JOURNAL OF FINANCIAL AND QUANTITATIVE ANALYSIS Vol. 48, No. 5, Oct. 2013, pp. 1635–1662

doi:10.1017/S0022109013000537

The Impact of Government Intervention in Banks on Corporate Borrowers' Stock Returns

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Abstract

We investigate whether and how government interventions in the U.S. banking sector influence the stock market performance of corporate borrowers during the financial crisis of 2007–2009. We measure firms' exposures to government interventions with an intervention score that is based on combined information on the firms' structure of bank relationships and their banks' participation in government capital support programs. We find that government capital infusions in banks have a significantly positive impact on borrowing firms' stock returns. The effect is more pronounced for riskier and bank-dependent firms and for those that borrow from banks that are less capitalized and smaller.

I. Introduction

Financial and banking crises have a significantly negative impact on the corporate sector, resulting in a lower stock market valuation of borrowing firms and a subsequent decrease in aggregate economic activity. However, little is known empirically about the existence and nature of spillover effects that might arise from a removal or mitigation of shocks to the financial and banking system to the corporate sector. Do stock prices of corporate borrowers react to rescue measures for banks? If yes, what are the direction, magnitude, and speed of the reaction? Which firms exhibit the strongest stock price reaction? To shed light on these questions, we investigate whether and how government interventions in the U.S. banking sector influence the stock returns of corporate borrowers during the global financial crisis of 2007–2009.

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Financial crises, such as the Japanese, the Russian, the Asian, and the recent global one, have not only adversely affected the financial system but also the real economy in many countries through a tightening of bank lending (e.g., Chava and Purnanandam (2011), Campello, Graham, and Harvey (2010), Carvalho, Ferreira, and Matos (2011), Giannetti and Simonov (2013), Ivashina and Scharfstein (2010), and Lemmon and Roberts (2010)). Related studies document a sharp drop in bank credit supply to the corporate sector during the peak of the financial crisis. To "restore liquidity and stability to the financial system" (U.S. Congress (2008), p. 2), the Federal Reserve System cut the target interest rate from 5.25% to close to zero from Sept. 2007 to Dec. 2008. When this monetary intervention proved ineffective, the U.S. government was forced to step in and use taxpayers' money to bail out the troubled banking industry. Under the Emergency Economic Stabilization Act (EESA), the U.S. government provided certain banks with additional equity to stabilize the financial industry via the Capital Purchase Program (CPP), a prominent part of the Troubled Asset Relief Program (TARP). The stated aim of the CPP was to "strengthen the capital base of the financially sound banks" by providing them with extra liquidity and equity so that banks could "increase the flow of financing to U.S. businesses and consumers and to support the U.S. economy" (U.S. Department of the Treasury (Oct. 14, 2008)). However, evidence is mixed on whether banks have actually used this government support to keep on lending (e.g., Li (2013)) or to repair their own balance sheets (e.g., SIGTARP (2010), Taliaferro (2009)). Thus, the question whether such intervention in banks has implications for corporate borrowers remains largely unanswered.

In this paper, we depart from the existing literature by investigating the impact of U.S. banks' participation in the CPP on borrowing firms' stock price performance. To identify the impact, we focus on the bank lending channel and define a firm-specific, time-varying intervention score that is based on the firms' precrisis structure of bank relationships and their banks' participation in government capital support programs. We focus on the corporate borrowers' stock price performance to capture the effect of government intervention on the bank lending channel. Using short-term event study methodology and panel data analysis, we investigate whether and how corporate borrowers' stock returns during the financial crisis of 2007–2009 relate to the variation in their intervention scores, controlling for the general stock market performance. We also test whether precrisis firm, bank, and bank-firm relationship characteristics influence this link.

While related studies document the negative spillover effects from the banking to the corporate sector in the first stage of the financial crisis, we show that bank-firm relationships serve as a transmission channel for positive spillover effects on the corporate sector in situations when shocks to banks are mitigated through government interventions. Our principal results indicate that firms significantly benefit from the CPP infusions in their banks. Firms display positive abnormal stock returns around intervention events in their banks and also exhibit higher average daily stock returns the higher their intervention scores. We further show that the positive effect on borrowing firms' stock returns is not merely significant for the forced CPP interventions but also when banks voluntarily participate in the CPP. Moreover, the impact of government intervention varies with precrisis firm and bank characteristics. Firms that are riskier (i.e., more levered,

less profitable, more financially distressed), bank dependent, and more strongly hit by the financial crisis benefit more from government capital infusions in their banks during the crisis. Firms also benefit more from government intervention when they borrow from banks that are less capitalized and smaller. Various empirical checks confirm these findings and their robustness. We further find some indication that financial constraints of firms have been reduced during the year after their banks received capital infusions, which is consistent with our main results based on firms' stock price performance.

Our paper relates to three strands of the banking and finance literature. The first strand examines the impact of financial and banking crises. Several studies show that such crises are associated with reductions in the aggregate output level (e.g., Dell'Ariccia, Detragiache, and Rajan (2008), Reinhart and Rogoff (2009)). Other studies examine the impact of the financial crises on banks and show that there are significant negative effects on banks' capital that reduce the supply of loans to the corporate sector (e.g., Panetta, Faeh, Grande, Ho, King, Levy, Signoretti, Taboga, and Zaghini (2010), Santos (2011)). For instance, Shin, Park, and Udell (2008) document that banks, especially the undercapitalized ones, were forced to swiftly repair their capital structure by reducing loan provisions during the Korean crisis to avoid bankruptcy. Further evidence suggests that adverse consequences from increased losses in the banking sector spill over to the corporate sector and negatively affect borrowing firms' performance (Chava and Purnanandam (2011), Lemmon and Roberts (2010)). Moreover, Campello et al. (2010) provide survey evidence that the recent financial crisis more adversely affected financially constrained firms, which were forced to cut heavily in their spending in research and development, marketing, and employment, and to forego profitable investment opportunities. We extend this research by showing that corporate borrowers' stock returns positively respond to government capital infusions in their banks.

Second, our work relates to the increasing literature on government interventions in the banking sector. Previous studies focus on the characteristics of banks that were subject to intervention and the changes in their performance. For example, banks that received capital infusions under TARP are larger and have lower capital ratios, lower market-to-book ratios, and better asset quality than non-TARP recipient banks (Bayazitova and Shivdasani (2012)). The finding on asset quality suggests that the U.S. government has predominantly supported those banks that were sufficiently healthy to recover from the crisis. Furthermore, evidence suggests that earlier rounds of TARP capital infusions resulted in wealth gains for the banks' shareholders (Bayazitova and Shivdasani (2012), Veronesi and Zingales (2010)). There is mixed evidence on the question whether TARP capital infusions effectively stimulated bank lending during the crisis. Li (2013) suggests that TARP has indeed encouraged bank lending. However, other studies argue that due to severe capital losses of banks during the crisis, most banks used the TARP funds to repair their balance sheets rather than lending to businesses (e.g., SIGTARP (2010), Taliaferro (2009)). In addition, government intervention was accompanied by stricter supervisory and governance rules that might have further tightened banks' lending (e.g., Adams (2012), Kim (2010), and Fahlenbrach and Stulz (2011)). Unlike studies that investigate characteristics

of TARP capital recipient banks and their performance, we analyze the impact on TARP banks' borrowers to identify spillover effects associated with the capital infusion program on the corporate sector.

The third strand of literature investigates the importance of bank-firm relationships. Given that the vast majority of corporate borrowers rely on multiple bank relationships, the effectiveness of the bank lending channel essentially depends on the structure of firms' bank relationships and the banks' ability and willingness to provide credit. Previous studies suggest that firms benefit from establishing and maintaining a close relationship with banks (James (1987), Petersen and Rajan (1994), Berger and Udell (1995), Boot (2000), Norden and Weber (2010), and Bharath, Dahiya, Saunders, and Srinivasan (2011)). Closer banking ties increase firms' access to credit and facilitate loan renegotiation (e.g., Petersen and Rajan (1994), Cole (1998), Shin et al. (2008), and Gopalan, Udell, and Yerramilli (2011)). Strong bank relationships are particularly valuable when borrowers face temporary liquidity problems or adverse economic situations (e.g., Bolton and Scharfstein (1996), Elsas and Krahnen (1998), and Detragiache, Garella, and Guiso (2000)). However, theory argues that the information monopoly arising from close bank relationships can create a "hold up problem" for the borrowers to obtain alternative funds from other banks (e.g., Rajan (1992), Gopalan et al. (2011)). This reasoning implies that a close bank relationship exposes the firm to a higher sensitivity to potential shocks to the bank. Empirical evidence confirms that banks that experience large exogenous shocks tighten their lending, and banks' financial insolvency negatively impacts their borrowers' stock returns (Slovin, Sushka, and Polonchek (1993), Kang and Stulz (2000), Bae, Kang, and Lim (2002), and Ongena, Smith, and Michalsen (2003)). Lemmon and Roberts (2010) highlight the important role of bank credit supply by showing that even large firms with access to the public credit market are vulnerable to shocks in bank credit supply. Chava and Purnanandam (2011) investigate the impact of the Russian crisis on U.S. banks and find that adverse shocks to bank capital mostly affect bank-dependent borrowers. Carvalho et al. (2011) confirm this result for the recent financial crisis by showing how negative shocks to banks spill over to the corporate sector. They find that sharp decreases in banks' market capitalization are associated with equity valuation losses of firms that have credit relationships with these banks. The effect is strongest for firms with close credit relationships, higher informational asymmetry, and a higher need to roll over their debt. Gokcen (2010) looks at whether the first TARP intervention positively impacted corporate borrowers. He reports a positive short-term impact on firm's stock returns if the firm's top lead bank is one of the nine banks that were forced to participate in TARP. In this paper, we use complementary empirical methods that make it possible for us to take into account the specific nature of the CPP. In addition to short-term event study methodology, which captures jump effects in stock prices due to the expected impact of the intervention, we apply a novel measurement approach, the intervention score, in panel data regressions to investigate the impact of intervention events over a longer time horizon. The intervention score reflects the impact of intervention-induced expected and actual changes in bank lending on corporate borrowers' stock returns, considering the number of banks that obtain capital infusions,

the bank-specific magnitude of the capital infusions, and the bank-specific duration of the capital infusion.

The rest of the paper is organized as follows: Section II describes the institutional background of the CPP. Section III presents our main hypotheses. Section IV describes the data. Section V reports the main findings. Section VI summarizes the results from further empirical checks. Section VII concludes.

II. Institutional Background of the CPP

Under the EESA of 2008, TARP was initiated by the U.S. Department of the Treasury to purchase up to $700 billion troubled assets from financial institutions and other companies. Secretary Paulson revised the TARP implementation plan on Oct. 14, 2008, and decided to directly infuse $250 billion to the financial system through the CPP. The CPP allows qualifying financial institutions to sell preferred stocks and warrants to the U.S. Department of the Treasury. The first nine banks were forced to participate in the CPP, whereas all the later recipient banks participated in the CPP voluntarily. Until the end of 2009, more than 600 financial institutions have received capital support that in total amounts to roughly $202 billion. Table 1 provides an overview of the CPP.

TABLE 1

The Capital Purchase Program

Table 1 provides information on banks that participated in the Capital Purchase Program (CPP). Panel A contains information on banks that received CPP funds and banks that paid back CPP funds later. Panel B provides statistics on the distribution of the CPP infusions. The sample period starts on Oct. 28, 2008, and ends on Dec. 31, 2009. Amounts of the CPP are calculated as cumulative numbers in billions of dollars.

Panel A. Top 10 Banks in Terms of Total Amount of CPP Received and Redeemed

CPP Capital Infusion		CPP Redemption	
Bank Name	Amt. (in billion $)	Bank Name	Amt. (in billion $)
Wells Fargo & Company	25.00	Bank of America Corporation	25.00
JPMorgan	25.00	JPMorgan	25.00
Citigroup Inc.	25.00	Wells Fargo & Company	25.00
Bank of America Corporation	25.00	Morgan Stanley	10.00
Goldman Sachs Group, Inc.	10.00	Goldman Sachs Group, Inc.	10.00
Morgan Stanley	10.00	U.S. Bancorp	6.60
PNC Financial Services Group Inc.	7.58	American Express Company	3.39
U.S. Bancorp	6.60	BB&T Corp.	3.13
SunTrust Banks, Inc.	4.85	Bank of New York Mellon Corporation	3.00
Capital One Financial Corporation	3.56	State Street Corporation	2.00
Total amount	142.58	Total amount	113.12
As a percentage of total CPP infusion	70.33%	As a percentage of total CPP repayment	95.04%

Panel B. The Distribution of CPP Infusions (banks are ranked in terms of total amount of CPP received)

	Amt. (in billion $)	As a Percentage of Total CPP Infusion
First quartile of CPP recipient banks (top 25% capital recipients)	197.95	97.64%
Second quartile of CPP recipient banks (26%–50% capital recipients)	3.10	1.53%
Third quartile of CPP recipient banks (51%–75% capital recipients)	1.23	0.61%
Fourth quartile of CPP recipient banks (76%–100% capital recipients)	0.46	0.22%

Panel A of Table 1 lists the top 10 banks in terms of the amount of CPP capital received and repaid. Note that the list of top CPP recipient banks does not fully coincide with the list of the first nine banks that were forced to participate. There are also a number of large voluntary capital infusions that happened at a later

stage; for example, US Bancorp was not forced to participate in the initial CPP infusion but voluntarily opted for CPP funding and obtained $6.6 billion in total. Panel B indicates that the distribution of CPP infusions is highly concentrated. We rank all CPP recipient banks in terms of the amount of capital received, and the result shows that the top 25% of CPP recipient banks in terms of the amount received have taken almost all (97.6%) of the total CPP funds.

For the CPP redemption, 63 banks had paid back $118 billion by the end of Dec. 2009. The initial CPP conditions made it impossible for banks to repurchase the stock completely at par within 3 years after receiving the CPP. In Feb. 2009, the enactment of the American Recovery and Reinvestment Act (ARRA) introduced stricter rules on incentive-based executive compensation, but it also made the early repayment of CPP funds possible.

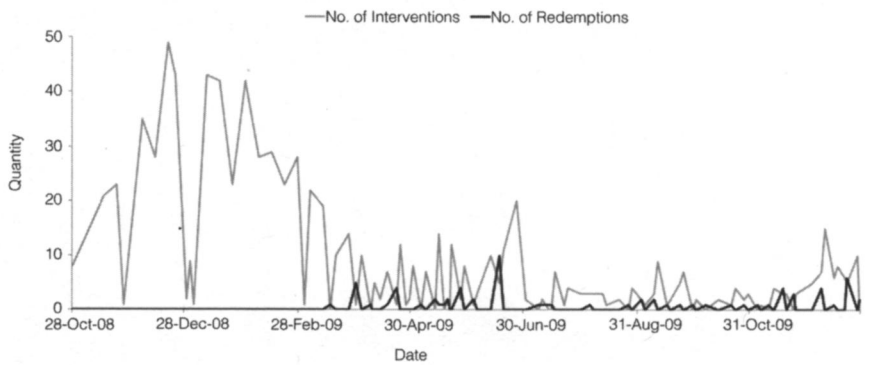
Figure 1 illustrates the number of events and amounts associated with CPP infusions and redemptions. Most capital infusions happened during the fourth

FIGURE 1

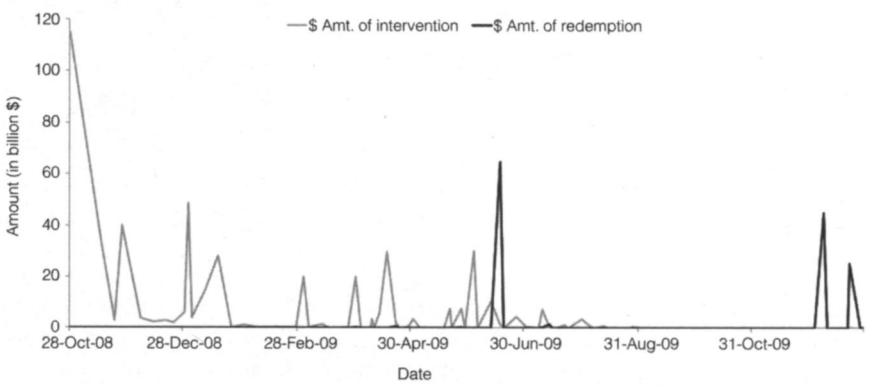
Number and Amount of CPP Capital Infusions and Redemptions over Time

The data on banks' participation in the CPP come from the Web site of the U.S. Department of the Treasury (http://www.financialstability.gov). Graph A of Figure 1 displays the distribution of the number of capital infusions and redemptions from Oct. 2008 to Dec. 2009. Graph B displays the distribution of capital infusions and redemptions (in billion $) from Oct. 2008 to Dec. 2009.

Graph A. Number of CPP Capital Infusions and Redemptions



Graph B. Amount of CPP Capital Infusions and Redemptions

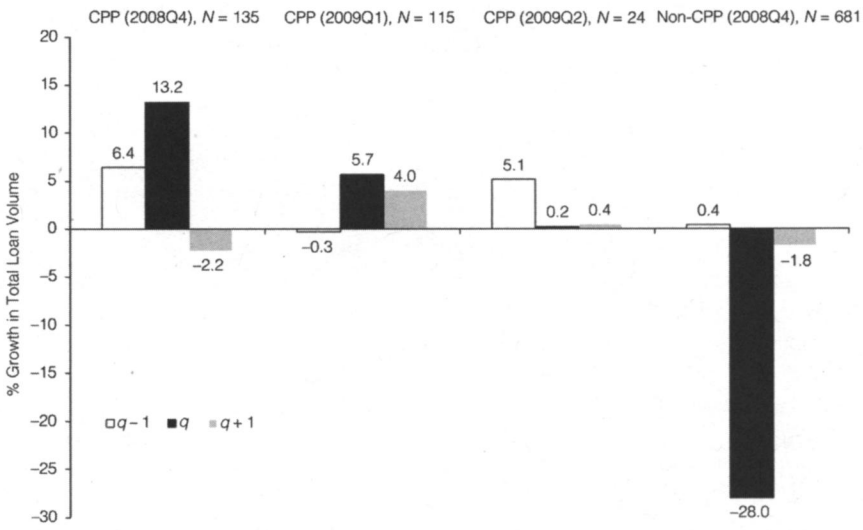


quarter of 2008 and the first quarter of 2009, and all CPP redemptions took place after Feb. 2009. CPP redemptions peak on June 16, 2009, when $64.74 billion were redeemed by several large banks. Those banks include JP Morgan, Morgan Stanley, and Goldman Sachs, which were forced to participate in the CPP initially. They choose to pay back funds at the same time in order not to leak information to the market on their relative financial soundness. Several recent studies on the impact of TARP and CPP show that the government intervention was predominantly associated with increases in banks' stock prices and decreases in credit default swap spreads (e.g., Veronesi and Zingales (2010), Li (2013), Elyasiani, Mester, and Pagano (2013), and Bayazitova and Shivdasani (2012)). Li shows that banks used approximately one-third of the TARP capital to support new loans and the rest to strengthen their balance sheets. Figure 2 displays banks' quarterly loan growth from the Federal Deposit Insurance Corporation (FDIC) Call Reports to document potential changes in credit supply around the government intervention events. Banks that obtain capital infusions indeed increased total lending in the quarter the intervention took place compared to the quarter before. Non-CPP banks did not. This observation suggests that CPP capital infusions have at least in part been used to restore business lending.

FIGURE 2

Growth in Total Loan Volume of CPP and Non-CPP Banks

Figure 2 plots the growth rate in total loan volume for the group of banks that received CPP money in 2008Q4, 2009Q1, and 2009Q2, respectively. The figure shows the growth in total loan volume one quarter before ($q-1$), the quarter of (q), and one quarter after ($q+1$) the bank received a capital infusion. For comparison, we also include the growth in total loan volume of the group of non-CPP banks in 2008Q4. N indicates the number of banks used to compute the growth in total loan volume. We aggregate quarterly loan volume from FDIC Call Reports across individual banks to obtain total loan volume. We then compute the percentage growth rate in total loan volume from one quarter to the next.



III. Hypotheses

The declared purpose of the U.S. government's intervention via CPP was to stabilize banks with extra liquidity and make it possible for them to keep on

lending or to increase lending to the corporate sector. If investors expect that government interventions in banks could help alleviate the negative credit shocks and improve credit availability to firms through the bank lending channel, then a positive valuation impact on corporate borrowers' stock price performance would be observed. Therefore, we propose the following hypothesis:

Hypothesis 1. CPP interventions in banks have a significantly positive impact on corporate borrowers' stock price performance.

We next investigate whether borrowers' characteristics affect the stock price impact of CPP intervention. Given the fact that the recent financial crisis originated from the supply side (Ciccarelli, Maddaloni, and Peydro (2010), Ivashina and Scharfstein (2010), and Ongena, Jiménez, Peydro, and Saurina (2010)), the entire banking industry became cautious and reluctant to grant new loans. Other things being equal, it was more difficult for smaller, bank-dependent, less-profitable clients with a higher leverage ratio and bankruptcy risk to get sufficient credit or to switch to alternative financing sources due to the high risk level and information asymmetry between banks and those firms. Also, a lower level of cash holdings prior to the crisis makes firms more vulnerable to the credit supply shocks during the banking crisis. It is also more difficult for more bank-dependent firms, such as firms with low liquidity and firms that lack an investment-grade rating, to raise external finance. These firms are therefore more sensitive to shocks to banks, and government intervention in the banking industry is expected to be especially helpful for those firms. We expect that the crisis stock price performance of these firms is more positively affected when the shocks to banks are mitigated by capital infusions in their banks. In addition, consistent with Chava and Purnanandam (2011), we expect firms that were most strongly affected during the financial crisis also benefit the most once the negative shocks are mitigated by the government interventions.

Hypothesis 2. CPP interventions in banks have a significantly stronger impact on stock returns of corporate borrowers that are smaller (2A), more leveraged (2B), less profitable (2C), closer to financial distress (2D), short on cash (2E), less liquid (2F), more strongly hit during the financial crisis (2G), and more bank dependent (2H).

We also investigate whether bank characteristics influence the magnitude of the impact of government interventions on firm's stock price performance. Previous studies on the bank lending channel argue that large and well-capitalized banks are better able to buffer their lending activity against shocks affecting the availability of external finance (Kishan and Opiela (2000), Gambacorta and Mistrulli (2004)). Empirical evidence from the recent financial crisis shows that banks with higher capital ratios are less adversely hit by the crisis, since they are better able to absorb potential losses (Bayazitova and Shivdasani (2012), Li (2013)). Without capital infusions in their banks, firms borrowing more from weaker and smaller banks would have experienced more funding difficulties (e.g., an increase in loan spread paid) during the credit crunch (Santos (2011)). In line with this argument, we expect a stronger improvement in the stock price

performance of firms that borrow from smaller and financially distressed banks once shocks on these banks are alleviated by CPP intervention.

Hypothesis 3. CPP interventions in banks have a significantly stronger impact on stock returns of corporate borrowers that borrow from banks that are less profitable (3A), less capitalized (3B), and smaller (3C).

IV. Data

Our data comprise information on firm stock price performance, firm characteristics, bank-firm lending relationships, banks' characteristics, and their participation in the CPP. We consider firms that are included in the Center for Research in Security Prices (CRSP), Compustat, and Loan Pricing Corporation (LPC) DealScan databases. We identify firm characteristics prior to the start of the crisis in the second quarter of 2007. Bank-firm relationships are measured prior to the government intervention in the banking sector. We identify banks' participation in the CPP interventions and borrowing firms' stock price performance during the crisis period, which extends from Aug. 9, 2007 (when the Fed first increased the level of temporary open market operations; see Cecchetti (2009)), to Dec. 31, 2009. In total, our sample consists of 1,156 firms, of which 260 are included in the Standard & Poor's (S&P) 500 index. The total market value of firms in our sample accounts for more than half of the total market capitalization of the listed U.S. firms. Table 2 reports summary statistics for the main variables, and the Appendix shows variable definitions, data sources, and the period of measurement. We describe these variables in more detail in the remainder of this section.

TABLE 2

Summary Statistics

Table 2 reports summary statistics for the main variables. Detailed variable descriptions are provided in the Appendix. Panel A reports summary statistics of firm characteristics and bank characteristics. The data for firm and bank characteristics come from the second quarter of 2007. Crisis performance is calculated as the buy-and-hold stock return from Aug. 9, 2007, to Sept. 30, 2008. Panel B reports summary statistics on firms' daily stock returns, the daily market returns based on the CRSP value-weighted market portfolio, and the two intervention scores (INT_SCO_DM, INT_SCO_AMT). The sample period starts on Aug. 9, 2007, and ends on Dec. 31, 2009. The pre-CPP period refers to the period from Aug. 9, 2007, to Oct. 27, 2008, and the post-CPP period refers to the period from Oct. 28, 2008, to Dec. 31, 2009.

Panel A. Firm Characteristics and Bank Characteristics

Variable Group	Variables	Mean	Median	Std. Dev.	Units
Firm characteristics	FIRM_SIZE	11,041	1,721	88,396	Million $
	log(FIRM_SIZE)	7.46	7.45	1.62	1
	LEVERAGE	28.60	26.09	21.70	%
	ROA	1.31	1.17	2.61	%
	Altman's *Z*	1.33	1.24	1.35	1
	BANK_DEPENDENCE	0.60	1.00	0.49	Dummy
	CASH_HOLDINGS	14.00	4.61	24.61	%
	BID-ASK_SPREAD	0.21	0.12	0.39	%
	CRISIS_PERFORMANCE	−0.18	−0.19	0.52	1
Bank characteristics	BANK_ROA	0.64	0.66	0.24	%
	BANK_CAPITAL_RATIO	12.19	12.02	10.53	%
	BANK_SIZE	1,685,739	1,585,788	1,134,451	Million $
	log(BANK_SIZE)	14.05	14.27	0.96	1
No. of firms		1,156			

(continued on next page)

TABLE 2 (continued)
Summary Statistics

Panel B. Firm Stock Price Performance, General Stock Market Performance, and Government Intervention

		Pre-CPP			Post-CPP			
Variable Group	Variables	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Units
Firm stock return	RETURN	−0.0017	−0.0012	0.0377	0.0027	0.0007	0.0553	1
Stock market return	R_{mt}	−0.0016	−0.0005	0.0188	0.0014	0.0026	0.0222	1
Government intervention	INT_SCO_DM	0	0	0	1.1042	1	0.6699	1
	INT_SCO_AMT	0	0	0	0.0284	0.02	0.0459	1
No. of firms		1,156			1,156			
No. of obs.		350,504			341,356			

A. Firm Characteristics and Stock Market Data

We collect data on firms' accounting variables and bank dependence (based on S&P credit ratings) from Compustat, and data on firms' stock market performance from CRSP. We merge the stock market performance data with firm accounting data using the CRSP identifier, "permno." We exclude the financial firms (Standard Industrial Classification (SIC) codes between 6000 and 6999). In order to avoid endogeneity problems in our analysis, we identify firms based on their precrisis accounting characteristics (2007Q2).

We include firms' total assets, cash holdings, and other variables that indicate the level of firms' financial distress, such as leverage ratio, return on assets (ROA), Altman's *Z*-score, and the crisis stock price performance. We also consider variables that reflect the ease of firms' access to the external financial resources, such as the bid-ask spread and bank dependence. In line with Kashyap, Lamont, and Stein (1994) and Chava and Purnanandam (2011), we evaluate a firm's dependence on banks by examining its public debt rating status. We treat the nonrated and not-investment-grade rated firms as bank-dependent firms and the investment-grade rated firms as not bank dependent. In a credit crunch of such a scale, it is very difficult for the noninvestment-grade firms to obtain alternative finance from either the public debt market or the commercial paper market. In our sample, roughly 60% of firms are categorized as bank-dependent borrowers according to their precrisis credit rating status.

B. Bank-Firm Lending Relationships

The strength of the bank-firm relationship is a key factor influencing the credit channel that transmits shocks from banks to their borrowers. Therefore, in order to examine the impact of government interventions on borrowing firms' performance, we first measure the strength of each pair of bank-firm relationships. Having a stronger lending relationship with a bank allows borrowers to have better access to credit from this bank but also makes them more sensitive to the shocks to this bank at the same time.

To establish bank-firm relationships, we employ the LPC DealScan database, which has been used in related studies (e.g., Dennis, Nandy, and Sharpe (2000), Bharath et al. (2011)). This database contains detailed information on bank loans,

mostly syndicated loans, granted to large companies. There are various ways of measuring the strength of a bank-firm relationship; some studies focus on the time dimension and measure the length of the lending relationship (e.g., Berger and Udell (1995)), while others employ the existence of repeated lending, concurrent underwriting, lines of credit, and checking accounts as proxies for a strong bank relationship (e.g., Schenone (2004), Drucker and Puri (2005), Bharath, Dahiya, Saunders, and Srinivasan (2007), (2011), and Norden and Weber (2010)). Since the LPC database starts in 1982, it would not be possible to observe the exact starting point of the lending relationship and thus difficult to calculate the length of any such lending relationship. Thus, instead of focusing on the "time dimension" of the banking relationship, we choose to focus on the "exclusivity dimension" of bank relationships, which takes into account the number of bank lending relationships and the concentration of bank debt.

In line with related studies that suggest that repeated contracting between firms and banks correlates with a strong bank-borrower relationship, we take the repeated lending of banks to firms in the past as an indication for a strong bank-firm relationship. Similar to the method used by Bharath et al. (2007), we construct a firm-specific and time-varying bank-firm lending relationship variable $LR_{ij,t}$ that quantifies the relative importance of the relationship with bank j among all lending relationships of firm i at time t. We construct this lending relationship measure by analyzing the loan portfolio of firm i at time t. To do so, we review the history of new business loans extended to firm i by bank j prior to time t over a 4-year window period from 2004 to 2007. We use that window length because the median maturity of the loans in the LPC DealScan database is 4.8 years. Given that our analysis period is from Aug. 2007 to Dec. 2009, a loan granted during 2004–2007 should still be counted as part of the firm's total loan portfolio in our analysis period and thus would provide information about the strength of the bank-firm relationship.

The reason why we only review the loan history until 2007 and then freeze the relationship during the government intervention period is that tracking relationships through the crisis could create an endogeneity problem, since certain firms might have started new relationships with banks that participated in the CPP because they expected that these banks are more willing or better able to provide credit. However, this does not seem to have happened on a large scale, since significantly fewer new lending relationships have been formed after the beginning of the crisis in 2008 and 2009 (see Figure 3).

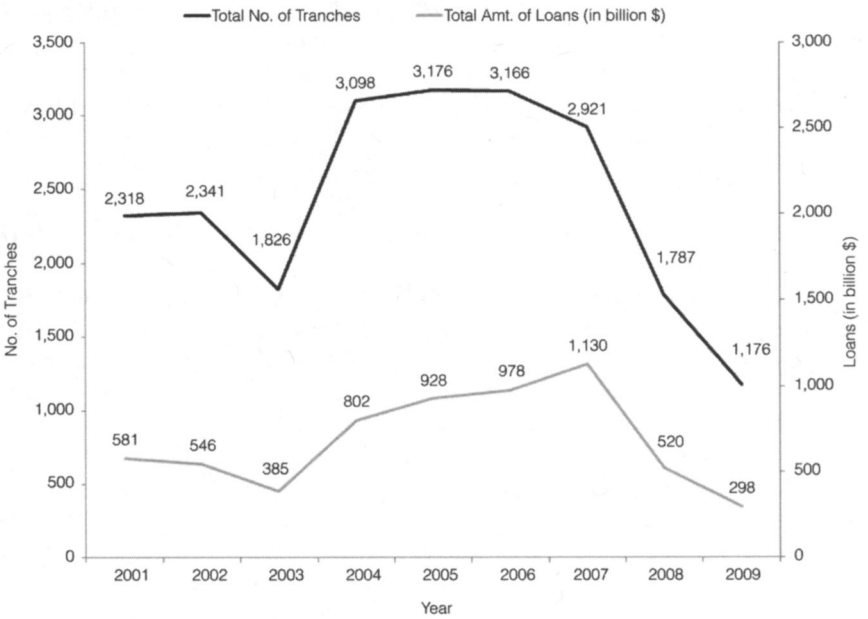
We construct the banking relationship $LR_{ij,t}$ by looking at firm i's top lead arrangers (banks) for each of firm i's historical loans in the LPC database. Suppose that firm i obtained n loans during the past 4 years prior to time t; then the lending relationship between firm i and one lending bank j at time t is calculated as

$$LR_{ij,t} = \frac{\sum_{x=1}^{n} LEAD_{ij,x}}{\sum_{x=1}^{n} NUM\_L_{i,x}}, \tag{1}$$

FIGURE 3

Loan Origination from 2001 to 2009

Figure 3 displays the total number and total volume (in billion $) of new bank loans to U.S. firms originated from Jan. 1, 2001, to Dec. 31, 2009. The data come from the LPC DealScan database.



where $LEAD_{ij,x}$ is a dummy variable that equals 1 if bank j (among the others) acts as a lead arranger in loan x to firm i, and 0 otherwise. $NUM\_L_{i,x}$ is the number of lead arrangers involved in loan x to firm i.

The calculation of LR_{ij} is best illustrated by an example. LPC DealScan reports that Accenture has entered two new loan contracts over the 4-year period from 2004 to 2007; the first loan contract was granted in June 2004 with Bank of America and JP Morgan as lead arrangers. The second loan was granted in June 2006 with Bank of America and Citigroup as lead arrangers. In this case, the strength of the relationship between Accenture and Bank of America is calculated as $LR_{ACCENTURE,BANK\_OF\_AMERICA} = 2/(2 + 1 + 1) = 0.5$; similarly, $LR_{ACCENTURE,JPM} = 1/(2+1+1) = 0.25$ and $LR_{ACCENTURE,CITI} = 1/(2+1+1) = 0.25$. This method not only identifies the most important banks (lead arrangers) for each firm, but also differentiates the relative importance among lead arrangers over the past years. Note that for many cases in the LPC database, information on the actual shares of the individual banks in each syndicated loan are missing or not reliable (i.e., we cannot calculate the relative importance of each lead arranger based on loan volumes). Therefore, we use an indicator variable-based measurement approach, which is the closest we can get to accurately reflecting the strength of a bank-firm relationship.

For both borrowing firms and lead banks, we aggregate data to the parent-bank level. We use the parent bank in our analysis because the CPP is only conducted at the parent-firm level. We also exclude finance companies as lenders

from our analysis because these institutions are not eligible to receive CPP capital infusions.

The large number of mergers and acquisitions in the U.S. banking industry during our sample period makes it challenging to track the dynamics of bank-firm relationships. We use the Thomson One Banker and Zephyr database to document bank mergers and acquisitions events from 2004 to 2009 and construct dynamic relationships between banks and firms. Similar to other studies, we assume that in most cases, the post-merger/post-acquisition bank inherited the loans of the pre-merger/pre-acquisition banks under normal economic situations. When bank A is acquired by bank B at time t_1, all clients of bank A are automatically counted as clients of bank B after time t_1, and $LR_{iB,t}$ for firm i is recalculated by taking into account the prior relationship with bank A.

Based on the information extracted from 2,449 loan contracts from Jan. 2004 to Dec. 2007, we are able to construct 127,748 pairs of bank-firm relationships $LR_{ij,t}$ at the beginning of 2005, and this number is then reduced to 112,512 pairs at the end of 2009 due to mergers and acquisitions in the banking sector. We use the borrower parent ticker from LPC DealScan to match to the ticker of Compustat. Using the link of Michael R. Roberts (http://finance.wharton.upenn.edu/~mrrobert/), we also match the company names from LPC DealScan to the "gvkey" from Compustat (see Chava and Roberts (2008) for more details on this link). This produces a similar match, given that all firms in our sample are publicly listed and have a borrower parent ticker available in LPC DealScan.

C. CPP Capital Infusions and Redemptions

The data on banks' participation in TARP's capital infusion program CPP come from the Web site of the U.S. Department of the Treasury (http://www.treasury.gov/initiatives/financial-stability). They include information on capital infusions and capital redemptions. We employ an innovative measurement to assess the intensity of the positive spillover effects stemming from intervention by defining a firm-specific and time-varying CPP intervention score that takes a firm's bank relationships and the banks' participation in the CPP program into account. We create two intervention variables for each firm to capture the presence (INT_SCO_DM) and magnitude (INT_SCO_AMT) of CPP interventions. For INT_SCO_DM, we first create a time-varying intervention variable $\text{INTERVENTION\_DM}_{j,t}$ for each firm's bank j. $\text{INTERVENTION\_DM}_{j,t}$ increases its value by 1 when a capital infusion took place and decreases its value by 1 if there is capital redemption. Second, we transform the bank-level variable $\text{INTERVENTION\_DM}_{j,t}$ into a firm-level intervention score, $\text{INT\_SCO\_DM}_{i,t}$, for each firm i by considering the lending relationships with its m banks. The daily firm-level intervention score is calculated as shown in equation (2):

$$\text{INT\_SCO\_DM}_{i,t} = \sum_{j=1}^{m} \text{LR}_{ij,t} \times \text{INTERVENTION\_DM}_{j,t}. \tag{2}$$

Following a similar procedure, we create a second firm-level intervention measure by considering firm i's lending relationships with m banks and the amount of CPP capital that is injected into each of the m lending banks. First, for each

bank, we create a time-varying intervention variable $\text{INTERVENTION\_AMT}_{j,t}$, which increases (decreases) its value by the CPP dollar amount injected to (redeemed by) bank j scaled by the total asset value of bank j prior to the start of the crisis (2007Q2):

$$(3) \quad \text{INTERVENTION\_AMT}_{j,t} = \frac{\text{AMOUNT\_INJECTED\_TO\_BANK}_{j,t}}{\text{PRECRISIS\_TOTAL\_ASSETS\_OF\_BANK}_{j}}.$$

We then transform the bank-level variable $\text{INTERVENTION\_AMT}_{j,t}$ into a daily firm-level intervention score, $\text{INT\_SCO\_AMT}_{i,t}$, by considering the lending relationships with its m banks, as shown in equation (4):

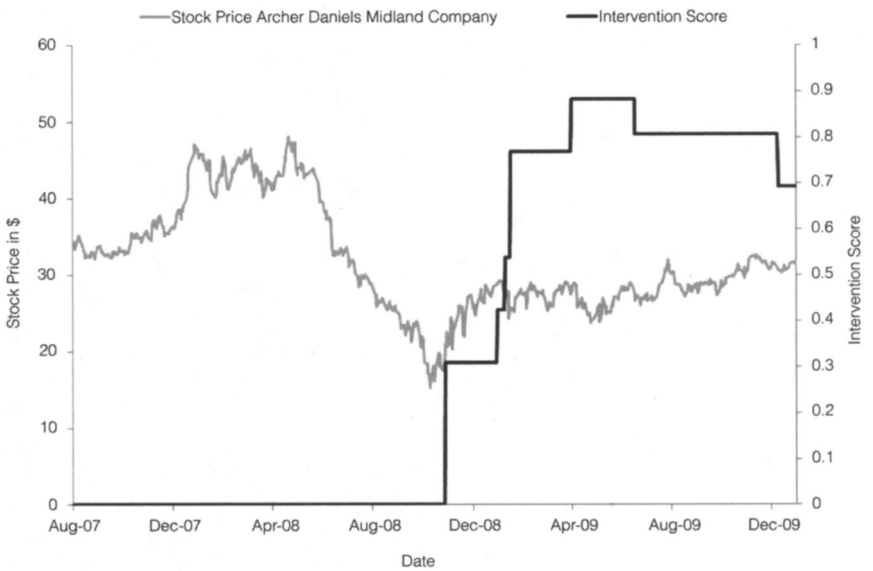
$$(4) \quad \text{INT\_SCO\_AMT}_{i,t} = \sum_{j=1}^{m} \text{LR}_{ij,t} \times \text{INTERVENTION\_AMT}_{j,t}.$$

Since the impact of the CPP intervention on firms' stock market performance is the main focus of our analysis, we use an example from our data set to illustrate the first intervention score $\text{INT\_SCO\_DM}_{i,t}$ and firms' stock price performance in Figure 4.

FIGURE 4

The Comovement of the Intervention Score and Firm Stock Price

Figure 4 displays the comovement of stock price and the intervention score (INT_SCO_DM) of Archer Daniels Midland Company from Aug. 9, 2007, to Dec. 31, 2009.



Archer Daniels Midland Company (NYSE: ADM, agriculture and food industry) started three loan contracts from 2004 to 2007, which involved a total of 26 lead arrangers (16 unique banks). As displayed in Figure 4, $\text{INT\_SCO\_DM}_{i,t}$ (measured on the left axis) first increased during the initial CPP infusion, since three banks (acted as lead arrangers eight times) received CPP funds. As more

banks obtained CPP funds later on, the intervention score $INT\_SCO\_DM_{i,t}$ increased further. After the enactment of the ARRA on Feb. 2009, some banks started to pay back the CPP money, and thus we see a decrease in INT_SCO_DM.

V. Empirical Results

A. The Short-Run Impact of CPP Intervention on Firms' Stock Returns

In our first set of tests, we examine the short-run impact of CPP intervention events on firms' stock performance. We calculate the 5-day cumulative abnormal returns (CARs) for the time interval $[-2, +2]$ around days on which corporate borrowers' banks experience CPP capital infusions. We calculate firms' abnormal returns using the market-adjusted model by subtracting the return of the CRSP value-weighted stock market returns (including dividends distributions) as the market portfolio, comprising all NYSE/AMEX/NASDAQ listed firms. We also use the market model to calculate abnormal returns based on a precrisis estimation window of 255 days ending Aug. 9, 2007, or a pre-intervention estimation window of 255 days ending Oct. 1, 2008.

We test the short-term stock price reaction for firms surrounding the first up to the sixth intervention event in one or more of their banks. We also distinguish between forced events (when the government forced nine banks to accept a capital infusion on Oct. 28, 2008) and voluntary events (when banks applied for a capital infusion at a later date on a voluntary basis).

Table 3 presents the short-term event study results. Consistent with our Hypothesis 1, firms display a significantly positive stock price reaction around intervention events in their banks. On average, using the market-adjusted model in Panel A of Table 3, we find that the mean (median) CAR equals 1.41% (0.84%)

TABLE 3

Short-Term Impact of Government Interventions in Banks on Corporate Borrowers' Stock Returns

Table 3 presents the event study results of government intervention in banks on corporate borrowers' stock returns. We report the mean and median 5-day cumulative abnormal returns (CARs) during an event window of $[-2, +2]$ surrounding government intervention in one or more of the firm's banks (in percent). We distinguish between the first up to the sixth intervention event, the forced intervention event on Oct. 28, 2008, subsequent voluntary intervention events, and all intervention events together. Panel A gives CARs using the market-adjusted model, Panel B gives CARs using the market model with a pre-intervention estimation window of 255 trading days (ending on Oct. 1, 2008), and Panel C gives CARs using the market model with a precrisis estimation window of 255 trading days (ending on Aug. 9, 2007). We use the CRSP value-weighted stock market returns (including dividends distributions) as the market portfolio, comprising all NYSE/AMEX/NASDAQ listed firms. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Intervention Event	Mean	*t*-Stat.	*p*-Value	Median	% Positive	*p*-Value Wilcoxon Sign Test	*p*-Value Wilcoxon Rank-Sum Test	No. of Obs.
Panel A. CARs during Event Window [–2, +2] Using the Market-Adjusted Model								
1	3.29	4.423	0.000***	2.07	58.70	0.000	0.000	1,109
2	0.97	1.881	0.030**	0.69	52.90	0.084	0.077	907
3	1.01	2.134	0.016**	0.44	52.50	0.157	0.153	840
4	−0.63	−1.623	0.109	0.04	50.40	0.870	0.268	603
5	1.55	2.621	0.000***	1.24	58.60	0.000	0.000	406
6	1.68	2.086	0.019**	1.05	58.70	0.095	0.055	104
Forced	3.45	6.626	0.000***	1.75	56.90	0.000	0.000	1,026
Voluntary	0.71	3.245	0.000***	0.29	51.30	0.139	0.110	2,943
All events	1.41	4.362	0.000***	0.84	54.70	0.000	0.000	3,969

(continued on next page)

TABLE 3 (continued)

Short-Term Impact of Government Interventions in Banks on Corporate Borrowers' Stock Returns

Intervention Event	Mean	*t*-Stat.	*p*-Value	Median	% Positive	*p*-Value Wilcoxon Sign Test	*p*-Value Wilcoxon Rank-Sum Test	No. of Obs.
Panel B. CARs during Event Window [−2, +2] Using the Market Model (pre-intervention estimation period)								
1	2.72	4.488	0.000***	1.99	57.08	0.000	0.000	1,109
2	1.08	2.131	0.017**	0.28	51.16	0.506	0.114	907
3	1.16	2.493	0.006***	−0.10	48.93	0.557	0.255	840
4	−0.41	−0.843	0.200	−0.25	48.25	0.414	0.132	603
5	1.67	2.879	0.002***	1.19	59.80	0.000	0.000	406
6	1.63	2.041	0.021**	1.21	57.28	0.167	0.089	104
Forced	2.83	5.668	0.000***	2.15	57.70	0.000	0.000	1,026
Voluntary	0.87	4.119	0.000***	0.28	51.90	0.035	0.011	2,943
All events	1.42	4.484	0.000***	0.57	57.08	0.000	0.000	3,969
Panel C. CARs during Event Window [−2, +2] Using the Market Model (precrisis estimation period)								
1	1.19	2.510	0.000***	0.67	52.36	0.100	0.192	1,082
2	1.24	3.797	0.017**	1.07	56.79	0.000	0.000	891
3	1.25	3.985	0.000***	0.59	53.63	0.040	0.037	826
4	−0.20	−0.641	0.261	0.23	51.60	0.461	0.976	596
5	1.44	4.603	0.000***	1.00	58.21	0.001	0.001	402
6	1.47	3.122	0.000***	0.30	52.94	0.621	0.158	103
Forced	1.17	2.222	0.027***	0.78	52.60	0.094	0.149	1,004
Voluntary	0.98	4.528	0.000***	0.67	54.30	0.000	0.000	2,896
All events	1.11	5.533	0.000***	0.75	54.51	0.001	0.000	3,900

during the 5-day event window. The first event and forced event show the largest stock price reaction. Note that the 1,109 first intervention events include the 1,026 forced events. This shows that most firms in our sample borrow from at least one of the nine banks that were forced by the U.S. government to participate in CPP. However, it is important to note that later intervention events and voluntary events also trigger a significantly positive stock price reaction.

The results remain robust when we calculate abnormal returns using the market model over a pre-intervention estimation period (255 days, up to Oct. 1, 2008; see Panel B of Table 3) or over a precrisis estimation period (255 days, up to Aug. 9, 2007; see Panel C of Table 3). We also use the Fama-French (1993) 3-factor model in unreported tests using the precrisis and the pre-intervention estimation period. The mean (median) CAR equals 1.2% (0.63%) for the pre-intervention estimation period and 1.12% (0.39%) for the precrisis estimation period. All CARs are significantly different from 0 at the 1% level of significance.

B. The Longer-Run Impact of CPP Intervention on Firms' Stock Returns

In our second set of tests, we estimate panel data regressions to examine the longer-run impact of CPP interventions on firms' stock price performance. There are several reasons why panel data regressions are well-suited in our setting. First, we can take into account the specific nature of the CPP, especially its scale, scope, and timing. Except in the first round of capital infusions, which were forced, banks could apply for government capital infusions during a predefined time horizon. The series of bank-specific intervention events sometimes followed close to each other, did not happen simultaneously, were spread out over

several quarters, and differ between banks in terms of number, timing, and magnitude. We use the intervention score to not only capture the mere presence of the intervention but to measure the time-varying exposure to interventions and capital redemptions at the individual borrowing firm level.

Second, panel data regressions allow us to better deal with the dynamics of change and omitted unobservable variables than pure cross-sectional or pure time-series data (Hsiao (2003)). This could be important, given that we study intervention events where contemporaneous correlation of residuals across firms may be nontrivial and omitted unobservable variables could influence the results.

Third, the short-term event study from the previous section captures the expectation effect in stock markets, while panel data analysis captures changes in firms' average stock returns over a longer period, comprising the initial expectation effect and (unexpected) subsequent effects due to the actual increase in bank lending. Considering the short-term and the longer-term perspectives with different methods also alleviates the concern that the short-term event study results are up- or downward biased because of the uncertainty surrounding the events. We estimate the following two panel data regression equations:

$$\text{RETURN}_{it} = \alpha + \beta_1 \text{INT\_SCO\_DM}_{i,t} + \beta_2 R_{mt} + u_i + \varepsilon_{i,t}, \quad (5)$$

$$\text{RETURN}_{it} = \alpha + \beta_1 \text{INT\_SCO\_AMT}_{i,t} + \beta_2 R_{mt} + u_i + \varepsilon_{i,t}. \quad (6)$$

We regress each firm's daily stock return RETURN_{it} on its intervention score INT_SCO_DM_{it} and INT_SCO_AMT_{it}, the market factor R_{mt}, and firm fixed effects u_i, as shown in equations (5) and (6). Table 4 reports the estimation results.

Table 4 reports that CPP interventions in general have a significantly positive impact on firms' stock returns. The regression results using the full sample show that both INT_SCO_DM (Panel A) and INT_SCO_AMT (Panel B) are positively and significantly related with firms' stock returns. For example, the findings from model 1 indicate that moving from the first to the third quartile of INT_SCO_DM is associated with an additional daily stock return of 0.042 percentage points, which translates into a substantial additional return per year of 11.34 percentage points. Hence, we find evidence in favor of our Hypothesis 1.

We then categorize firms into three groups according to the types of CPP interventions in their lending banks (i.e., forced only, voluntary only, and mixed) and re-run the regression models of equations (5) and (6) for these groups separately. Firms are categorized as forced if they have lending relationships with only one of the nine banks that were forced into a bailout by the government on Oct. 28, 2008 (63 firms), while firms are categorized as voluntary if they have a relationship only with banks that voluntarily participated in the CPP at a later stage (79 firms). "Mixed" firms are those that borrow from banks that were forced to participate and voluntarily participated in the CPP (963 firms). The results, which are not reported here but are available from the authors, show that for both intervention score measures, the positive valuation effect on firms' stock price performance stays robust and consistent across three categories of intervened firms.

A potential problem with our panel data regressions is that the residuals of a given firm may be time-series dependent (i.e., a firm effect correlated across

time), and residuals of a given day may be dependent in the cross section (i.e., a time effect correlated across firms). We address these issues by using two-way clustered standard errors in model 2 of Table 4, following Petersen (2009). The results are similar to the panel regression shown in model 1.

In model 3 of Table 4 we estimate the three-factor panel model following Fama and French (1993) with firms' excess returns ($RETURN_{it} - R_{ft}$) as the dependent variable, and the intervention score, the stock market factor ($R_{mt} - R_{ft}$), the SMB factor, and the HML factor as independent variables. We collect the data on the stock market risk factors from Kenneth French's Web site (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/). It turns out that we find a similar effect of the intervention score as in the baseline model 1.

TABLE 4

Longer-Run Impact of Government Interventions in Banks on Corporate Borrowers' Stock Returns

Table 4 presents the results of panel data regressions (models 1–4) with firm fixed effects and firm-by-firm time-series regressions (model 5) for the period from Aug. 9, 2007, to Dec. 31, 2009. The dependent variable in models 1, 2, 4, and 5 is the firm's daily stock return including dividends ($RETURN_{it}$). The dependent variable in model 3 is the firm's daily excess stock return including dividends over the 1-month U.S. T-bill rate ($RETURN_{it} - R_{ft}$). Panel A (Panel B) reports the regression results using INT_SCO_DM (INT_SCO_ AMT), the daily market return R_{mt}, the stock market factors, and the post-intervention dummy, respectively, as independent variables. Model 4 in Panels A and B includes the intervention score orthogonalized to the post-intervention dummy variable as well as the daily market return. *, **, and *** indicate coefficients that are significantly different from 0 at the 10%, 5%, and 1% levels, respectively. Variables are defined in the Appendix.

	Dependent Variable									
	$RETURN_{it}$				$RETURN_{it} - R_{ft}$		$RETURN_{it}$			
	Model 1 Panel Data, Huber-White Robust Standard Errors		Model 2 Panel Data, Two-Way Clustered Standard Errors		Model 3 Panel Data, Huber-White Robust Standard Errors		Model 4 Panel Data, Huber-White Robust Standard Errors		Model 5 Firm-by-Firm Time-Series Regressions	
	Coeff.	*t*-Stat.	Coeff.	*t*-Stat.	Coeff.	*t*-Stat.	Coeff.	*t*-Stat.	Mean Coeff.	Mean *t*-Stat.
Panel A. The Impact of Interventions (dummy) on Corporate Borrowers' Stock Returns										
INT_SCO_DM	0.0006	8.03***	0.0005	2.16**	0.0005	6.88***			0.0012	7.06***
$INT\_SCO\_DM_{ORTHOG}$							0.0004	7.11***		
R_{mt}	1.1517	484.10***	1.1530	45.71***			1.1521	484.20***	1.1507	78.64***
$R_{mt} - R_{ft}$					1.1388	404.06***				
SMB					0.6593	102.46***				
HML					0.1287	21.42***				
Post-intervention dummy							0.0004	6.73***		
Constant	0.0002	3.76***	0.0002	1.20	0.0002	3.26***	0.0004	9.06***		
Firm fixed effects	Yes		Yes		Yes		Yes		No	
No. of firms	1,156		1,156		1,156		1,156		1,156	
No. of obs.	691,860		691,860		691,860		691,860		1,156	
Adj. R^2	0.254		0.254		0.266		0.255		N/A	
Panel B. The Impact of Interventions (amount) on Corporate Borrowers' Stock Returns										
INT_SCO_AMT	0.0131	7.86***	0.0087	2.99***	0.0114	6.32***			0.0722	7.37***
$INT\_SCO\_AMT_{ORTHOG}$							0.0003	6.10***		
R_{mt}	1.1533	484.89***	1.1536	45.70***			1.1522	484.40***	1.1508	78.65***
$R_{mt} - R_{ft}$					1.1396	405.27***				
SMB					0.6598	102.56***				
HML					0.1277	21.26***				
Post-intervention dummy							0.0004	8.58***		
Constant	0.0004	6.83***	0.0004	2.15**	0.0003	7.01***	0.0005	9.06***		
Firm fixed effects	Yes		Yes		Yes		Yes		No	
No. of firms	1,156		1,156		1,156		1,156		1,156	
No. of obs.	691,860		691,860		691,860		691,860		1,156	
Adj. R^2	0.254		0.254		0.266		0.255		N/A	

Another potential concern is whether our intervention score fully captures the cross-sectional and time-varying dynamics of the impacts of CPP interventions on each firm. For this purpose, we create an indicator variable (post-intervention dummy) that equals 1 from the first CPP intervention to the end of the sample period to capture the macro-level time-series effects from interventions. We then orthogonalize the intervention score with this indicator variable and include both variables in the panel regression model with daily data. This approach ensures that we consider only that part of the intervention score that is left unexplained by the macro effect indicator variable. Model 4 of Table 4 shows that the indicator variable (post-intervention dummy) and the orthogonalized intervention score ($\text{INT\_SCO\_DM}_{\text{ORTHOG}}$) exhibit positive coefficients that are statistically significant (t-statistics = 6.73 and 7.11). Thus, the variation in the intervention score not only reflects the macro-level structural changes to the market as a result of the CPP interventions but also captures both the cross-sectional and time-varying dynamics of the impact of CPP interventions on corporate borrowers' stock returns.

A final problem with our panel data regressions may be that we do not allow the coefficient on the intervention score variables to vary across firms. We therefore repeat our analysis in the spirit of Schipper and Thomson (1983) using daily raw returns over the crisis period from Aug. 9, 2007, to Dec. 31, 2009, as a dependent variable in 1,156 firm-by-firm time-series regressions and using the intervention score and the daily market return as independent variables. Model 5 of Table 4 indicates that the mean of the 1,156 coefficients on INT_SCO_DM equals 0.0012 (with more than 55% of the coefficient estimates being positive). The mean of the 1,156 coefficients on INT_SCO_AMT equals 0.0722 (with more than 57% of the coefficient estimates being positive). These mean values are both significantly different from 0 at the 1% level of significance (the same holds for the corresponding medians). We further analyze the cross-sectional determinants of these coefficients in Section VI.

We conclude that there is strong support for our Hypothesis 1, regardless of whether we conduct a short-term event study, panel data regressions, or firm-by-firm time-series regressions. All results consistently show that government intervention in banks had positive spillover effects on borrowing firms.

C. The Influence of Firm Characteristics

To test our Hypothesis 2, we consider the influence of precrisis firm characteristics and investigate whether firms with certain characteristics are more sensitive to the impact of CPP interventions. We run the daily panel data regression shown in equation (5) on quintiles that we created based on firms' precrisis characteristics except for bank dependence. This empirical approach also makes it possible for us to examine whether the influence of firm characteristics is monotonic or not. The empirical results are reported in Table 5.

We obtain two main findings. First, consistent with the results in Table 4, we note that CPP interventions in general have a positive impact on firms' stock returns in almost all quintile groups. Second, the magnitude of the impact of CPP interventions on firms' stock returns varies depending on firm characteristics.

TABLE 5

Panel Data Regression Results by Firm Characteristics

Table 5 presents the results of panel data regressions with firm fixed effects from Aug. 9, 2007, to Dec. 31, 2009. The dependent variable is the firm's daily stock return including dividends ($RETURN_{it}$), and the independent variables are the intervention score INT_SCO_DM and the daily market return R_{mt}. Observations are grouped into one of five quintiles according to one of the eight firm characteristics measured with precrisis data from 2007Q2 and firms' crisis stock price performance (from Aug. 9, 2007, to Sept. 30, 2008). Coefficients of the INT_SCO_DM and *t*-statistics based on Huber-White robust standard errors are reported. *, **, and *** indicate coefficients that are significantly different from 0 at the 10%, 5%, and 1% levels, respectively. Variables are defined in the Appendix.

	(lowest) Quintile 1		Quintile 2		Quintile 3		Quintile 4		(highest) Quintile 5		Significance Quintile 5–1
Quintiles Split by	Coeff.	*t*-Stat.	Coeff.	*t*-Stat.	Coeff.	*t*-Stat.	Coeff.	*t*-Stat.	Coeff.	*t*-Stat.	*t*-Stat.
log(FIRM_SIZE)	0.0007	4.51***	0.0004	2.60***	0.0006	3.56***	0.0006	3.92***	0.0004	2.15**	1.04
LEVERAGE	0.0005	3.54***	0.0003	2.27**	0.0005	3.23***	0.0008	4.23***	0.0010	4.44***	−6.39***
ROA	0.0017	7.22***	0.0006	3.26***	0.0003	1.90*	0.0003	2.24**	0.0002	1.35	6.86***
Altman's *Z*	0.0012	5.35***	0.0007	3.99***	0.0004	2.70***	0.0007	4.47***	0.0002	1.30	8.28***
CASH_HOLDINGS	0.0007	3.68***	0.0005	3.24***	0.0008	4.27***	0.0006	3.56***	0.0004	2.48**	1.65*
BID-ASK_SPREAD	0.0003	2.66***	0.0005	2.73***	0.0005	3.49***	0.0005	2.89***	0.0010	4.91***	−6.47***
CRISIS_PERFORMANCE	0.0029	11.88***	0.0009	5.33***	0.0003	2.76***	−0.0003	−2.60***	−0.0009	−6.86***	14.92***

	Not Bank-Dependent Firms		Bank-Dependent Firms		Significance between Groups
	Coeff.	*t*-Stat.	Coeff.	*t*-Stat.	*t*-Stat.
BANK_DEPENDENCE	−0.0001	−1.13	0.0005	4.55***	5.05***

For firm size, daily stock returns of smaller firms are more sensitive to CPP infusion, which is in line with Hypothesis 2A. However, we note that the difference between quintiles 1 and 5 is not significant. Results on a firm's financial ratios (Hypotheses 2B: leverage ratio; 2C: profitability; and 2D: Altman's *Z*-score) indicate that during adverse economic situations, CPP capital infusion in banks has had a more pronounced impact on stock price performance of more financially distressed firms. Differences between the lowest and highest quintiles are all significant at the 1% level. Stock returns of less-profitable firms are significantly more sensitive to CPP infusions. The CPP interventions have stronger positive valuation impacts on the stock price of firms with lower Altman's *Z*-score, and the impact declines as the Altman's *Z*-score increases (although not monotonically). This set of results confirms that the borrower's level of financial distress (leverage, profitability, *Z*-score) is an important factor that influences the impact of CPP intervention on corporate borrowers' stock returns.

Results on firms' precrisis cash holdings indicate that firms that are short on cash benefit significantly more when the government infuses capital in their lending banks, which is in line with Hypothesis 2E. Moreover, conforming to Hypothesis 2F, government capital infusions have more pronounced impacts on firms with less-liquid stocks (higher bid-ask spread). In addition, we find firms that were most strongly hit by the financial crisis also benefit the most from CPP interventions in their lending banks, which supports Hypothesis 2G.

We find that bank-dependent firms benefit more from capital infusions in their banks during the financial crisis than less bank-dependent firms, which is consistent with Hypothesis 2H. Results show a significantly positive impact of CPP intervention on bank-dependent firms' daily stock returns, while there is no significant impact of CPP intervention on stock returns of firms that are not bank

dependent. The difference is significant at the 1% level. This result is in line with Chava and Purnanandam (2011), who document stronger positive stock price reactions for bank-dependent firms after a positive liquidity shock to banks due to an unexpected cut of the Fed Funds rate. As discussed earlier, the goal of the CPP capital infusion program is to stimulate banks' lending to the industry by providing extra liquidity to banks. Since bank lending is the primary source of financing for bank-dependent borrowers, they are most sensitive to CPP interventions in banks. It is important to note that all the results presented above remain similar when we use the INT_SCO_AMT instead of the INT_SCO_DM to measure government intervention in banks.

Summarizing, our results provide evidence that firm characteristics influence the impact of the CPP on firms' stock performance. We find that riskier (i.e., more levered, less profitable, more financially distressed) and bank-dependent firms are more sensitive to the positive impact of government capital infusions. These effects are not only significant from a statistical perspective but also economically significant.

D. The Influence of Bank Characteristics

We now examine the impact of bank characteristics on the sensitivity of firms' stock returns to intervention in these banks. We construct weighted bank characteristics for each firm i at time t by considering the relationship between firm i and its lending bank j, as well as bank j's specific characteristics l (i.e., bank profitability, capital ratio, and bank size) at time t:

$$\text{WEIGHTED\_BANK\_CHARACTERISTICS}_{il,t} = \sum_{j=1}^{n} \text{LR}_{ij,t} \times \text{BANK\_CHARACTERISTICS}_{jl,t}. \tag{7}$$

We refer to Table 2 for descriptive statistics on these weighted bank characteristics. For each bank characteristic, we estimate the regression model shown in equation (5) on subsamples that result from a quintile split based on the weighted bank characteristics measured during the second quarter of 2007. Table 6 reports the results.

First, we find that firms borrowing from the least-profitable banks (quintile 1) benefit more from the government capital infusion. As proposed in Hypothesis 3A, the positive impact becomes weaker for those firms that borrow from more-profitable banks (quintile 5). However, the difference between quintiles 1 and 5 is not significant. Second, stock returns of borrowers of banks with weaker capital ratios are more sensitive to CPP infusions. The effect is strongest for the least-capitalized banks' clients (quintiles 1 and 2) and weakest for firms that borrow from banks with the highest capital ratio (quintile 5), which is in line with Hypothesis 3B. We further find that capital infusions matter more for corporate borrowers of smaller banks. Consistent with Hypothesis 3C, the impact of interventions becomes stronger when they borrow from smaller banks. Our finding is consistent with studies that argue that smaller banks with weaker capital ratios were most strongly hit by the crisis and also benefited the most once the negative shock is alleviated by the CPP (e.g., Panetta et al. (2010), Santos (2011)).

TABLE 6

Panel Data Regression Results by Bank Characteristics

Table 6 presents the results of panel data regressions with firm fixed effects on daily data from Aug. 9, 2007, to Dec. 31, 2009 (see equation (5) in the paper). The dependent variable is a firm's daily stock return including dividends ($RETURN_{it}$), and the independent variables are the intervention score INT_SCO_DM and the daily market return R_{mt}. Observations are grouped into one of five quintiles of the three bank characteristics, respectively, using precrisis data (gathered from 2007Q2). Bank characteristics are averaged across the banks that the firm borrows from using the strength of the bank's lending relationship with the borrowing firm as a weight (see equation (7)). Regression coefficients of the INT_SCO_DM and their *t*-statistics based on Huber-White robust standard errors are reported. *, **, and *** indicate coefficients that are significantly different from 0 at the 10%, 5%, and 1% levels, respectively. Variables are defined in the Appendix.

Quintiles Split by	(lowest) Quintile 1		Quintile 2		Quintile 3		Quintile 4		(highest) Quintile 5		Significance Quintile 5–1
	Coeff.	*t*-Stat.	Coeff.	*t*-Stat.	Coeff.	*t*-Stat.	Coeff.	*t*-Stat.	Coeff.	*t*-Stat.	*t*-Stat.
BANK_ROA	0.0009	4.62***	0.0007	2.70***	0.0006	3.22***	0.0005	3.73***	0.0004	3.21**	1.46
BANK_CAPITAL_RATIO	0.0007	3.28***	0.0008	5.23***	0.0006	3.50***	0.0006	3.61***	0.0003	2.42**	2.05***
BANK_SIZE	0.0013	4.75***	0.0007	3.83***	0.0003	1.73*	0.0007	4.54***	0.0004	3.83***	2.77***

VI. Further Checks

We also estimate cross-sectional regressions using the estimated coefficients on the intervention score obtained from firm-by-firm time-series regressions as the dependent variable. We use firm and bank characteristics from the second quarter of 2007 as independent variables. An examination of the pair-wise correlations and variation inflation factors indicates that there is no severe multicollinearity problem. Table 7 reports the findings.

TABLE 7

Regression Results for the Determinants of the Intervention Score Coefficient

Table 7 presents the results of cross-sectional ordinary least squares (OLS) regressions with β_{1i} (obtained from firm-level time-series regressions $R_{it} = \alpha_i + \beta_{1i}INT_SCO_DM_{it} + \beta_{2i}R_{mt} + \varepsilon_{it}$) as the dependent variable and firm and bank characteristics as explanatory variables. Models 1 and 2 report the regression results for the full sample, which includes 1,125 firms with available data for all variables; Models 3 and 4 report the regression results for 624 firms with positive β_{1i}. The *t*-statistics are based on Huber-White robust standard errors. *, **, and *** indicate coefficients that are significantly different from 0 at the 10%, 5%, and 1% levels, respectively. Variables are defined in the Appendix.

	Dependent Variable: β_{1i}							
	Model 1		Model 2		Model 3		Model 4	
	Coeff.	*t*-Stat.	Coeff.	*t*-Stat.	Coeff.	*t*-Stat.	Coeff.	*t*-Stat.
Panel A. Firm Characteristics								
log(FIRM_SIZE)	0.0001	0.98	0.0001	1.07	0.0003	2.22**	0.0004	2.44**
LEVERAGE	0.0037	4.02***			0.0039	3.22***		
ROA	−0.0106	−2.24**			−0.0135	−2.68***		
CRISIS_PERFORMANCE	−0.0024	−2.33**	−0.0023	−2.07**	−0.0018	−2.12**	−0.0017	−1.79*
CASH_HOLDINGS	0.0005	0.58	0.0004	0.47	0.0010	0.95	0.0009	0.85
BID-ASK_SPREAD	0.0238	1.44	0.0179	1.10	0.0408	1.69*	0.0377	1.58
BANK_DEPENDENCE	0.0009	2.57***	0.0011	2.96***	0.0019	3.90***	0.0023	4.11***
Altman's *Z*			−0.0004	−4.26***			−0.0005	−3.62***
Panel B. Bank Characteristics								
BANK_ROA	−0.1550	−1.92*	−0.1438	−1.76*	−0.4691	−3.26***	−0.4499	−3.09***
BANK_CAPITAL_RATIO	0.0003	0.26	0.0004	0.32	−0.0003	−0.34	−0.0003	−0.25
log(BANK_SIZE)	−0.0003	−2.00**	−0.0004	−2.44**	−0.0003	−1.31	−0.0004	−1.75*
Constant	0.0028	1.29	0.0050	2.32**	0.0035	1.12	0.0058	1.81*
No. of obs.	1,125		1,125		624		624	
Adj. R^2	0.098		0.091		0.132		0.116	

Models 1 and 2 of Table 7 are estimated on the full sample, whereas models 3 and 4 are estimated for those firms with significantly positive coefficients on the intervention score. Moreover, we alternatively include either leverage and firm profitability (ROA) or the Altman's *Z*-score. Models 1 and 3 indicate that higher leverage is associated with a higher coefficient on the intervention score. In addition, firm profitability (ROA) and the crisis stock price performance prior to intervention are negatively related to the intervention score coefficient. Models 2 and 4 show that higher bankruptcy risk (lower Altman's *Z*-score) significantly increases the positive impact of CPP intervention on firms' stock returns. Bank dependence leads to higher coefficients on the intervention score in all four models. We further find that lower bank profitability and smaller bank size is associated with a higher coefficient on the intervention score in firm-by-firm time-series regressions. These findings show that the impact of government interventions on stock returns is more pronounced for firms that have stronger lending relationships with smaller, and less-profitable banks. Overall, the results from Table 7 largely confirm our earlier results using panel data regressions.

Next, we investigate potential real effects associated with government intervention in the banking industry. Specifically, we examine potential changes in firms' financial constraints after government interventions in their lead banks. We estimate the corporate borrower's investment-cash flow sensitivity that indicates its dependence on internal financing. We are aware that there has been debate on how to measure financial constraints in the literature (e.g., univariate criteria (firm size, earnings retention, tangible assets, and bond ratings), investment-cash flow sensitivities, cash holdings-cash flow sensitivities, and indices such as those by Kaplan and Zingales (1997), Cleary (1999), Whited and Wu (2006), and Hadlock and Pierce (2010)). However, an application of all these methods would be beyond the scope of our paper.

Table 8 presents the results of panel data regressions that control for time-varying firm-specific growth and investment opportunities by including the market-to-book ratio and firm-fixed effects and time-fixed effects. The coefficient of the cash flow ratio is significantly positive, suggesting that the investments of the average firm depend on the availability of internal finance. We examine whether the investment-cash flow sensitivity has changed by interacting the cash flow ratio with the intervention score. We find that the coefficient on the interaction effect of the cash flow ratio and the intervention score is significantly negative, indicating that firms' cash flow sensitivities have decreased after capital infusions in their banks. Corporate borrowers therefore became less financially constrained after government intervention in their banks. This provides some indication that the government intervention in banks helped to relax financial constraints.

Although the results are consistent with our main findings on firms' stock returns, we feel that these findings should be interpreted with caution. It might be premature to conclude that CPP interventions have positive real effects on firms because of lead-lag effects between intervention and banks' and firms' reactions. In addition, confounding events at the bank and firm level might have delayed or compromised the positive effects of intervention. Moreover, we do not consider potential changes in demand for investment and consumption that might have

TABLE 8

Government Intervention in Banks and Corporate Borrowers' Financial Constraints

Table 8 presents the results of a panel data regression with time and firm fixed effects for firms' quarterly capital expenditures during post-intervention crisis period from 2008Q4 to 2009Q4. The dependent variable is the firm's capital expenditure (divided by lagged total assets), and the independent variables are the cash flow ratio, the interaction term of the intervention score INT_SCO_DM and the cash flow ratio, the intervention score INT_SCO_DM, and the market-to-book ratio. The market-to-book ratio is the ratio of the market value of assets to total assets, where the market value is calculated as the sum of market value of equity, total debt, and preferred stock liquidation value less deferred taxes and investment tax credits. The cash flow ratio is calculated as the cash flow from operations divided by lagged total assets. The reported *t*-statistics and level of significance are based on Huber-White robust standard errors. *, **, and *** indicate coefficients that are significantly different from 0 at the 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Capital Expenditure	
	Coeff.	*t*-Stat.
Cash flow ratio	0.2009	14.37***
INT_SCO_DM × cash flow ratio	−0.0351	−3.43***
INT_SCO_DM	0.0146	8.51***
Market-to-book ratio	−0.0067	−2.84***
Constant	0.0340	14.30***
Time fixed effects	Yes	
Firm fixed effects	Yes	
No. of firms	1,078	
No. of firm-quarter obs.	5,160	
Adj. R^2	0.283	

taken place during the post-intervention period. We acknowledge that these issues complicate the interpretation and make it hard to uncover "clean" real effects in our setting.

VII. Conclusion

We investigate whether the U.S. government capital infusion program for banks, the Capital Purchase Program (CPP), affects corporate borrowers' stock returns during the financial crisis of 2007–2009. Based on detailed information on the firms' borrowing history, we identify credit relationships with banks as channels that transmit financial shocks from banks to their borrowers. Our principal result is that CPP interventions in banks have a significantly positive impact on the borrowing firms' stock returns. The short-term event study indicates that corporate borrowers of banks that obtained CPP capital infusions experience abnormal stock returns of 1.41 percentage points during the 5-day event window. In the panel data analyses, we find that moving from the first to the third quartile of the intervention score is associated with an additional daily stock return of 0.042 percentage points, which translates into a substantial additional return per year of 11.34 percentage points. We further find that the positive impact of CPP intervention is more pronounced for riskier and bank-dependent firms and those that borrow from banks that are less capitalized and smaller. These findings extend the evidence from related studies on negative credit supply-driven spillover effects from banks to the corporate sector in the first stage of the recent financial crisis and previous crises (Campello et al. (2010), Ivashina and Scharfstein (2010), Lemmon and Roberts (2010), and Chava and Purnanandam (2011)).

Our study contributes to the existing literature by identifying significantly positive spillover effects on corporate borrowers when negative shocks to their

banks are mitigated. We leave it to future research to analyze whether similar effects exist when economic shocks spill over from the corporate to the banking sector (demand-driven shocks and real economy crises). Our evidence is consistent with the broader view that bank-firm relationships serve as an important transmission channel for positive shocks to banks.

Appendix. Variable Definitions

Firm Characteristics

FIRM_SIZE. Firm total assets. (Data source: Compustat; Measurement period: 2007Q2)

log(FIRM_SIZE). The logarithm of the firm's total assets. (Data source: Compustat; Measurement period: 2007Q2)

LEVERAGE. (Long-term debt + short-term debt)/total assets. (Data source: Compustat; Measurement period: 2007Q2)

ROA. Income before extraordinary items/total assets. (Data source: Compustat; Measurement period: 2007Q2)

Altman's Z. Altman's (1968) Z-score. (Data source: Compustat; Measurement period: 2007Q2)

BANK_DEPENDENCE. 1 for bank-dependent firms (public debt rated as noninvestment-grade or nonrated firms), and 0 for other firms (public debt rated as investment-grade). (Data source: Compustat; Measurement period: 2007Q2)

CASH_HOLDINGS. Cash and marketable securities/total assets. (Data source: Compustat; Measurement period: 2007Q2)

BID-ASK_SPREAD. Average daily percentage bid-ask spread. (Data source: CRSP; Measurement period: 2007Q2)

CRISIS_PERFORMANCE. Firm buy-and-hold stock return during the financial crisis before the CPP. (Data source: CRSP; Measurement period: 8/9/2007–9/30/2008)

Bank Characteristics

BANK_ROA. Firm-level weighted bank ROA (based on net income/total assets; see equation (7)). (Data sources: Compustat, FDIC Call Reports, and BankScope; Measurement period: 2007Q2)

BANK_CAPITAL_RATIO. Firm-level weighted bank capital ratio (based on Tier 1 capital + Tier 2 capital)/Risk-weighted assets; see equation (7)). (Data sources: Compustat, FDIC Call Reports, and BankScope; Measurement period: 2007Q2)

BANK_SIZE. Firm-level weighted bank total assets (see equation (7)). (Data sources: Compustat, FDIC Call Reports, and BankScope; Measurement period: 2007Q2)

log(BANK_SIZE). Firm-level weighted log bank size (based on the logarithm of the bank's total assets; see equation (7)). (Data sources: Compustat, FDIC Call Reports, and BankScope; Measurement period: 2007Q2)

Government Intervention

INT_SCO_DM. Firm-level CPP intervention score (based on the CPP dummy; see equation (2)). (Data sources: LPC DealScan and U.S. Department of the Treasury; Measurement period: 8/9/2007–12/31/2009)

INT_SCO_AMT. Firm-level CPP intervention score (based on the amount of CPP infusion; see equation (4)). (Data sources: LPC DealScan and U.S. Department of the Treasury; Measurement period: 8/9/2007–12/31/2009)

POST-INTERVENTION_DUMMY. Firm-level dummy variable that equals 1 after the first intervention and remains 1 until the end of the sample period. (Data sources: LPC DealScan and U.S. Department of the Treasury; Measurement period: First intervention–12/31/2009)

Stock Market Return

R_{mt}. The value-weighted daily return on all NYSE, AMEX, and NASDAQ stocks. (Data source: CRSP; Measurement period: 8/9/2007–12/31/2009)

Firm Stock Return

RETURN_{it}. Daily return (including dividends) on the corporate borrower's common stock. (Data source: CRSP; Measurement period: 8/9/2007–12/31/2009)

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