Credibility and Distributional Effects of International Banking Regulations: Evidence from US Bank Stock Returns

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September 1, 2013

Abstract

Financial regulatory networks are a pervasive, new type of global governance heralded by some as a flexible answer to globalization dilemmas and dismissed by others as ineffective due to weak enforcement mechanisms. Whether regulatory network agreements provide global public goods or private goods for certain states' firms is a second debated issue. This paper adjudicates among competing perspectives by examining whether Basel III, an international agreement negotiated by the bank regulatory network about bank capital minimums in 2009 and 2010, was viewed as credible and affecting regulated US firms. I use stock returns to measure investors' perceptions, and an event study methodology to test whether regulated banks' observed stock returns significantly differ from expected stock returns on days when new information about Basel III becomes available. If the agreement is viewed as credible and affecting firm value, banks' stock returns will deviate from expectations. The direction of any deviation indicates whether regulations benefit or hurt banks. While the direction of effects is not uniform across events, I find that the initial stock return reaction and the net effect across all five events are negative, indicating that US banks were not helped by new international regulations. Further, US banks experienced stock returns that differed from expectations, providing evidence that international regulatory network agreements are viewed as credible and tangibly affect firms independent of domestic implementation.

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1 Introduction

Financial regulatory networks – international groups of national regulators – represent a new form of governance and are the primary fora for financial regulatory cooperation.[1] Comprised of national regulators, these are neither traditional intergovernmental organizations (IGOs) nor nongovernmental organizations (NGOs). Regulatory networks create international agreements, standards, best practices, and memoranda of understandings (MOUs) that are nonbinding upon members and rely upon decentralized implementation by national regulatory authorities.

This paper's empirical analysis pushes forward two open debates about financial regulatory networks. First, do investors view regulatory network agreements as credible? That is, are international agreements expected to be implemented domestically? Regulatory network agreements are nonbinding and lack enforcement mechanisms, which may limit implementation likelihood and the ability to identify and punish free riders.[2] Second, do these regulatory agreements help or hurt banks? Some scholars suggest these agreements create global public goods, while others argue they provide private benefits to regulated US firms.[3]

To adjudicate among the competing claims of each debate, this paper analyzes the Basel III capital adequacy agreement negotiated by the bank regulatory network, the Basel Committee on Banking Supervision (BCBS). Basel III, negotiated between September 2009 and December 2010, is a most-likely agreement to affect firms because the agreement is detailed, which allows investors to evaluate expected distributional effects, and because prior agreements on the same topic have been in place since 1988, increasing the credibility of domestic implementation. Basel III unambiguously increased regulatory stringency compared to the status quo, both qualitatively (by narrowing the definition of capital) and quantitatively (by raising minimum required levels). If Basel III has no observable effect, then other BCBS outputs, such as principles and best practices, are unlikely to have any effect either.

Whether Basel III is credible and whether it holds distributional effects, however, is *a priori* ambiguous. If US banks incur adjustment costs and higher ongoing costs to comply with more stringent regu-

[1] See Slaughter 2004; Kahler and Lake 2009; and Helleiner 2012.

[2] See Downs, Rocke, and Barsoom 1996; Fearon 1998; and Koremenos, Lipson, and Snidal 2001. Specific to regulatory networks, see Slaughter 1997 and 2004; Verdier 2009; and Brummer 2011.

[3] On the former, Kapstein 1989 and 1994. On the latter, see Kapstein 1991; Oatley and Nabors 1998; Drezner 2007; and Simmons 2001.

lations, they should be hurt. However, because regulated European and Japanese banks were expected to incur even higher adjustment costs than US banks, regulations may confer a competitive advantage upon, and potentially benefit, US banks. Regarding credibility, the US delayed implementation of Basel III's predecessor agreement, Basel II, in 2006 and 2007 while Europe implemented in a timely manner. The effect of this compliance breach might decrease credibility of Basel III implementation within the US.

This paper uses an event study research design that incorporates stock returns as outcome measures to isolate investor perceptions about international regulatory network announcements.[4] Event studies analyze whether specific types of news (each instance of a news release constituting an "event") systematically affect outcomes of interest. Within the context of Basel III, events are BCBS press releases announcing Basel III negotiation progress. Basel III negotiations occur in secret and outcomes are announced through formal BCBS press releases. Thus, each press release provides new public information about Basel III regulations. On press release days, regulated firms' observed stock returns are compared to expected stock returns. If investors believe the agreement will be implemented domestically (i.e. the agreement is credible) and that domestic implementation will significantly affect regulated firm value (i.e. the agreement has distributional effects), then there should be a statistically significant difference between expected and observed stock returns. On the other hand, if regulatory network outcomes are viewed by investors as either incredible or lacking distributional effects, then there should be no observable difference. The direction of any effect indicates whether investors perceive regulations to help (if observed stock returns are systematically higher than expected) or hurt (if observed stock returns are systematically lower than expected) regulated firms.

Expected stock returns refer to stock returns that are expected in the absence of an announcement. As they are unobserved counterfactuals, these values must be estimated from observed data. For each regulated firm for each event, this paper identifies a subset of firms that have similar stock return patterns to each regulated firm but that should be unaffected by the Basel III announcements. The full set of unaffected firms is comprised of 2,884 nonfinancial firms publicly traded on US stock exchanges. I use a

[4] Two other political science event studies interested in measuring the effects of international institutions include Bechtel and Schneider, who use a traditional event study methodology to establish the effect of European Security and Defense Policy upon seven European defense stocks, and Pelc, who uses google scholar searches to establish the possibility that audience costs are present for the case of WTO dispute settlement. Bechtel and Schneider 2010; and Pelc 2013.

variable selection method called a Lasso estimator to identify the subset of nonfinancial firms that best predicts each regulated firm's stock returns *prior to the announcement*. Then, on an announcement day, the observed stock returns of the unaffected firms are used to estimate the regulated firm's expected stock return.

The proposed approach used in this paper - using select, unaffected firms to estimate the counterfactual - improves upon the common event study approach. The traditional approach uses an aggregate market index (such as the S&P 500) as a single regressor to predict each regulated firm's stock returns, resulting in two major problems. First, an aggregate market index value may include the regulated firm itself, or other firms that are affected by the event of interest. In turn, there may be direct relationships between the regressor and dependent variable. The proposed approach ensures that only nonfinancial firms comprise the counterfactual. Second, an aggregate market index is an average of many firms' stock returns on a given day, and thus include many firms that do not predict the individual firm's stock returns well. For this reason, the single index predicts many individual firms' stock returns with a high degree of variation. In contrast, this paper uses a statistical method to identify unregulated firms whose stock returns are most correlated with each regulated firm's stock returns, creating a custom market index that fits historical data with a consistently high goodness of fit. I show that the Lasso regression explains more variation in historical stock return data and provides more precise predicted values on event days compared to the traditional approach.

Stock return patterns across the five BCBS announcements about Basel III negotiating progress provide evidence that Basel III was viewed as credible and as having real effects upon regulated firms. On each announcement day, regulated firms' stock returns systematically differed from expectations.

The direction of the effects is not uniform across events, but the initial reaction and net effect across all five events are negative. Early events (the two 2009 announcements) are associated with US bank stock returns that are systematically lower than expected by an average of 1.43% and 0.41%, respectively, representing billions of dollars in foregone equity value. On these days, investors either sold bank stocks, or did not buy as readily as expected. Negative reactions to the unexpected initial announcement in September 2009 (Event 1) may be clearly interpreted as investors viewing regulations as more stringent than expected and as hurting US banks. Once Basel III was in the public eye in 2010 (following a detailed

consultative proposal released in December 2009 with public comments due April 2010), two midyear announcements, in July and September 2010, were associated with bank stock prices systematically higher than expected. Media coverage indicates the pattern is likely driven by increased regulatory certainty and long implementation timelines rather than expectations that competitive advantages from the regulation would benefit US banks. This paper illustrates a general method to analyze policies with distributional effects that are *a priori* ambiguous.

The next section explains theoretical debates associated with financial regulatory networks and justifies Basel III as a useful case for analysis. It introduces stock returns as objective measures of investor perceptions specifically attributable to news about international agreements. The distributional effects of capital minimums are explained, and hypotheses are developed to tie theoretical expectations to observable outcomes. The third section formally defines the methodology and estimation procedure used to calculate the press release effects. It provides detailed information about the data and explains analytical findings and implications. A final section concludes by discussing the larger implications of the analysis.

2 Credibility and Distributional Effects

Two debates surround the credibility and distributional effects of financial regulatory networks. First, increased regulatory stringency could plausibly help or hurt regulated firms. Second, it is unclear whether international financial regulatory network agreements will be credibly implemented as national regulations in the first place.

To adjudicate among the conflicting expectations of each debate, this paper uses systematic empirical analysis applied to Basel III. Basel III is an international agreement negotiated in 2009 and 2010 that codified bank capital minimums. Basel III emerged from closed negotiations among BCBS members. Negotiation outcomes are publicly reported through official press releases. Because of the surprise timing and content of press releases, firm-level stock returns are used to isolate and measure financial regulatory effects as perceived by investors, and as distinct from other regulations negotiated at similar times such as the US Dodd-Frank Act. Whether observed stock returns deviate from expected stock returns on days of press releases, and the direction of any deviation, informs the two debates. Hypotheses that tie

theoretical expectations to observable stock return outcomes are discussed before turning to research design and empirical analysis in the subsequent section.

2.1 Theoretical Debates About Regulatory Networks

What is the motivation behind increased regulatory stringency through financial regulatory networks? And, are resulting international agreements viewed as credible? The 1988 agreement (called Basel I) that first codified bank capital minimums is alternatively characterized as global public goods provision and as providing private goods for US domestic banks.[5] Both perspectives assume the agreement will be credibly implemented across BCBS member countries, but they hold different expectations about the direction of the agreement's distributional effects for regulated firms.

The public goods perspective is that international agreements enable greater financial stability while maintaining competitive advantage across countries.[6] Regulators desire both financial stability and domestic bank competitiveness, yet when a regulator unilaterally decides upon a level of national regulatory stringency, he faces a tradeoff between these two objectives, known as the "regulator's dilemma".[7] Higher (lower) regulatory stringency increases (decreases) financial stability, but hinders (helps) competitiveness of regulated firms. However, if regulators from different countries coordinate regulatory increases, it alleviates each country's regulator's dilemma. Financial stability increases while competitiveness is maintained. The increase in financial stability is a global public good.

A contrasting, private goods perspective is that higher regulatory stringency *increases* the competitiveness of firms in states that already have high regulatory stringency.[8] International agreements require member countries with low regulatory stringency to increase minimum regulatory levels, while member countries with higher regulatory stringency, at the time of the agreement, face lower adjustment costs to comply. In this way, banks in states with high regulatory stringency prior to the agreement will incur *private gains* in competitiveness compared to banks in states with relatively low status quo stringency.[9]

These perspectives anticipate opposite distributional effects. The public goods perspective expects

[5] Kapstein 1989 and Oatley and Nabors 1998, respectively. Singer extends the debate to identify conditions under which regulators generally prefer international cooperation. Singer 2004 and 2007.
[6] Kapstein 1989.
[7] Ibid., 324.
[8] Oatley and Nabors 1998.
[9] Within the context of Basel I, Japanese bank expansion was the main concern. See, for example, Oatley and Nabors 1998, 36; and Tarullo 2008, 45–54.

competitive advantage across countries is maintained while all countries' banks must comply with higher minimums. In this case, US banks will be hurt by increased regulatory stringency, as compliance requires adjustment and ongoing operational costs. The private goods perspective expects relative benefits for banks in countries with high regulatory stringency prior to the agreement. In this case, US banks, which begin from high stringency, will benefit from competitive advantages shaped by the agreement.

The credibility of financial regulatory networks, while assumed by both the public goods and the private goods perspectives, is debated among international law scholars. Regulatory networks represent a new form of governance that does not neatly fit into existing governance typologies.[10] From a functionalist perspective, the rise and proliferation of regulatory networks implies that demand exists for such governance structures. Slaughter argues that these groups are flexible, efficient, and accountable, and that their nonbinding nature facilitates governments' willingness to delegate to international bodies.[11] From an institutional design perspective, Verdier and Brummer, among others, argue that regulatory network agreements are ineffective because they lack enforcement mechanisms.[12]

Negotiated agreements that emerge from financial regulatory networks are all nonbinding soft law, as they are not established through treaties or other formal obligations among countries.[13] Informal agreement lowers the likelihood, relative to binding agreements, that states will implement.[14] Implementation itself is decentralized, requiring each country to incorporate the agreement's terms within its national regulations or domestic laws. Finally, regulatory networks lack institutional enforcement mechanisms through which noncompliance may be identified and rectified. For these reasons, financial regulatory networks have formal characteristics of relatively weak international organizations.[15] Specif-

[10] Political science typologies abound to explain the form and function of various global governance arrangements, yet regulatory networks fall through the cracks because they are not agreed upon by executives or direct executive representatives, and agreements are nonbinding. For instance, see Koremenos, Lipson, and Snidal 2001 on formal features of international institutions; Abbott, Keohane, Moravcsik and Slaughter 2000 on legalization; Abbott and Snidal 2000 on hard and soft law; Abbott and Snidal 1998 on formal institutions' roles; Lipson 1991 on informal agreements; and Vabulas and Snidal 2013 on informal international organizations. A related set of typologies theorize about relationships between various actors and government authority. See, for instance, Kahler and Lake, eds. 2003; Hawkins, Lake, Nielson, and Tierney, eds., 2006; and Buthe and Mattli 2011. This list excludes a large legal scholarship exploring concepts and implications of hard versus soft international law.

[11] Slaughter 1997, 185–186 and 2004, 1–64.

[12] Verdier 2009, especially 132–133, 162–163; and Brummer 2011, especially 263–264.

[13] Soft law describes agreements that are legally nonbinding, while hard law includes laws or regulations on the books. See, for example, Abbott and Snidal 2000; and Raustiala 2005. In the US case, regulators hold administrative authority to implement into regulations.

[14] Lipson and Simmons both argue that nonbinding, or informal agreements rely upon reputation to compel compliance. Lipson 1991; and Simmons 2000.

[15] This statement is descriptive and takes the regime design as a given in order to emphasize the questionable nature of country compliance with financial regulatory network agreements. Theoretically, institutional design features are endogenous to member preferences at creation and evolution of any regime. Explaining the design of financial regulatory regimes lies outside the scope of this paper, although existing theories expect that states create weak institutions when there is a

ically, the BCBS relies upon decentralized implementation, holds limited monitoring channels, and has no process to address compliance breaches, all increasing state discretion to implement and comply on an ongoing basis.[16] Empirically, the US delayed Basel II implementation while Europe implemented ahead of schedule. Basel II did not have to be adopted until 2006, but in October 2005 the European Union adopted a Capital Adequacy Directive implementing Basel II. In contrast, US regulators issued final rules more than two years later, in November 2007.[17] Nonetheless, Slaughter and others continue to find regulatory networks remain a growing form of governance associated with widespread adoption and policy diffusion.[18]

If regulators implement international agreement terms by incorporating them into national laws or regulations, full domestic bank compliance may be assumed.[19] This is empirically justified. The United States, along with other advanced industrial countries, has strong bank supervision, meaning that regulators have broad powers to oversee bank operations and, on an ongoing basis, to sanction banks that do not comply with regulations. Because US banks generally comply with regulations on the books, and so the relevant research question is whether international agreements shape national regulation.[20] The next section discusses these debates within the context of Basel III, and justifies the case selection.

The Case of Basel III

Basel III represents a regulatory network agreement which is most likely to be credible and to have distributional effects. It is preceded by the 1988 Basel I agreement and its 2004 renegotiation (called Basel II), both of which were widely adopted among BCBS members and nonmember states.[21] Wide adoption of prior agreements may increase the likelihood that Basel III will be implemented domestically. Second, among financial regulatory outputs, Basel III is rule-based and unusually detailed. Thus, observers can anticipate and evaluate the regulation's distributional effects once details become available. Third,

high future uncertainty about various aspects of the issue at hand. Koremenos, Lipson and Snidal 2001.

[16] It is worth noting that a number of authors argue that formal institutional enforcement is not necessary for effectiveness. See Lipson 1991; Chayes and Chayes 1993; Simmons 2000; Gilligan 2006; Dai 2007; Kelley 2007; and Morrow 2007. Or, informal practices of formal institutions may matter more than formal practices, as in Stone. Stone 2011.

[17] Tarullo 2008, 126–130.

[18] Slaughter 2004; Kahler and Lake 2009; and Bach and Newman 2010.

[19] Thanks to Stephen Chaudoin for emphasizing this point.

[20] Whether the content of regulations adequately prevents crisis and limits regulatory arbitrage opportunities is a separate question outside the scope of this inquiry.

[21] Simmons 2001; Ho 2002; and Barth, Caprio, and Levine 2006.

Basel III significantly increased regulatory stringency compared to Basel II, forcing banks to maintain triple the old standard for high quality (i.e. Tier 1) capital. Finally, as will be discussed below, Basel III's negotiation process enables a research design that can isolate investors' reactions to international agreement news. The next section explains the distributional effects of Basel III upon US firms in more detail before explaining how credibility and distributional effects will be measured.

Distributional Effects of Basel III

Regulatory capital is a bank's buffer against unexpected losses.[22] An accounting measure called the "capital ratio" – regulatory capital as a percent of risk-weighted assets – quantifies a bank's capital level at any time. Three aspects of Basel III regulations, the definition of capital, minimum required capital levels, and the implementation timeline, all affect the magnitude and direction of the distributional effects upon regulated firms. First, the *capital ratio definition* delineates what counts as regulatory capital and sets rules for calculating asset riskiness. It can affect the types of assets and capital that firms hold, in turn affecting adjustment costs and ongoing costs to comply with regulations. Second, the required *minimum capital ratio level* is thought to affect firms' ongoing opportunity costs, as holding higher levels of capital requires firms to hold money that could otherwise be actively invested. Finally, the *implementation timeline* affects how quickly firms must adjust operations to become compliant. Long timelines provide firms with flexibility. From a competitiveness perspective, US firms are most likely to benefit compared to European and Japanese rivals, primarily through capital ratio definition details.

Capital Ratio Definition Details. Capital ratio components, regulatory capital and risk-weighted assets are calculated as a combination of balance sheet accounts.[23] Balance sheet accounts are comprised of assets, liabilities and shareholder's equity.[24] Liabilities and shareholder's equity accounts are both types of firm financing, but liabilities are financing that the firm promises to pay back (e.g. loans) while shareholder's equity is financing in return for corporate ownership (e.g. stock shares). While a company is insolvent if it cannot pay its debt, shareholder's equity does not define a firm's solvency. Capital is

[22] In contrast to "unexpected loss", an example of an "expected loss" is a bank's estimated percentage of loans that will not be repaid as part of standard business operations. Expected loss is incorporated directly into a reserve line item on the bank's balance sheet.

[23] The following is a simplified description for the purpose of explaining the role of capital and how regulatory definition of capital may affect firms' costs in the short- and medium-term. For a more technical review, see Tarullo 2008, 16–29.

[24] Because of double-entry bookkeeping, at any given time a company's assets exactly equal the sum of a company's liabilities plus shareholder's equity.

comprised of shareholder's equity accounts, and in this way it acts as a buffer against insolvency (i.e. paying debt obligations) in the case that assets do not produce expected revenues to cover liabilities. The most narrow definition of "capital" would be common stock and retained company earnings. Broader definitions of capital reflect capital with higher levels of obligation for the company to pay shareholders (e.g. preferred stock and hybrid capital). Basel I and Basel II each defined two tiers of capital: "Tier 1" comprised of narrow capital and "Tier 2" comprised of broad capital. Basel III created additional minimum levels of common stock distinct from Tier 1 and Tier 2.

Upon initial announcement of Basel III negotiations in September 2009 (Event 1), it was clear that capital would be narrowly defined under Basel III, in turn requiring higher adjustment costs for European and Japanese banks as compared to US banks. As of 2008, European banks held high levels of hybrid securities, which are combinations of debt and shareholder's equity. These were a form of Tier 2 capital under Basel II but would not be considered regulatory capital under Basel III's more narrow definition. Media coverage of the initial Basel III announcement in September 2009 immediately identified European banks, especially French and German banks, as being hurt because of reliance upon hybrid securities.[25] Japanese media also reported throughout late 2009 and 2010 that Basel III's narrow capital definition would require Japanese banks to raise capital.[26] In contrast, no reports identified US banks as incurring especially high adjustment costs relative to other countries. Thus, if any country's banks would benefit from relative competitive advantage, it would be US banks at the expense of European and Japanese banks.

Although a secondary issue during Basel III negotiations, asset risk-weights affect a firm's capital ratio. Asset risk-weights capture each asset's likelihood of incurring an unexpected loss.[27] For illustrative purposes, under Basel I investments viewed as most safe, such as cash or loans to OECD member governments, had a zero percent asset risk-weighting, indicating that no capital need be held against

[25] For instance, on September 15, 2009, Reuters reported, "The big change in Sunday's reforms is that at least half of core Tier 1 capital must be common equity and retained earnings.... A greater focus on common equity within Tier 1 is already something the United States has done and Switzerland and the UK as well, but there are still plenty of markets in Europe where hybrids account for a large proportion of capital.... This could affect UK government stakes in UK banks, as well as holders of hybrid capital in banks elsewhere in Europe. It may force France and Germany to semi-nationalise more of their banks." *Reuters News*, 2009, "Banks Eye Clock on Tougher Capital Rules", September 15. Similar sentiments were reiterated in January 2010 following the release of the consultative proposal, for instance, Weaver, Courtney, 2010, "Capital Rules Worries Hurt Banks *Financial Times* January 13, Asia Page 22.

[26] For instance, *Neikkei Report*, 2009, "Narrower Definition of Core Capital to Hurt Japanese Banks. November 6; and *Nikkei Report*, 2009, "Japan Still Wary About Early Enforcement of New Basel Rules, December 24.

[27] See footnote 22.

these assets. In contrast, investments considered more vulnerable, such as loans to non-OECD member governments, held a 100 percent risk-weighting, meaning minimum capital (8%) of the full value of the assets must be held by the bank.[28]

Capital Ratio Levels. Basel III clearly increased minimum levels of required capital compared to Basel I and Basel II.[29] Minimum required *levels* of capital are associated with opportunity costs, as banks are forced to hold greater amounts of capital that could otherwise be invested to earn a return.[30] Firms that must raise capital to become compliant with new minimums will incur adjustment costs. For a bank to increase its capital ratio it must increase capital (the ratio's numerator) or decrease risk-weighted assets (the ratio's denominator). Common approaches by banks to increase capital ratio levels are to issue new stocks, to change the asset mix, or to sell-off assets. Each option is expensive, as new equity issues dilute existing stock shares' values, and selling assets or substantially changing asset mix takes time.

Implementation Timelines. Finally, implementation timelines affect banks' adjustment costs. BCBS members made clear throughout BCBS press releases that implementation would not hinder general economic recovery. Banks prefer long timelines because it allows for gradual compliance and the possibility of favorably interfering in regulatory details at the level of national implementation.

In summary, while Basel III unambiguously increased regulatory stringency compared to existing regulations, US firms could plausibly be helped or hurt.[31] Capital definitions were expected to affect European and Japanese regulated banks more so than US firms. The next section explains how stock returns are used to assess credibility and distributional outcomes of the regulations upon regulated US banks.

[28] For in-depth discussion of the distortions and distributional effects of Basel Accord asset risk-weightings for developing countries, see Claessens, Underhill and Zhang 2008.

[29] Basel I required 8% minimum capital to risk-weighted assets, with at least 4% of risk-weighted assets held as Tier 1 capital. Basel III also required 8% minimum capital to risk-weighted assets, but comprised of higher quality capital. Moreover, Basel III requires that common equity comprise at least 4.5% of risk-weighted assets and total Tier 1 capital (including common equity) must comprise at least of 6% of risk-weighted assets. Basel III additionally requires a dynamic, countercyclical buffer (additional capital that has to be held during times of high credit growth), a leverage ratio (a straightforward measure of Tier 1 capital over non-risk weighted assets), and a liquidity ratio (a measure of liquid assets as a percent of liabilities). GAO 2012, 8.

[30] This is a common assumption but not a fact. For a strong argument that holding higher levels of capital does not increase firm costs, see Admati and Hellwig 2013. Additionally, many banks overcomply with capital regulations on an ongoing basis and therefore perhaps adjustment costs are small. See, for example, Winecoff 2012.

[31] At any given time, however, the direction of the effect is contingent upon investors' expectations, which change as regulatory details develop.

2.2 Using Stock Returns to Measure Institutional Effects

It is challenging to find a measure that isolates the effects of international institutions and international agreements because international institutions are endogenous to member selection into institutions, and international agreements are endogenous to member negotiations.[32] This study uses firm stock prices as observable measures that inform regulatory effects. Stock prices, transformed into stock returns, are analyzed within an event study, a research design with clear counterfactuals that circumvent endogeneity and have causal interpretation.

Stock prices adjust to public news almost immediately, and this analysis uses stock returns to proxy for investors' perceptions about international agreements. Considering only the immediate period following the announcements isolates reaction to the expected effects of the international agreement.[33] Stock returns offer a costly, observable measure of investors' changing perceptions of a firm's value. A large literature in economics debates whether stock price movements are best explained by the efficient market hypothesis, where investors rationally and consistently recalculate firm value, or by behavioral theories, where investors trade based on expectations of the future nominal price of the stock distinct from the underlying firm value. However, no assumption about investors' trading behaviors are necessary in this application because regardless of an investor's trading strategy all investors seek profit. Whether an investor trades because his perception of a stock's inherent value changes (if he acts consistently with efficient market theories) or because he anticipates other actors' reactions will result in a change in the stock's nominal value (if he acts consistently with behavioral theories), the observable outcome – a stock price change – is the same.[34] New information that changes an investor's perception of a stock's value will cause him or her to act, with the change reflected in the stock price and occurring on the day that new information is available. Stock returns thus proxy for perceived credibility and distributional effects of the regulation. Firms regulated by the agreement are those that should be affected by investor actions.

This study contributes micro-level evidence to existing empirical studies that use policy adoption and firm accounting data to measure long-term regulatory effects. Bach and Newman establish the

[32] See Downs, Rocke, and Barsoom 1996; Von Stein 2005; Hafner-Burton, Victor, and Lupu 2012; and Martin 2013.
[33] Although, it is distinct from national implementation.
[34] For an overview of the efficient market hypothesis and behavioral theory challenges, see Malkiel 2003; and Kindleberger 2005, 38–63. For examples of behavioral theories across time, see Kindleberger 2005; Galbraith 1954, 71–92; and Akerlof and Shiller 2009.

most systematic empirical association between financial regulatory networks and state policies.[35] They convincingly show that states with securities regulators who are members of the securities regulatory network (called IOSCO), are more likely to adopt and implement insider trading legislation. No equivalent pattern holds for states with bilateral MOUs with the US. Bach and Newman establish broad patterns of adoption and implementation, yet these are necessarily associational and not causal, as there is endogeneity in selecting into the institution and policies.[36] Bernauer and Koubi use accounting data to establish regulatory effects upon firm operations. They provide empirical evidence that higher minimum capital regulations are associated with less loan liquidity.[37] The limitation of this approach is the inability to isolate whether firm changes are due to international agreements or domestic implementation of the agreement.

The next section explains Basel III negotiation as an especially appropriate case for such an analysis because of the opaque BCBS negotiation process and specific, identifiable dates when negotiation progress becomes public knowledge.

2.3 Surprise Announcements

BCBS press releases represent new public information about Basel III negotiation progress, making Basel III an appropriate case upon which to apply an event study research design. Because stock returns constantly adjust to new information, to identify a stock price effect it is important that information be released to the public on a clear date without prior information leaks.[38] The standard BCBS negotiation process, followed for Basel III, upholds this element of surprise.

To negotiate Basel III, the BCBS followed its standard negotiation process characterized by closed meetings among BCBS members followed by public press releases to announce meeting outcomes, and a public consultative process. Table 1 outlines the five events that constitute the international agreement negotiations.[39]

BCBS press releases are surprises in both release dates and content. As shown in Table 1, BCBS

[35] Bach and Newman 2010.
[36] See footnote 32.
[37] Bernauer and Koubi 2002, 2004, and 2006.
[38] If the content of an announcement is accurately anticipated or released to different actors at different times, stock returns will adjust prior to the official announcement.
[39] Although additional updates that tweak the December 2010 agreement and develop some of the more vague regulations have occurred since.

	Event Description	BCBS Meeting Date	BCBS Press Release Date		Basel III Regulatory Details?
1	Agree to Negotiate	2009 September 6	2009 September 7	(Monday)	No
2	Consultative Proposals	2009 December 8–9	2009 December 17	(Thursday)	Yes
3	Agree to Finalize	2010 July 14–15	2010 July 26	(Monday)	No
4	"Calibration" (Minimum Levels)	2010 September 12	2010 September 12	(Sunday)	Yes
5	Final Rules Release	2010 Nov 30 - Dec 1	2010 December 16	(Thursday)	Yes

Table 1: *Events*: Between September 2009 and December 2010, five BCBS meetings resulted in press releases providing public information about Basel III negotiations. Event 1 and Event 3 state broad agreement to move forward with negotiations to increase regulatory stringency, without providing details of the regulations, while Event 2, Event 4, and Event 5 provide details about some aspect of the likely Basel III rules. SOURCE: BCBS press releases, available on the BIS website, `http://www.bis.org/list/press_releases/index.htm`.

press releases are not released at a set time following a BCBS meeting. Press releases range from being announced on the same day as the BCBS meeting (as in the case of Event 4, where both the meeting and press release occur on September 12, 2010), to being announced more than two weeks after the meeting (as in the case of Event 5, where the meeting was held on November 30 and December 1, 2010 but a press release detailing meeting outcomes was not made until December 16, 2010). Further, newspaper coverage about the Basel Committee between events provides no indication that there are any non-events, where investors expected, but the BCBS did not make, a press release about negotiation progress.

The BCBS is an extremely opaque negotiating body and BCBS press release content is unknown to the public and to private interests prior to formal announcements.[40] Meeting minutes are never publicly released, and the organization maintains closed archives.[41] Although the public may know BCBS meeting dates, newspaper coverage never reports meeting *outcomes* prior to BCBS press releases, increasing confidence that press releases reflect new public information.[42] Further, interview evidence suggests that, during 2009 and 2010, the BCBS maintained especially formal and distant relations with private interests.[43]

Finally, BCBS meeting outcomes cannot be known with certainty prior to each meeting because BCBS members actively negotiate within meetings.[44] In a rare description of BCBS meeting proceedings, Sheila Bair, the US Federal Deposit Insurance Corporation (FDIC) chairman during the Basel III negotiation

[40] Zaring 1998, 288.

[41] The forward of a new BCBS history specifically acknowledges that the historian's access to BCBS archives was granted under special permission. Even then not all archives were made available and access was restricted to the period ending in 1997. Nout Wellink in Goodhart 2011, ix–x.

[42] This statement is a generalization of all *Financial Times* and *The Wall Street Journal* newspaper coverage surrounding the events. One exception is a leak on the Japanese market just prior to Event 5.

[43] Young forthcoming.

[44] The described process lies in contrast to G-20 leaders' meetings, the content of which is largely prearranged prior to meetings. Throughout Basel III negotiations, BCBS membership included 27 countries.

period, gives no impression that BCBS meeting outcomes were determined prior to each meeting.[45] In contrast, she documents a fragmented US negotiating position just days prior to certain BCBS meetings about Basel III.[46] If the US position was unclear prior to meetings, it is reasonable to believe that the collective outcome of a 27-country negotiation was also unforeseeable. No negotiation updates occur between BCBS meetings.

Overall, BCBS press releases about Basel III negotiations represent new public information upon which investors may trade.

Contingent Expectations

Because stock return deviations capture changes relative to investor expectations *at a given time*, ideally each press release's content could be compared to an objective measure of investors' expectations just prior to the announcement on each dimension of regulations (e.g. expected capital levels, capital definitions, and implementation timeline). Unfortunately, no such measure exists to the author's knowledge and would be nearly impossible to create given limited media coverage of Basel III prior to announcements. However, media coverage provides high-level insights. Specifically, between September 2009 and December 2010, Basel III regulations were consistently expected to be more stringent than the status quo, and Event 1 (initial announcement that Basel III negotiations would begin) and Event 4 ("calibration", or the revelation of specific capital minimums and implementation timelines) emerge as the events that generated the most media coverage and may be considered most substantively important.

Event 1, on September 7, 2009, was a press release announcing that BCBS members agreed in principle to update capital standards, and offered broad direction of reforms. Minimum capital quantities and quality would increase compared to the status quo. A leverage ratio and liquidity ratio would be introduced. The *Financial Times*' London Edition reported on September 8, 2009 that, "Regulators have agreed [upon] tough rules for banks...that would force many institutions in Europe to raise tens of billions of euros in capital in coming months."[47] While investors expected some form of new regulations would be negotiated, the timing of the announcement came as a surprise.

[45] Bair 2012, 257–272.
[46] Ibid., 266.
[47] Jenkins, Patrick, Norma Cohen, and James Wilson, 2009."Europe's Banks Face Capital Push After Regulators Agree to Tough Rules." *Financial Times*, September 8, London Page 1.

Event 2 included two consultative documents released on December 17, 2009 and were reported upon by the media to be more stringent than expected. "The description of what will count as tier 1 capital and how the leverage ratio will be calculated was stricter than some analysts had expected."[48] with public responses due April 16, 2010. At the same time, multiple newspaper reports commented that the implementation timeline was longer than expected.[49] By the time of Event 3, July 26, 2010, consultative proposals had been scoured by the public and new regulations were clearly on the way. "Basel III" was a household name.

Event 3 occurred in the wake of media reports that bankers were trying to weaken Basel III proposals. On July 28, 2010 the *Financial Times* reported that "the principles outlined late on Monday by the Basel Committee on Banking Supervision contained far-reaching concessions [by regulators towards industry preferences for weaker regulations]."[50] Nonetheless, the BCBS announced general agreement to move forward with negotiations, and included some intended modifications from the consultative proposals regarding certain specific capital definitions. Event 3 also occurred just after the seminal US national legislation, the Dodd-Frank Wall Street Reform and Consumer Protection Act, was signed into law on July 21, 2010.[51]

Finally, Event 4 and Event 5 provided regulatory details of capital minimum levels and confirmed the shape of rules, respectively. Event 4 on September 12, 2010 was "calibration", the first unveiling of minimum capital levels that banks would have to hold. The *Wall Street Journal*'s front page headline read, "Banks Get New Restraints - Historic Refashioning of Rules,"[52] while the front page of the *Financial Times* explained, "global banking regulators on Sunday sealed a deal to in effect triple the size of the capital reserves that the world's banks must hold against losses..."[53] Regulatory stringency unambiguously increased. At the same time, it was noted generally that regulated banks welcomed certainty about the regulations with which they would have to comply. An official implementation timeline

[48] Jenkins, Patrick and Brooke Masters, 2009."Tougher Than Expected Framework Leaves Room for Manoeuvre." *Financial Times*, December 18, London Page 8.

[49] See *Nikkei Report*, 2009, "Banks Given 10 Years to Meet Tougher Capital Rules," December 16; and Fukase, Atsuko, 2009, "Basel Group to Ease Bank Rules," *The Wall Street Journal Europe*, December 17, Page 23.

[50] Murphy, Megan, and Patrick Jenkins, 2010."Shares Bounce as Regulators Soften Rules." *Financial Times*, July 28, London Page 5.

[51] H.R. 4173, the Dodd-Frank Wall Street Reform and Consumer Protection Act, was presented to the President on July 15, 2010 and signed into law on July 21, 2010. THOMAS US Library of Congress Bill Summary, `http://thomas.loc.gov/cgi-bin/bdquery/z?d111:HR04173:@@@R` (December 3, 2012).

[52] Paletta, Damian and David Enrich, 2010. "Banks Get New Restraints - Historic Refashioning of Rules" *Wall Street Journal*, September 13, A1.

[53] Masters, Brooke, 2010. "Basel Deal Reached on Banks' Reserves." *Financial Times*, September 13, London Page 1.

was released, confirming full implementation would not be required until 2019.[54] The final rules release, Event 5 on December 17, 2010, finalized regulatory details and the implementation timeline, without any significant changes or surprises from previously released details. The *Wall Street Journal* stated, "the resulting compromise was rules that are much tougher than the current requirements but don't fully kick in for nearly a decade."[55] Thus, regulations were confirmed to be of high increased regulatory stringency compared to the existing regulations.

While Basel III increased stringency compared to the status quo, it is unclear a priori how investors evaluate the relative contributions of more stringent rules, the long implementation timeline, and general regulatory certainty. Stock market data provides an unambiguous indication of whether investors, in the aggregate, viewed news to be especially helpful, especially harmful, or a wash, for banks.

Event 1 (agreement to negotiate with broad objectives) and Event 4 (detailed capital minimums and implementation timelines) emerged as the most important news events, evidenced by front page stories in both *The Wall Street Journal* and the *Financial Times*. Reaction to Event 1 clearly captures investors' initial perspectives about increases in regulatory stringency. Specific to Basel III, it should be difficult to find an observable negative effect for the first announcement (i.e. Event 1) since investors could reasonably expect increasingly stringent bank regulations after the height of the financial crisis in September 2008 and likely priced expected costs of increasingly stringent regulation into bank stock prices prior to Event 1 in September 2009. As early as November 2008, the French President and British prime minister called for a "New Bretton Woods," assumedly a sweeping overhaul of international financial cooperation. Leaders of G-20 nations began meeting semi-annually in November 2008 to coordinate international crisis response, and the ascent of democratic Barack Obama to the US presidency in January 2009 all increased the likelihood of more stringent regulations for US banks.

Event 4 confirmed dramatic increases in required minimum capital levels. Stock return reactions to Event 4 capture investors' marginal changes in expected firm value relative to cumulative expectations. The next section lays out hypotheses that tie theoretical expectations to observable outcomes.

[54] Although, with shorter-term, phase-in deadlines.

[55] Enrich, David, 2010. "Global Finance: New Rules Mean More Capital for Banks." *Wall Street Journal*, December 17, C3.

2.4 Hypotheses

For reasons explained above, stock returns of US regulated banks on dates of BCBS press releases are used to proxy for investor reactions to Basel III negotiating progress. Each regulated firm's *observed* stock return is compared to a firm-specific *counterfactual* stock return. The counterfactual stock return is the estimated firm stock return in the absence of any extraordinary news on a given day. The difference between each firm's observed stock return and counterfactual stock return is the firm's abnormal return, or the estimated effect of the announcement for the firm ("Abnormal Firm Return"). The average effect across all firms on a trading day is the average effect of the press release ("Average Announcement Effect").[56] Average Announcement Effect is estimated for each of the five BCBS press release announcements between September 2009 and December 2010. If regulated firms experience systematically negative or positive average effects on days of BCBS announcements, this is evidence that investors are reacting to BCBS press release content.

As discussed earlier, the most fundamental question is whether BCBS press releases provide meaningful news to investors. Investors will only react to BCBS press releases if Basel III is viewed as both likely to be implemented and is viewed to significantly change perceived firm value. Thus, an Average Announcement Effect statistically distinct from zero requires an agreement that investors perceive as both credible and as having distributional effects. This leads to Hypothesis 1.

Hypothesis 1, Institutional Effect*: If an international agreement is viewed to be credible and to impact the profits of regulated firms, then regulated firms' stock returns will have non-zero Average Announcement Effects on press release days.*

As discussed above, the direction of any effect implies whether US regulated banks were helped or hurt by Basel III regulations, and it is worth reiterating that stock price changes are conditional upon investor expectations at an existing point in time. Four mechanisms could underlie increasingly stringent regulations in a way that *benefits* banks. First, consistent with Oatley and Nabors, regulatory details may benefit firms that easily comply with regulations compared to firms that face high adjustment

[56] In formal event study terminology, Average Announcement Effect is called "Average Abnormal Return". BCBS "announcements" and "press releases" are used interchangeably. For an overview of event study calculations and intuition, see MacKinlay 1997; and Corrado 2011. For event study methodological issues, see McWilliams and Siegel 1997.

costs.[57] This calculation occurs at the firm level, yet national differences, as discussed above, affect general proclivity of regulations to be more or less favorable to a country's banks. US banks faced lower adjustment costs to comply with Basel III than did European and Japanese banks. While a direct comparison of US and foreign stock returns is beyond the scope of this paper, focusing upon US banks identifies whether investors viewed competitive advantage to be the *dominant* effect of regulations. This mechanism relies upon relative adjustment costs of compliance.

Second, keeping in mind that reactions are conditional upon investor expectations at a given time, if regulatory details were less stringent than investors expected, bank stock returns could increase on days when new information reveals regulations are not *as* stringent as expected. Third, if investors prefer regulatory certainty and are less concerned about regulatory details, certainty could increase bank stocks. This was cited in media coverage and earnings calls. Finally, in the wake of the 2008 financial crisis, investors may have an increased preference for financial stability, or if the regulations are expected to increase firms' long-term financial stability, this may actually *increase* investors' perceptions of firm value.[58] Under all these alternative circumstances, US banks will benefit from stringent regulations, and stock returns would be systematically *positive* on event days.

If any of the four mechanisms are the dominant one at work, then US banks will benefit from stringent regulations. Demand for bank stocks will increase, regulated banks will have positive Abnormal Firm Returns, and in aggregate, Average Announcement Effect will be positive. This leads to Hypothesis 2a.

Hypothesis 2a, Bank Regulatory Benefits*: If Basel III is viewed as a credible international agreement and is expected to benefit regulated firms, then days of BCBS press releases will be associated with positive estimated Average Announcement Effects.*

An alternative expectation is that Basel III will hurt banks due to compliance costs or because regulations are more stringent than expected. More stringent regulations are often associated with adjustment costs to become compliant and ongoing opportunity costs associated with holding higher capital. Increased firm costs will hurt banks.[59] If investors perceive regulated banks as less profitable

[57] Oatley and Nabors 1998.
[58] Thanks to Bob Keohane, David Lake, and Helen Milner for each emphasizing this point.
[59] This does not mean that companies do incur costs, but instead that investors perceive this as the dominant effect of regulations.

Hypothesis	Theoretical Concept	Research Question	Observable Implication
		Does Basel III...	
H1, Institutional Effect	Credibility	...affect banks?	Average Announcement Effect $\neq 0$
H2a, Regulatory Benefits	Distributional Effects	...help banks?	Average Announcement Effect > 0
H2b, Regulatory Costs	Distributional Effects	...hurt banks?	Average Announcement Effect < 0

Table 2: *Hypothesis Summary*: Hypotheses and observable implications are presented in the above table.

investments today compared to yesterday, demand for bank stocks will decrease, firms will experience negative Abnormal Firm Returns, and the analysis will reveal a negative Average Announcement Effect. This leads to Hypothesis 2b.

Hypothesis 2b, Costly Bank Regulations*: If Basel III is viewed as a credible international agreement and is expected to increase regulated firms' operating costs, then days of BCBS press releases will be associated with negative estimated Average Announcement Effects.*

For clarity, the three hypotheses are summarized in Table 2. The next section formally defines the method used to test for evidence of each hypothesis, and the research design as applied to Basel III negotiations.

3 Empirical Analysis

This section applies an event study methodology to estimate the effect of Basel III negotiation news upon US regulated firm stock returns. After describing the event study methodology, sample firms, and events, I define the model and quantity of interest. The paper uses a variable selection method to estimate counterfactual outcomes (that is, stock returns in the absence of an announcement). Compared to the traditional approach, based upon an aggregate stock market index, the variable selection model increases estimation precision and flexibility to conduct sensitivity tests related to estimation window choice. Results are then presented and interpreted.

3.1 Event Study Methodology

Stock return event studies test whether an event of interest leads to unusually high or low unexplained stock returns in the immediate period surrounding an event.[60] A strength of an event study is a clearly

[60] The seminal event study was Fama, Fisher, Jensen and Roll, who studied the effect of stock splits on stock returns. Binder emphasizes that regulatory event studies (where regulations are the events of interest) are especially difficult to

identified counterfactual. Applied to Basel III, BCBS press releases comprise the five events of interest. The trading day on which an event occurs is the day when any estimated effect is most attributable to investors' reactions to Basel III news.[61] When BCBS press releases occur on non-trading days (e.g. Event 1 and Event 4), adjustment is expected on the first trading day following the press release.[62] This paper is interested in the effect of news upon firms that would be subject to the agreement's regulations. Regulated firms are both identifiable and cannot opt into or out of being regulated.[63]

Stock Return Data

Stock returns, the percent change in stocks' prices today compared to yesterday, provide normalized measures of stock price changes across firms. For example, on the first trading day of 2009, Wells Fargo's stock return was 1.76%, reflecting a nominal stock price increase of \$0.56 (from \$29.48 to \$30.00). This stock return is about equal to Bank of America's 1.78% stock return, even though Bank of America's nominal stock price increase was only \$0.25 (from \$14.08 to \$14.33). The analysis uses stock returns that account for dividends and stock splits.[64]

Stock prices are not especially volatile across the 2009 and 2010 analysis period. Figure 1 plots broad US bank stock price trends between 2008 and 2012 compared to January 2008 levels, with grey panels highlighting 2009 and 2010, the years of Basel III negotiation. Dotted lines indicate the five press releases. The left panel shows divergent trajectories for the largest American banks. While JPMorgan Chase and Wells Fargo's values plummeted during 2008, each recovered by the end of 2009. In contrast, Citigroup and Bank of America's stock values fell and, through the end of 2012, remained low compared to January

uncover abnormal stock returns because there is typically lots of anticipation surrounding regulations. Fama, Fisher, Jensen, and Roll 1969; and Binder 1985.

[61] The logic is not that BCBS announcements about Basel III are the only events leading to systematic returns. Instead, conditional on a Basel III negotiating announcement, an effect is expected if investors follow negotiation news about the international agreement. Media reports on announcement days reveal no obvious news that might affect all large banks but not the market as a whole, which might confound interpretation of announcement days as reaction to Basel III, with the exception of Event 3 which occurs just before the US Dodd-Frank Act is signed into law.

[62] Event 1 is a press release made on US Labor Day (2009 September 7) and Event 4 is a press release on a Sunday (2010 September 12), both nontrading days. The first trading days following these events, and the days I expect to observe Average Announcement Effects on September 8, 2009 and September 13, 2010, respectively.

[63] Theoretically, the firms could leave due to bankruptcy or enter if they experience high growth or through mergers. For this sample, however, no firms grow to become large enough to meet the threshold during this period, and firms that go bankrupt are excluded because of the criteria that trading data must be available for all trading days during 2009 and 2010. The sample thus includes firms that have been large for the full period under consideration. Thanks to Christina Davis for emphasizing this point.

[64] Formally, this is the Center for Research in Security Prices' (CRSP's) "holding period return", also known as "adjusted return" in Yahoo! Finance. Alternative approaches include the difference in logged prices or nominal percent change, but these do not capture stock splits or dividends which are not necessarily observable in nominal data.

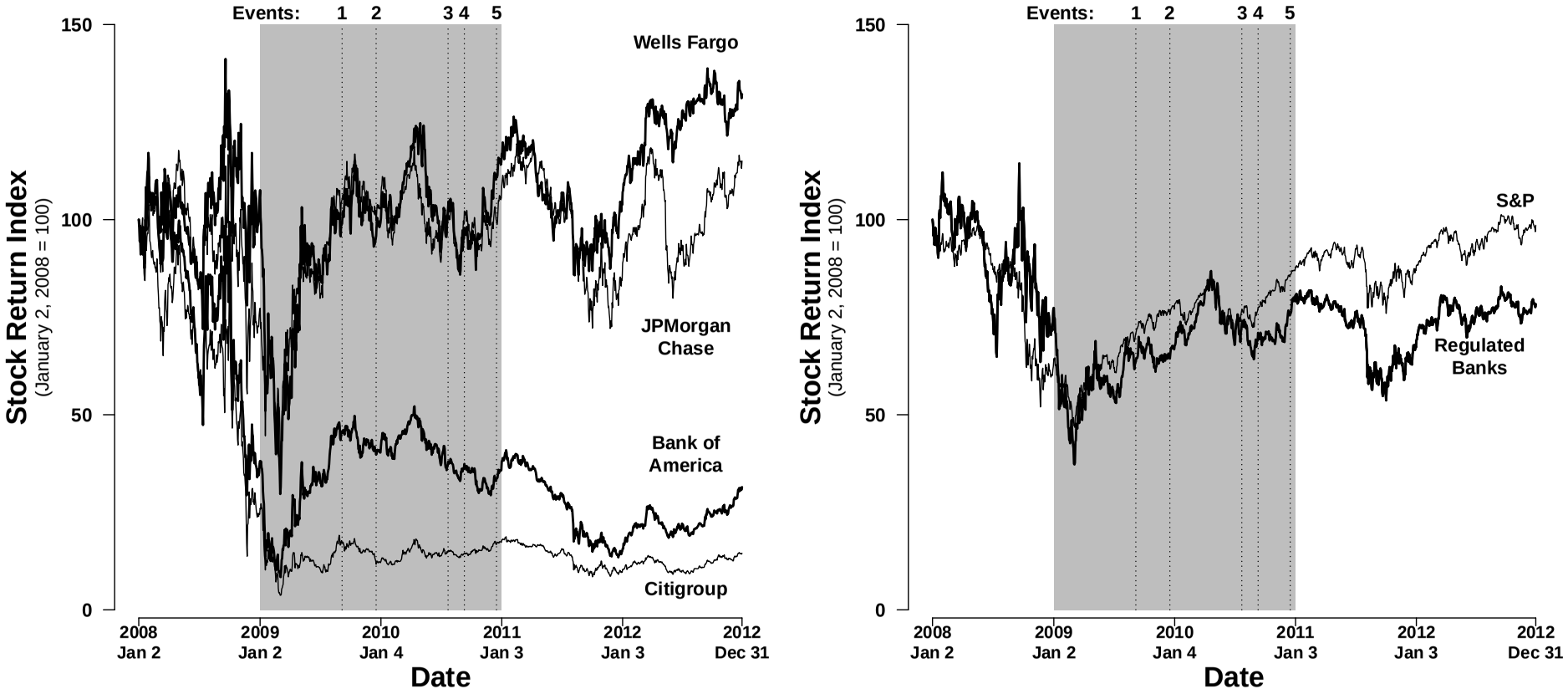

Figure 1: *Regulated Bank and Stock Market Indices, 2008 January 2 to 2012 December 31*: Each graph plots a stock's, or the average of a group of stocks', price index, where 100 is the stock's value on January 2, 2008. Left graph plots firm stock levels for the four mega US-headquartered banks. Wells Fargo and JPMorgan Chase do well over this four-year period, while Bank of America and Citigroup do poorly. The right graph plots the average index level of all sample regulated banks ($N_i = 45$) compared to the S&P 500, an index comprised of large stocks across industries. Trading days during 2009 and 2010 are shaded, and the five events are indicated with dotted lines. Although stock price levels change across time, the analysis uses short timeframes that ensures results are not driven by long-term stock price level trends.

2008. The right panel shows the average index level across all 45 banks in the sample. The average of sample banks' price indicies are lower than stock prices at the beginning of 2008 and lower than the S&P index, a measure of the stock market as a whole. The figure provides broad context surrounding the analysis, yet because analysis considers short periods around each event, divergent, long-term trajectories of individual banks should not affect overall results.

Firms

The exact group of banks subject to international regulations is determined by national regulators, but large US banks were certain to be regulated by Basel III. For this reason, main results include the largest available sample of publicly-traded, US-headquartered banks with more than $10 billion in consolidated assets in 2009.[65] Firms cannot opt into or out of the sample.[66] This leaves a sample of 45 firms, whose names, asset sizes and Tier 1 Capital Ratio are listed in Appendix Table A.

Nonfinancial firms comprise a a set of firms that should not be directly affected by Basel III. 2,884 nonfinancial firms publicly traded on US stock exchanges have full stock return data to include in this group.[67] Nonfinancial firms will be used to create counterfactual stock returns for each regulated firm of interest. Nonbank financial firms are excluded from analysis, as they are neither regulated firms nor are they a reliable control group because they could gain or lose from Basel III in a more direct way than nonfinancial firms. The formal estimation method is identified below; model specifications and results are then presented.

Formal Quantity of Interest

[65] Size threshold is based upon the Federal Reserve's standard to identify the largest banks (called "Peer 1" banks). The sample is the largest set of banks meeting all of the following criteria: (1) bank must be publicly traded on the New York Stock Exchange (NYSE), the American Stock Exchange (AMEX) or the NASDAQ exchanges, (2) bank must be US-headquartered (i.e. federally incorporated in the United States), (3) bank must be actively traded on all trading days between 2009 January 2 and 2010 December 31, (4) bank must have regulatory capital data available for Q1 2009, and (5) bank must be designated by the Federal Reserve as a Peer 1 Bank Holding Company as of Q1 2009. Stock data comes from The Center for Research in Security Prices (CRSP), regulatory capital data comes from Compustat, and the Federal Reserve Bank Holding company designation comes from BHCPR Peer Group Average Reports, available at `http://www.ffiec.gov/nicpubweb/content/BHCPRRPT/BHCPR_Peer.htm` (August 18, 2012). The sample excludes First Bancorp PR (NYSE: FBP), which meets the criteria but which was identified as an outlier firm through tests identified in "Estimation Specification" section below.

[66] While some non-bank financial institutions, such as Goldman Sachs and Morgan Stanley, formally became bank holding companies in the aftermath of the financial crisis, these companies do not meet the criteria for inclusion into the sample.

[67] More specifically, each of the 2,884 firms meet all of the following criteria: (1) nonfinancial firms (SIC code < 6000 or SIC code > 6999), (2) that trade on the New York Stock Exchange (NYSE), American Stock Exchange (AMEX), or NASDAQ stock exchanges, and (3) had active trading data on all trading days between 2009 January 1 through 2011 April 11. Stock price and SIC code data comes from the Center for Research in Securities Prices (CRSP).

Formally, the following estimation is conducted for each of the five events listed in Table 1. Let i represent each regulated bank ($i = 1, 2, ..., 45$) and t be a trading day relative to the event ($t = -\infty, ..., -1, 0, 1, ..., \infty$), with the event occurring on day $t = 0$. Each regulated bank's stock returns are observed on each trading day and are denoted by R_{it}.

For each regulated bank, the observed stock return on the event day (R_{i0}) may be decomposed into Expected Firm Return (R^*_{i0}) and an error term (ϵ^*_{i0}) which is the Abnormal Firm Return. Expected Firm Return is the estimated stock return for the regulated firm in the absence of an announcement. Abnormal Firm Return captures how much the observed stock return deviates from Expected Firm Return.

$$\underbrace{R_{i0}}_{\text{Observed Firm Return}} = \underbrace{R^*_{i0}}_{\text{Expected Firm Return}} + \underbrace{\epsilon^*_{i0}}_{\text{Abnormal Firm Return}} \tag{1}$$

The overall quantity of interest for each event, the Average Announcement Effect (P), is the average Abnormal Firm Return across all regulated firms on event day. Specific to this analysis, there are 45 regulated firms ($N = 45$).

$$\underbrace{P}_{\text{Average Announcement Effect}} = \underbrace{\frac{1}{N}\sum_{i=1}^{N} \epsilon^*_{i0}}_{\text{Average Abnormal Firm Return}} \tag{2}$$

Abnormal Firm Return is the relevant estimate for each firm and it is the difference between Observed Firm Return (R_{i0}) and estimated Expected Firm Return (R^*_{i0}), an approach that is illustrated by the grey panel in Figure 2.

To calculate Expected Firm Return on an event day, observed stock returns of firms that should be unaffected by the event *and* whose stock returns were highly correlated with the regulated firm's stock returns prior to the event provide a reasonable measure of the expected stock return of the regulated firm in the absence of the event. This paper uses a variable selection method, a Lasso estimator, to identify specific firms that together create a custom market index for each firm for each event. While the Lasso regression differs from the traditional approach that uses an aggregate stock market index, both the Lasso regression and the traditional approach use data prior to the event to identify a relationship between each regulated firm and the a measure of the stock market. They both assume that data observed prior to the (unanticipated) event captures the relationship between an individual stock and the stock market generally. Then, on the event day, the relationship observed prior to the event can be used to predict

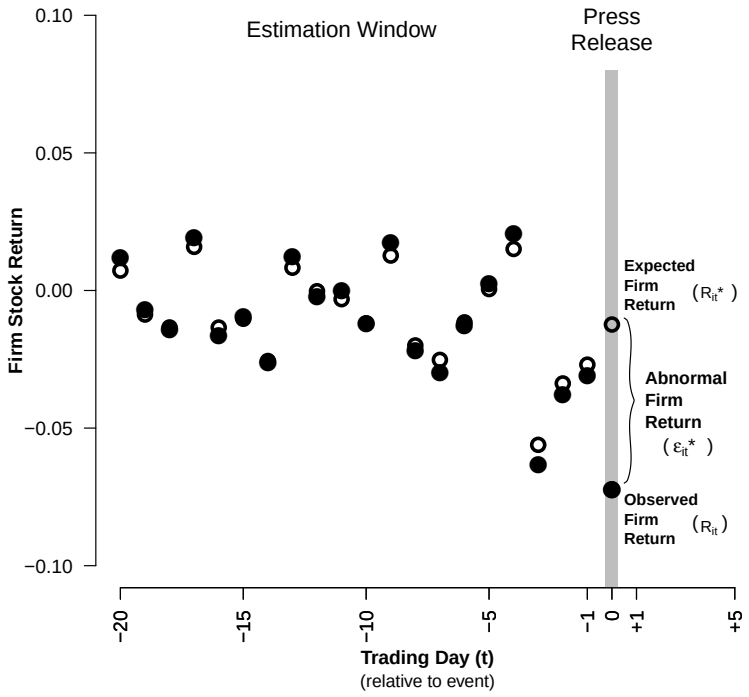

Figure 2: *Calculating Firm Abnormal Return, Illustrative Example*: Each day during the estimation window, a given firm's stock returns are observed (solid dots). The relationship between a regulated bank's stock returns and stock market returns generally during the estimation window are modeled such that counterfactual stock returns (open circles) are the fitted values of this estimation. On the day of the press release, the difference between the observed firm return and the counterfactual stock return is the firm's Abnormal Firm Return. This process is repeated for each firm for each event.

the individual stock's return on event day.

Formally, to estimate Expected Firm Return, an estimation window is defined as the period of trading days prior to the event that captures the typical relationship between a regulated bank and the stock market generally. Formally, the estimation window $[a, b]$ is the set of trading days $a < b < 0$ prior to the event ($t = 0$). The estimation window is of length $l = b - a + 1$. For instance, the main event window specification ($[-20, -1]$) uses a 20-day estimation window ($l = 20$) that includes the 20 trading days immediately prior to the event.[68]

The next sections elaborate upon the traditional approach versus my Lasso methodology. I provide evidence that Lasso regression models historical data, and predicts out-of-sample observations, better than does the traditional approach.

Traditional Approach – Stock Market Index. Traditional event studies model each regulated

[68] To control for possible anticipation effects, a separate 20-day estimation window ($l = 20$) includes the 20 trading days prior to 10 days before the event, $[-30, -11]$.

firm's stock returns over the estimation window as a function of a stock market index, such as the S&P 500 (the weighted-average stock returns of 500 large companies) or an equally-weighted index (the simple average of all publicly traded firm stock returns).[69] The traditional approach applies a simple linear regression to the estimation window data. The dependent variable is the regulated firm's stock return each day during the estimation window, and the explanatory variable is the stock market index return each day. Formally, define M_t as the stock market index return on a given trading day. For each regulated firm, for the set of all trading days within the estimation window, $a \leq t \leq b$, the following model is fit: $R_{it} = \alpha_i + \beta_i M_t + \epsilon_i$. The stock market index provides a single, daily measure of performance to fit all regulated firms. Because the daily index reflects an average over many firms' stock returns, it poorly fits different regulated banks' individual stock returns. Further, each stock market index may include some regulated firms themselves within the aggregate index measure, resulting in inconsistencies. Regulated firms of interest include large firms, such as Bank of America (Forbes' #11 largest firm in 2009), Citigroup (# 12), JPMorgan Chase(# 16), and Wells Fargo (#41).[70] Because regulated firm stocks are likely to affect general stock market indicies (which are supposed to act as a control group), this is a serious concern for this analysis. The next section explains the alternative method used in this paper to overcome these issues and create better goodness of fit.

Variable Selection Model – Custom Firm Index via Lasso Estimator. This paper uses a variable selection model, called a Lasso estimator, to identify a subset of nonfinancial firms whose weighted-average stock returns over the estimation window are most similar to each regulated firm of interest. Using patterns in the estimation window data, the Lasso estimator selects a subset of firms that create a custom market index for each regulated firm. This approach better fits estimation window data, creating precise estimations and the ability to test for model sensitivity across estimation windows.

The variable selection method utilizes individual stock returns of unregulated firms over an estimation window. Nonfinancial firms should not be affected by the Basel III regulations and thus the set of all nonfinancial firms comprise the control group. Formally, let j denote a publicly-traded, nonfinancial firm

[69] Prominent extensions use multiple measures of stock market performance, yet the general critique remains. Fama and French 1993 have a 3-factor model (with three regressors capturing overall market, firm size, and market-to-book ratio) and Carhart 1997 has a 4-factor model (using the Fama-French regressors plus a measure of stock return momentum).

[70] `http://money.cnn.com/magazines/fortune/fortune500/2009/full_list/`. (Accessed July 1, 2013.)

$(j = 1, 2, ..., 2,884)$, where $j \neq i$. The observed stock return of each nonfinancial firm on trading day t is denoted R_{jt}.

This model also uses a simple regression, but one with a Lasso constraint and with individual firm returns as possible regressors. The dependent variable is the regulated firm's stock return each day during the estimation window, and N_j explanatory variables are the stock returns of each unregulated firm. Because there are many more possible regressors ($N_j = 2,884$) than observations during the event window, the Lasso estimator imposes a constraint such that most weights are constrained to zero and only regressors that best approximate estimation window data have non-zero weights. Formally, the estimation window data is fit by the following model: $R_{it} = \alpha_i + \sum_{j \neq i} R_{jt}\beta_{ij} + \epsilon_i$ subject to the constraint $\sum_{j \neq i} |\beta_j| < \lambda$.[71] Thus, the series of $\widehat{\beta_{ij}}$ over the set of j control firms is the weight given to each nonfinancial, control firm j to fit regulated bank i's stock returns over the estimation window. Most $\widehat{\beta_{ij}}$ equal zero.[72] Thus, only a few nonfinancial firms emerge as regressors for each regulated firm and they are specifically selected based upon regulated bank's stock returns over the estimation windows. When estimation windows change, selected regressors change accordingly. Table B in the Appendix shows variation for the largest US banks (e.g. Wells Fargo, JPMorgan Chase, Bank of America, and Citigroup), illustrating that even the most similar banks have largely different regressors across firms and events.

The Lasso estimation method has significantly higher goodness of fit and better predictive power than the traditional stock market index approach, indicating that Lasso provides a more precise model than the traditional approach. Figure 3 plots density of goodness of fit (i.e. adjusted R^2) under each estimation strategy for a 20-day estimation window.[73] The interquartile range of the full set of adjusted R^2 values using the Lasso estimator is between 0.58 (first quartile adjusted R^2) and 0.95 (third quartile adjusted R^2). This range is smaller, and has a higher fit, than the full set of adjusted R^2 using the traditional approach (which is between 0.29 (first quartile) and 0.67 (third quartile)). The Lasso regression fits

[71] See Tibshirani 1996; and Hastie, Tibshirani, and Friedman 2009, 68–72. Selecting λ is an important modeling choice in these models, and in all specifications I use 5-fold cross-validation to produce a series of 100 lambda and select the largest lambda within one standard deviation of the minimum.

[72] Of 2,884 nonfinancial firms that are potential regressors, the Lasso constraint identified, on average, 17.5 regressors (with a standard deviation (sd) of 3.51) for 20-day estimation windows, 26.1 regressors (sd of 6.64) for 30-day estimation windows, and 147.7 regressors (sd of 25.18) for 180-day estimation windows.

[73] Adjusted R^2 controls for the number of regressors. Separating the plots into individual events, or creating a parallel plot using 180-day estimation window, does not meaningfully change the shape or distribution of each curve.

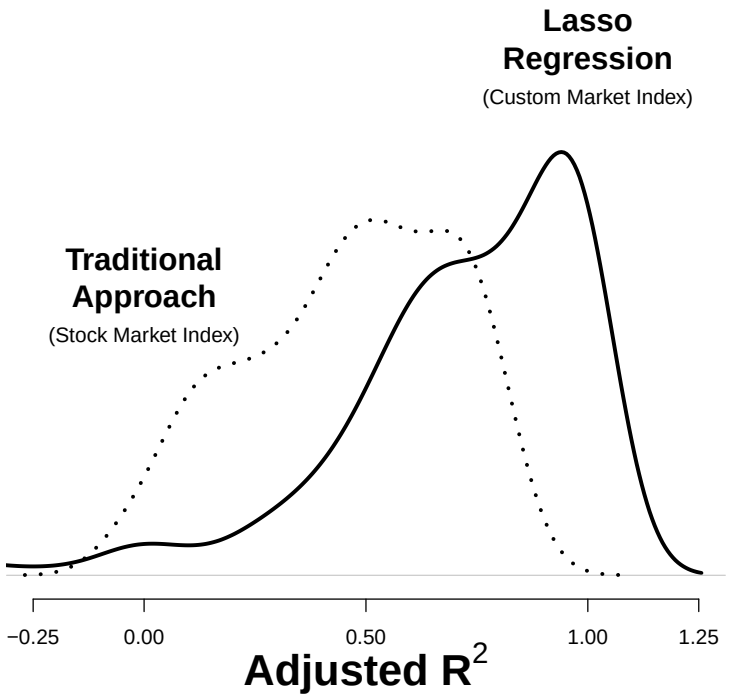

Figure 3: *Comparing Goodness of Fit (Adjusted R^2) Distribution Across Estimation Methods*: Adjusted goodness of fit estimates for each firm's model of stock returns over a 20-day estimation window is calculated for each event using the traditional approach and Lasso regression methods, resulting in 225 adjusted R^2 estimations for each method (= 45 banks × 5 events). The above graph plots density curves of the traditional (dotted line) and Lasso (solid line) goodness of fit estimates pooled across events and firms. Higher goodness of fit for Lasso over traditional model using the same observed stock price data indicates that Lasso provides a better model of regulated firm stock returns over the estimation window.

observed data during the estimation window better than does the traditional approach. Further, to ensure that better goodness of fit of sample data translates into better predictive values outside of the estimation window, I calculate the root mean square error (RMSE) for random samples of nonfinancial firms using both the Lasso method and traditional approach. RMSE measures variation in observed values compared to predicted values, with lower RMSE indicating a regression line with better predictive value. Lasso regression has lower RMSE than the traditional event in each calculation, and RMSE using the traditional approach is, on average, 43 times larger than RMSE using the Lasso regression.[74] High goodness of fit and better predictive power using the Lasso estimator lowers estimation noise and leads

[74] Specifically, for each event, I calculated RMSE using Lasso regression and the traditional approach for five random samples of 200 randomly selected nonfinancial firms without replacement. In each of the 25 samples (5 samples for each of the 5 events) the Lasso regression always had a significantly lower RMSE. For summary purposes, pooling the 25 samples, average RMSE for Lasso was 0.039 (with a range between a minimum of 0.002 to a maximum of 0.261) versus 0.392 for traditional approach (with a range between 0.168 and 0.600). Among the average RMSE values, Lasso is 10 times lower than the traditional approach, while taking the relative RMSE values for each observation results in the average 43 times referenced in the text.

to clearly interpretable results.

To estimate uncertainty around Average Announcement Effect, I compute 95 percent confidence intervals by following a modified bootstrap method specific to the Lasso estimator.[75] Additional estimation details are provided in the next section before presenting statistical results.

Estimation Specifications

Average Announcement Effect is calculated using four estimation window specifications. Specification 1, the base specification, uses a 20-day estimation window, comprised of the 20 trading days just prior to each event ($[-20, -1]$).[76] The results from these models indicate whether stock returns on an event day differ from stock return patterns just prior to press releases. Specification 2 uses a 30-day estimation window immediately prior to each event ($[-30, -1]$) to add confidence that Specification 1 results are not driven by the arbitrary choice of a 20 day estimation window. Specification 3 uses a long, 180-day estimation window ($[-180, -1]$) to check for result sensitivity.[77] The interpretation of 180-day estimation window is stock returns compared to long-run, average stock prices. Finally, Specification 4 uses a 20-day estimation window but controls for the possibility of anticipation effects by ending the estimation window 10-trading days prior to each press release ($[-30, -11]$).[78]

Given a relatively small sample of 45 firms, two tests ensure each calculated Average Announcement Effect is not driven by outliers.[79] First, a jacknife procedure checks that the calculated quantity of interest is not driven by any one firm. Each firm is dropped individually from the analysis and Average Announcement Effect and the 95 percent confidence interval is recalculated. Second, I regress Abnormal Firm Return on Observed Firm Return and use Cook's Distance to identify any influential points. The set of influential points are dropped simultaneously and the Average Announcement Effect is recalculated

[75] Chatterjee and Lahiri 2011 show their modified bootstrap process yields a consistent confidence interval for Lasso estimators. The specific process first entails calculating the set of residuals from the set of regulated firms' expected stock returns on an event day. The set of residuals are sampled, with replacement, and added to the fitted values of the original data to create a new sample of (bootstrapped) observed stock returns. For each of 100 bootstrapped samples per event, I use bootstrapped observed returns to reestimate Abnormal Firm Return and calculate Average Announcement Effect. Assuming a normal distribution, I obtain 95 percent confidence intervals using point estimates from the bootstrapped sample data and standard deviation calculated from the bootstrapped samples.

[76] That is, the estimation window includes the set of trading days $t = \{-20, ..., -1\}$.

[77] Event 1 occurs on the 172 day of trading data, so the estimation window for Event 1's third model is $[-171, -1]$ instead of $[-180, -1]$.

[78] Alternative anticipation periods, including 5-trading days prior to each announcement, or an event-specific anticipation period based on media reports, do not change substantive results.

[79] Note that First Bancorp PR (NYSE: FBP) meets all criteria laid out in footnote 65, but it was identified as an outlier firm driving net effect direction. Therefore, it is removed from the sample.

with remaining firms. Results are not sensitive to either test.[80] Table B in the Appendix shows distributions of Observed Firm Returns, Expected Firm Returns and the bootstrapped estimates of Average Announcement Effects.

Finally, to establish the validity of the method as a whole, I run a placebo test randomly selecting samples of unregulated firms and estimating Average Announcement Effect for these firms that should not be affected by Basel III regulations. I sample across industries so Average Announcement Effect should be statistically indistinguishable from zero.[81] Specifically, of the 2,884 non-financial firms, I take 100 random samples of 200 nonfinancial firms without replacement and treat each as if it were a regulated bank. I estimate the Average Announcement Effect using a 20-day estimation window. To add confidence to the research design and statistical models, placebo results should be statistically insignificant. The next section presents empirical results.

3.2 Empirical Results

Two substantive findings and one methodological point emerge from the empirical analysis. First, across events and estimation windows, stock returns systematically differ from expectations, consistent with Hypothesis 1 that regulatory agreements, despite weak formal enforcement mechanisms, are viewed as credible and as affecting firm value. A placebo test, using an identical methodology but where random sets of nonfinancial firms are treated as if they were regulated firms, uncovers a null result (that is, Average Announcement Effects do not statistically differ from zero) and adds confidence that results for firms of interest are not driven by the selected methodological strategy.

Second, although the direction of the effects varies across events, initial investor reaction to Basel III negotiations in September 2009 and December 2009 (Event 1 and Event 2) were unambiguously negative, more consistent with the public goods perspective (Hypothesis 2b) and less consistent with the private goods perspective (Hypothesis 2a). That is, initial investor perception was that US regulated banks were likely to incur costs associated with new regulations. This is striking given that investors expected some

[80] Cook's Distance indicates the following outliers: Event 1 outliers include Sterling (ticker: STSA), Popular (BPOP), and Citigroup (C); Event 2 outliers include Sterling (STSA), Popular (BPOP), Synovus (SNV), and Huntington (HBAN); Event 3 outliers include Fifth Third (FITB) and Citizens Republic (CRBC); Event 4 outliers include First Citizens (FCNCA), Sterling (STSA), First Horizon (FHN) and Privatebancorp (PVTB); and Event 5 outlier is PNC (PNC). Average Announcement Effect sign and significance does not change when outliers are simultaneously removed from the analysis.

[81] For each randomly selected firm that I treat as a financial firm, I limit possible estimates to firms outside the selected firm's industry at the broadest, 1-digit SIC specification.

increase in regulatory stringency prior to any Basel III announcement, and indicates that Basel III's broad outlines were more stringent than investors expected.

Each event's stock return deviations must be interpreted as a change from investors' expectations at a given point. While the direction of effects varies across events, the net effect is negative and statistically significant. Early events (during 2009) are clearly interpretable while later events (during 2010) are less straightforward because they are associated with stock returns that are more positive than expected (Event 3 and Event 4, between July and September 2010), and then more negative than expected (Event 5 in December 2010). Qualitative evidence indicates that any positive effects follow from expectations of relatively less stringent rules than expected (conditional upon information from Event 1 and Event 2) rather than more stringent rules as benefitting US banks at the expense of foreign rivals. Specifically, newspaper coverage of the 2010 events cite the regulation's long implementation timelines and certain capital definition adjustments as more favorable to regulated banks than early events. In sum, there is more evidence to support Hypothesis 2b that Basel III regulations are provided as global public goods, and less evidence to support Hypothesis 2a that they provide private goods for US firms.

Methodologically, the sign and significance of Average Announcement Effects for each event are stable across various estimation windows. Because each estimation window uses different control firms for counterfactuals, this adds confidence to the results. The next section presents the statistical results.

Statistical Results

Figure 4 displays statistical results in two panels. The left panel includes the base specification using a 20-day estimation window immediately prior to each event (shown with an open circle) and the placebo test result (shown with a black square). The right panel includes all four specifications, as a test of sensitivity across event windows.

Beginning with the left panel, placebo test estimates are statistically indistinguishable from zero for each of the five events, indicating that the methodology is capable of uncovering a null result. This increases confidence that test results are not drive by random noise in the market as a whole.

20-day estimation window (i.e. Specification 1) results indicate stock returns statistically differ from zero (evidence in support of Hypothesis 1) and are not sensitive to outlier observations. The largest

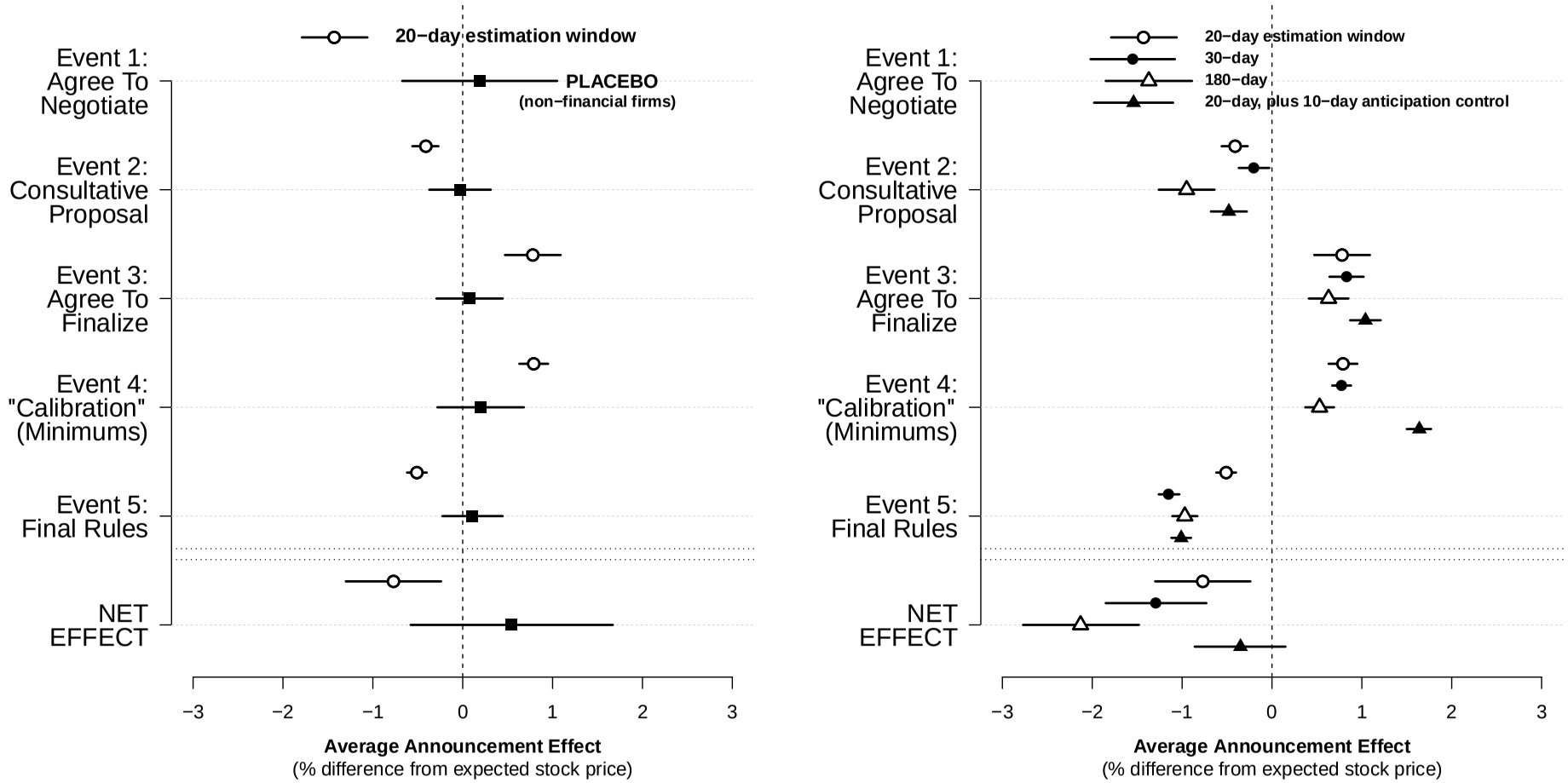

Figure 4: *Average Announcement Effect on Event Days*: For each event, the Average Announcement Effect with 95 percent confidence interval reflects the experience of 45 US regulated firms, with the expectation of the Placebo, which represents 100 samples, each sample comprised of 200 randomly selected nonfinancial firms. Average Announcement Effect is the simple average of regulated firms' Abnormal Firm Returns, where Abnormal Firm Return is the difference between observed firm return and expected firm return (calculated using a Lasso estimator as described in the text). Estimates are directly interpretable as the average percent that each regulated firm's stock return were above or below what would have been expected controlling for each day's specific market conditions.

divergence was Event 1, where observed stock returns for Event 1 were lower than expected stock returns by 1.43% on average (that is, the Average Announcement Effect was −1.43%). This is the equivalent of $783 million foregone equity for Citigroup shareholders and $2.1 billion foregone equity for Bank of America shareholders.[82] Event 2 (consultative paper release) and Event 5 (final rules release) also resulted in negative and statistically significant stock returns, but with smaller magnitudes (Average Announcement Effects of −0.41% and −0.51%, respectively). Event 3 and Event 4 are associated with firm stock returns that are *greater* than expected by 0.78% and 0.79%, respectively. Together, the results imply that stock returns do deviate on days of press releases, and while the direction of deviations vary, the net effect is negative and statistically significant, averaging −0.77%.

The right panel presents all four estimation window specifications and establishes consistent results (same sign and statistical significance) across specifications. Within each event, estimates using different estimation windows have similar directions and magnitudes.[83]

It is worth noting that Event 4, "Calibration," emerges as the most anticipated press release. That is, the 20-day estimation window (Specification 1) and its 95 percent confidence interval do not overlap with the 20-day estimation window with a 10-day anticipation control (Specification 4). Compared to stock returns immediately prior to the press release, regulated bank stocks were higher than expected by an average of 0.79%. Compared to stock returns up until two weeks before the press release, regulated bank stocks were higher than expected by more than double, an average of 1.64%. This may indicate that anticipation effects in the days leading up to the press release led to underestimated positive stock returns on the day of press release.

Stock return patterns indicate that investors pay attention to financial regulatory network agreements, and clear interpretation of negative effects for Event 1 and Event 2, along with net negative effects, indicate that investors view the regulations as hurting regulated banks. Results provide evidence that investors view international financial regulations as credible and as affecting regulated firms. The relative positive effects of Event 3 and Event 4 reflect less stringency instead of competitive benefits from more stringent regulations.

[82] Citigroup's previous closing day price was $4.85 with 11.3 billion stock shares outstanding, and Bank of America's previous close was $17.09 with 8.65 billion shares outstanding.

[83] The one exception is the statistically insignificant Net Effect for Specification 4, the 20-day estimation window with 10-day anticipation window. This is the result of the large positive effect of Event 4 when controlling for anticipation, as discussed below.

4 Conclusion

This article offers the first statistical evidence that financial regulatory network agreements, despite weak enforcement mechanisms, are viewed as credible and as affecting firm value. The research, based upon observed stock returns of regulated US firms in reaction to surprise bank regulatory updates throughout 2009 and 2010, confirms that investors systematically traded regulated stocks on days of bank regulatory network updates. This holds across all press releases. Specific to the case of Basel III, initial announcements in 2009 about new regulations led investors to trade bank stocks at systematically lower levels than expected. This is consistent with banks incurring greater regulatory costs, and less consistent with any expectation that US regulators negotiate for the private net benefit of US banks. As regulatory negotiations progressed, later events (mid-2010 announcements) were associated with higher stock returns than expected, though this is relative to the cumulative, high-regulatory stringency expected based on earlier events. Media coverage surrounding 2010 events indicate that any relative benefit is attributable to a relatively less stringent regulation than initially expected as the BCBS confirmed long implementation timelines and broadened some capital definition details.

The findings presented here demonstrate the promise of event studies and other micro-level data to analyze informal international obligations, or other policy events that have ambiguous distributional effects. Using indirect outcome measures such as stock returns, which are costly, allow researchers to isolate very specific events, and to parse out international agreement effects distinct from domestic implementation. It circumvents endogeneity inherent in the traditional study of institutional effects which typically measure government actions in response to formal international commitments.

Substantively, findings support the view of financial regulatory networks as credible global governance bodies, consistent with Slaughter and other theorists who argue that third-party enforcement is not necessary for international regime effectiveness. For an important international agreement negotiation, regulators set the regulatory agenda motivated by providing global public goods rather than the international regime locking in net benefits for US firms, consistent with Kapstein. It is also an important case study that shows that regulatory capture does not seem to fully dilute outcomes as Basel III was negotiated.

Finally, this study informs general analysis of international institutional design. Financial regulatory networks, comprised of regulators and agreeing upon technical, nonbinding regulatory commitments, defy easy fit into existing typologies of international institutions. Future research on international institutions should continue to find additional ways to systematically analyze nontraditional forms of global governance.

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Appendix

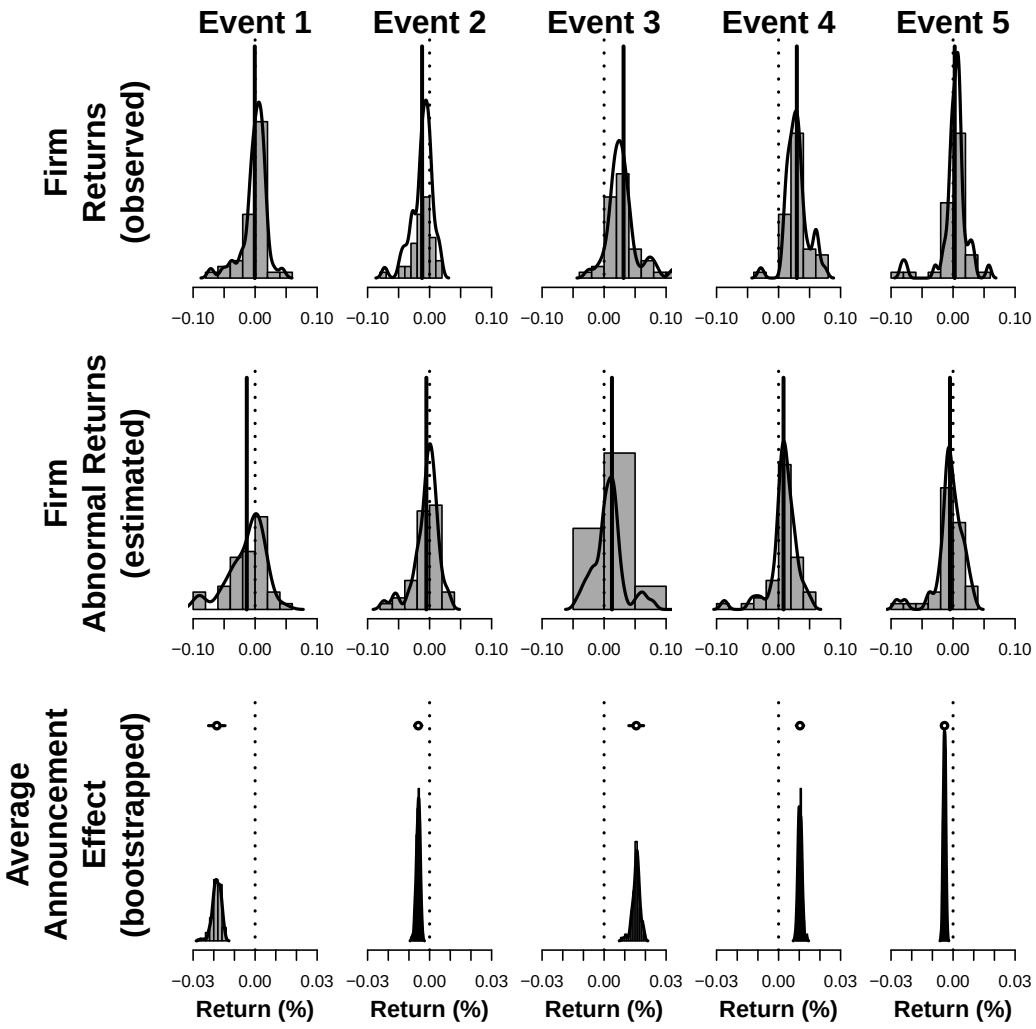

Figure A: *Distributions of Firm Returns, Bootstrapped Samples, 20-day Estimation Window*: To add transparency, these graphs show the data distributions (histograms and density curves) that underlie the aggregate results in Figure 4. The vertical dotted line in each graph delineates zero returns. For the sample of 45 regulated US banks, the top row is the distribution of Observed Firm Returns (R_{i0}) for each event, where the vertical solid line shows the average observed firm return. The middle row is the distribution of calculated Abnormal Firm Returns (ϵ_{i0}) for each event, where the vertical solid line shows the average Abnormal Firm Return for each event. The bottom row is the distribution of the calculated Average Announcement Effect for 100 bootstrapped samples for each event. The white circle at the top of each graph on the bottom row indicates the point estimate from the 100 bootstrapped sample, and 95 percent confidence interval. Together, the figures reinforce that results are not driven by outlier observations.

Ticker	Company Name	Consolidated Assets ($bill)		Tier 1 Capital Ratio (%)	
		fiscal year 2008	fiscal year 2009	2nd quarter 2009	3rd quarter 2010
Assets >$1 trillion					
BAC	Bank of America Corp	$1,817	$2,223	11.93%	11.16%
C	Citigroup Inc	1,938	1,856	12.74	12.25
JPM	JPMorgan Chase & Co	2,175	2,031	9.70	11.90
WFC	Wells Fargo & Co	1,309	1,243	9.80	10.90
Assets >$100 billion					
BBT	BB&T Corp	152	165	10.60	11.70
BK	Bank of New York Mellon Corp	237	212	12.50	12.20
FITB	Fifth Third Bancorp	119	113	12.90	13.85
KEY	Keycorp	104	93	12.57	14.30
PNC	PNC Financial Services Grp Inc	291	269	10.50	11.90
RF	Regions Financial Corp	146	142	12.16	12.07
STT	State Street Corp	173	157	14.50	15.80
STI	Suntrust Banks Inc	189	174	12.23	13.58
USB	US Bancorp	265	281	9.40	10.30
Assets >$10 billion					
ASBC	Associated Banc Corp	24	22	11.93	17.68
BOKF	BOK Financial Corp	22	23	9.76	12.30
BXS	Bancorpsouth Inc	13	13	10.92	10.56
BOH	Bank of Hawaii Corp	10	12	12.02	17.71
CATY	Cathay General Bancorp	11	11	12.50	14.95
CRBC	Citizens Republic Bancorp Inc	13	11	12.16	12.41
CYN	City National Corp	16	21	12.00	12.00
CMA	Comerica Inc	67	59	11.06	9.97
CBSH	Commerce Bancshares Inc	17	18	11.05	14.27
CFR	Cullen Frost Bankers Inc	15	16	10.64	13.38
EWBC	East West Bancorp Inc	12	20	13.67	17.90
FCNCA	First Citizens Bancshares Inc NC	16	18	13.29	14.38
FHN	First Horizon National Corp	31	26	14.97	17.34
FMER	Firstmerit Corp	11	10	11.86	11.46
FULT	Fulton Financial Corp PA	16	16	11.20	11.40
HBAN	Huntington Bancshares Inc	54	51	11.16	12.82
IBOC	International Bancshares Corp	12	11	16.27	18.79
MTB	M&T Bank Corp	65	68	8.76	9.45
NYB	New York Community Bancorp Inc	32	42	7.86	8.87
NTRS	Northern Trust Corp	82	82	13.00	13.20
BPOP	Popular Inc	38	34	11.16	14.87
PVTB	Privatebancorp Inc	10	12	10.13	12.25
SIVB	SVB Financial Group	10	12	13.74	15.04
STSA	Sterling Financial Corp	12	10	9.10	10.50
SUSQ	Susquehanna Bancshares Inc	13	13	11.13	13.51
SNV	Synovus Financial Corp	35	32	11.06	13.06
TCB	TCF Financial Corp	16	17	11.20	10.35
UMBF	UMB Financial Corp	10	11	13.93	12.61
VLY	Valley National Bancorp	14	14	12.07	10.73
WBS	Webster Financial Corp	17	17	12.00	12.94
WTFC	Wintrust Financial Corporation	10	12	9.10	12.70
ZION	Zions Bancorp	55	51	9.33	13.97

Table A: *Banks in Sample*: The table gives key firm size and capitalization characteristics of the 45 banks in the main sample. SOURCE: Compustat.

	Wells Fargo	JPMorgan Chase	Bank of America	Citigroup
Event 1				
	TrueBlue Inc	AngioDynamics Inc.	Lamar Advertising Co	Teledyne Technologies
	Cytokinetics Inc	Robert Half International Inc	Microstrategy Inc	Diana Shipping Inc.
	Capital Product Partners	3 D Systems Corp Del	Syneron Medical Ltd	China Unicom Hong Kong Ltd
Event 2				
	Blackbaud Inc	Tim Hortons Inc.	Perusahaan P P P T Telekom Indo	Exxon Mobil Corp
	Ryland Group Inc.	Standard Parking Corp	Revlon Inc.	C R H PLC
	Liveperson Inc.		Saba Softward Inc.	InvaCard Corp
Event 3				
	Commscope Inc	C A Inc	Sanfilippo John B & Son	China Mobile Ltd
	Concur Technologies Inc	EOG Resources Inc	Heico Corp New	Compuware Corp
	NV Energy Inc		EOG Resources Inc	National Beverage Corp
Event 4				
	Qiagen NV	Atlantic Tele Network Inc	Sasol Ltd	Nustar Energy L P
	News Corp	Dominos Pizza Inc	Constellation Energy Group Inc	Constellation Energy Group Inc
	B H P Billiton PLC	Kraft Foods Inc	Infosys Technologies Ltd	Newell Rubbermaid Inc
Event 5				
	B P Prudhoe Bay Royalty Trust	Atlas Energy Inc	Q L T Inc	Super Micro Computer Inc
	Outdoor Channel Holdings Inc	Jacobs Engineering Group Inc	CBeyond Inc	Hercules Offshore Inc
	Q L T Inc	Q L T Inc	Lawson Products Inc	M Y R Group Inc DE

Table B: *Nonfinancial Firm, Lasso-Selected Regressors for Select US Regulated Banks*: For the four largest US banks, the table shows the three nonfinancial firms for each event that the Lasso constraint identified as having the highest weights using Specification 1, a 20-day estimation window $[-20, -1]$. Regressor firms vary across events and largely vary across US banks. Two exceptions are EOG Resources Inc., which are key regressors for Event 3 for both JPMorgan and Bank of America, and Q L T Inc., which is a key regressor for Event 5 for Wells Fargo, JPMorgan Chase, and Bank of America.