \alpha \), which is unknown to the investor by a normal distribution with mean \( \alpha \) and variance \( \nu_\alpha \).

**10.3.1 Continuous Time Evidence of Rule Value**

The investor collects continuous-time evidence about a rule’s value according to Brownian motion with drift, where the drift is determined by the (unobserved) value (\( \alpha \)) of the rule for the asset under consideration. Formally, the Agent observes readings about the the realized value of the rule \( Y \), which is separable and independent from \( X_t \), and which evolves according to the following stochastic differential equation.

\[ dy(t) = \alpha (y(t)) \, dT(t) + \xi (y(t)) \, dw(T(t)) ; t > 0 \]  \( (12) \)

where \( T_y \) (\( = 0 \) when \( t = t^A \)) is the learning time for the rule, \( w \) is a standard normal distribution with mean zero and variance \( \nu_y \). The parameter \( \xi \) encodes the amount of information Equation 12 contains for the investor: if \( \xi = 0 \) then the investor can immediately infer the value of the rule by examining the slope of Equation 12 and as \( \xi \to \infty \) the SDE contains no information about a rule’s implications for the asset.

**10.3.2 Estimating Rule Value From Readings**

Given that the Investor only observes \( Y(t_y) \) we first prove that the learning problem is identified: the Agent is able to disentangle the contribution of the value of the rule to \( Y(t_y) \).
Identification of Learning Problem and Sufficient Statistics. We assume fixed coefficients and adopt the technology of Herman Chernoff (1968), who presents closed-form Bayes posteriors of a Brownian motion with drift. Without loss of generality, then, for any \( Y(t) \), the history of \( Y(t) \), \( H(t) \) can be expressed by its sufficient statistics, namely the dual \( (t_y, Y(t_y)^*) \).

\[
\text{Posterior Mean } \equiv \mathcal{E}_{y,t_y}(\alpha) = \hat{\alpha}_t = \frac{a/v_a + y/\xi^2}{1/v_a + t_y/\xi^2} \tag{13}
\]

\[
\text{Posterior Variance}(\hat{\alpha}) \equiv \mathcal{V}(t_y) = \frac{1}{1/v_a + t_y/\xi^2} \tag{14}
\]

10.4 Filtered Evidence and Value Functions

The Investor seeks to define an optimal continuation rule for the filtered rule-value evidence process \( \hat{\alpha}(t_y) \) found by combining Equations (13) and (14). The Investor faces a convex function \( \hat{\alpha}(t_y) \times t_y \mapsto \Psi(\hat{\alpha}(t_y), t_y) \), that is twice differentiable with respect to both \( \hat{\alpha}(t_y) \) and \( t_y \). This function is a map from the current state of the filtered rule-value process and time to the value experienced by the investor. For a strictly positive quitting cost \( Q \) and for any rule, the Investor wishes to do the following

\[
\sup \mathcal{E} e^{-rt_y} \left[ Q - \mathcal{E} \int_0^\infty e^{-r(q-t_y)} \alpha^*(q, \omega) dq \right] \tag{15}
\]

where \( q \) is a variable of integration. For the following analysis we will replace \( y \) with \( \hat{\alpha} \), without loss of generality due to the scale-invariance property of \( Y(t_y) \).

Using the scale-invariance of diffusions (Karatzas and Shreve 1991: 66-71), the Investor’s optimal policy will be to observe the first passage of the evidence process \( \hat{\alpha}(t_y) \) through a border that encodes the tradeoff between continuation of readings and the value of incorporating stopping the readings for incorporation into a call or put. Then the investor can consult and compute a Hamilton-Jacobi-Bellman equation for the rule:

\[
\delta \Psi (y) = \max \hat{\alpha}(y(t_y)) \frac{\partial \Psi (y)}{\partial y} + \hat{\alpha}(y(t_y)) \frac{\partial \Psi (y)}{\partial t_y} + V_a(t_y)^2 (y(t_y)) \frac{\partial^2 \Psi (y)}{\partial y^2} + o(t) \tag{16}
\]

where \( o(t) \) denotes “vanishing” terms of order greater than \( t \), that is, terms that converge to zero faster than \( t_y \) does. After applying Ito’s Lemma, independence, and the pure martingale property, dividing through by the differential \( dt_y \) and taking limits as the differential vanishes, the infinitesimal generator \( \mathcal{L} \) for the rule-value evidence process \( \hat{\alpha}(t_y) \) can then be expressed as:

\[
(\mathcal{L}^\Psi) (y) = \Psi_\alpha (y, t_y) + \Psi_t (y, t_y) + \frac{1}{2} V_a^\alpha (t_y)^2 \Psi_{\hat{\alpha} \hat{\alpha}} (y, t_y)
\]

Evaluating \( \mathcal{L}^\Psi (y) \) according to the Shiryaev conditions (smooth pasting and value matching; Shiryaev 1978) results in elimination of the \( \Psi_{t_y} \) term and a uniquely optimal first-passage time policy. We have proved:

---

By scale invariance of the Brownian diffusion (Karatzas and Shreve 1991: 66-71), the usual operators and Lemmata of Ito calculus can be applied straightforwardly to these posterior quantities.
Proposition 1: Optimal Stopping Barrier for Each Incumbent Product

The Agent incorporates the information in a call or put when and only when, and if and only if, $\hat{\alpha}(t_y)$ passes for the first time through the optimal stopping barrier,

$$\gamma^*(t_y) = rQ + \frac{1}{2\epsilon^2} \Psi_{\alpha,\hat{\alpha}}(\hat{\alpha}(t_y), t_y)V_{\alpha}(t_y)^2$$

(17)

where $\Psi_{\alpha,\hat{\alpha}}(\hat{\alpha}(t_y), t_y)$ is the second partial derivative of the value function $\Psi$ with respect to the filtered state variable $\hat{\alpha}$, given a realization of $\hat{\alpha}$ at time $t_y$.

11 Incorporating Rule-Value Evidence into the Lévy Market

At the optimal incorporation time $t^*_y$, the Investor assigns $\hat{\alpha}(t^*_y)$ to the value of the Lévy fundamental, such that $S(t = t^A + t^*_y) = e^{X_t + \hat{\alpha}_t}$, and the solutions (11) and (12) are adjusted as follows.

$$V_c(S_0) = \frac{\mathcal{E}[S_0e^{\alpha + M} - KE(e^M)]}{\mathcal{E}(e^M)}$$

$$\tau^*_c = \inf\{t \geq 0 : e^{X_t + \hat{\alpha}_t} \geq S^*_c\}$$

$$S^*_c = KE(e^M)$$

(18)

and that for the put option is

$$V_p(S_0) = \frac{\mathcal{E}[KE(e^I) - S_0e^{\alpha + I}]}{\mathcal{E}(e^I)}$$

$$\tau^*_p = \inf\{t \geq 0 : e^{X_t + \hat{\alpha}_t} \leq S^*_p\}$$

$$S^*_p = KE(e^I)$$

(19)

It is immediate from (19) and (20) that once the rule has been valued, the option put and call values change by $e^{\hat{\alpha}_t}$, an that the option exercise times may also change.

Proposition 2: Non-monotonicity of the Incorporation Time.

Define by $\Psi(t_y)$ the distribution governing the incorporation time, namely $t^*_y = \inf\{t \geq 0 : \hat{\alpha}_t \geq \gamma^*(t_y)\}$, and likewise define its density as $\Psi(t_y)$. The hazard rate of incorporation can then be defined as $h(t_y) = \frac{\psi(t_y)}{1 - \Psi(t_y)}$. The fact that $h(0) = 0$ follows from the specification of (17), and because $\Pr[\alpha < Q] > 0$ (the investor may never incorporate the rule into an option call or put), $\lim_{t_y \to \infty} \Psi < 1$, and $\lim_{t_y \to \infty} h = 0$.

Proposition 2 is sufficient to establish a lower (positive) bound on the incorporation time for an Investor to react to the rule, hence the optimal window for event study must include positive $t_y$. To complete the demonstration of a non-monotonic event window, consider the signal to noise ratio $\chi$, defined as
\[ \chi(t) = \frac{\alpha}{\text{Var}[S(t)]} \quad \forall t \geq t^4 \] 

As \( \chi \) grows large, \( \alpha \) and the Investor’s actions upon it become undetectable. But by \( (20) \),

\[ \text{Var}[S(t)] = e^{(\sigma^2 + \lambda^+ + \lambda^-)t} \] 

And because \( \sigma^2, \lambda^+ \) and \( \lambda^- \) are strictly positive, \( \lim_{t \to \infty} \chi \to 0 \) and approaches its asymptote exponentially.

Finally, for a multiproduct firm with positive complementarities (positive definite covariance matrix), the event window should be smaller still.

Let the multiproduct firm consist of \( N \) products (divisions), such that its asset price is given by

\[ S^m(t) = e^{X_1(t) + X_2(t) + \cdots + X_j(t) + \cdots + X_N(t)} \] 

Because \( \text{cov}(X_j, X_{j'}) \neq 0 \) for some \( j \) and \( j' \), the variances do not sum linearly. Since the covariance matrix is positive definite, however, \( \text{Var}(S^m(t)) \) is a convex combination of the finite series \( \text{Var}(e^{X_1(t)}) \), \( \text{Var}(e^{X_2(t)}) \), \( \ldots \text{Var}(e^{X_N(t)}) \), and

\[ \text{Var}S^m(t) > \text{Var}S(t) \implies \chi^m(t) > \chi(t) \] 

References


Fama, Eugene F et al. (1969). The Adjustment of Stock Prices To New Information. DOI: 10.2307/2525569. URL: http://www.jstor.org/stable/2525569?direct=true%7B%5C&%7Ddb=bth%7B%5C&%7DAN=5711094%7B%5C&%7Dsite=ehost-live%7B%5C&%7Dscope=site.


Hwang, Thomas J. et al. (2014). “Quantifying the food and drug administration’s rulemaking delays highlights the need for transparency”. In: *Health Affairs* 33.2, pp. 309–315. ISSN: 02782715. DOI: 10.1377/hlthaff.2013.0564.


Lucca, David, Amit Seru, and Francesco Trebbi (2014). “The revolving door and worker flows in banking regulation”. In: *Journal of Money, Credit, and Banking* 65, pp. 17–32. ISSN: 03043932. DOI: 10.1016/j.jmcle.2014.05.005.


