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EVIDENCE ON THE IMPACT OF THE TROUBLED ASSETS RELIEF PROGRAM ON STOCK RETURNS

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ABSTRACT

In response to the global financial crisis which began in 2008, the US government launched the Troubled Assets Relief Program (TARP), the largest government bailout in US history. TARP was controversial and publicly unpopular. This article examines the market responses to the TARP-related events as reflected in stock returns. Our empirical strategy permits a counterfactual interpretation of the data and provides empirical evidence to answer the question "what would have happened to those banks that did in fact receive bailout funds if they had not received the bailout." We find that the market responded favorably to the announcement of TARP, which suggests that the bailout program launch helped restore investors' confidence in the financial system. However, the market reacted negatively to the receipt of TARP bailout funds. Hence, instead of ensuring certification, receiving bailouts generated an adverse market signal. Our empirical evidence suggests that TARP receipt rather than the announcement by banks to accept TARP funds was essential.

JEL: G18, G21, G28

KEYWORDS: TARP Bailout, Abnormal Returns, Tail Risk, Financial Crisis, Counterfactual

INTRODUCTION

"It's very hard to know the counterfactual." Mervyn King, the Governor of the Bank of England, before the Treasury Select Committee on the Financial Crisis, March 2009. Banks can face distress and a consequence of "too big to fail" is a rescue package from the central bank using taxpayer funds which the largest banks can be pressured to participate in (Calomiris & Khan, 2015). On October 3, 2008, the Troubled Asset Relief Program (TARP) was announced, the largest government bailout in US history. It authorized the US Department of the Treasury to inject capital into banks. This injection sometimes occurred regardless of whether the banks needed capital or not. TARP's objective was to persuade investors and consumers of the safety of the banking sector, to bolster lending, and prevent bank runs. How far TARP restored investor confidence by stabilizing financial markets and helped banks survive the global financial meltdown remains an open question. Whether TARP hindered or even worsened the financial crisis remains open to debate among policymakers, academics, and the general public. Several distinguished academic economists wrote to the US Congress protesting TARP. It rapidly became a favorite punching bag of the public, Republicans, Democrats, conservatives, and liberals.

In October 2009 a Bloomberg poll questioned how TARP had impacted the economy. Samuelson (2011) reports that 24% said it strengthened the economy, 43% said it weakened the economy, 21% said it did not impact the economy, and 12% were uncertain. Pundits in the Wall Street Journal, the New York Times, etc. criticized TARP. Implementing TARP into law even induced one member of Congress to state that "this may be the day America died." TARP closed December 19, 2014 yielding the US government a $15.3 billion profit (Isidore, 2014). The heated debate over TARP has underscored the fact that economic theories can rarely explain with certainty whether one set of policies is superior to another or is certain to succeed

in a given circumstance. Indeed, for every example of success with TARP, opponents are quick to show failures with it. Critics argue that conditions would have been better without TARP, implying that financial markets would have recovered faster and stronger without bailouts. They also point to apparent successes with alternative policies. Taylor (2009) concludes that "government actions and interventions caused, prolonged and worsened the financial crisis". In contrast, Blinder and Zandl (2010) argue that

> *"If policymakers had not reacted as aggressively or as quickly as they did, the financial system might still be unsettled, the economy might still be shrinking, and the costs to U.S. taxpayers would have been vastly greater."*

La Monica (2009) reports that "many big-bank executives argued that they only took TARP funds because they were strong-armed into it and thought not taking the cash would make them look weak and unworthy of government support." Yet, evaluating public policies is:

> *"… a taxing task. It remains impossible to assess the consequences of a path not taken. TARP passed; we know what occurred. We cannot say with certainty what would have occurred if TARP had not passed or if the government had pursued another option."*

Let us consider three challenges and how to address these. First, a crucial challenge to any article on the topic of TARP is to clearly carve out the contribution relative to earlier analyses of TARP and related programs, see e.g. Liu et al. (2013) or Cornett et al. (2013). Second, it is generally hard to draw causal inferences from event studies. One challenge pertains to the negligence of cross-sectional dependence of equity returns. Kolari and Pynnönen (2010) demonstrate systematic over-rejection of the null of CAR when neglecting cross-sectional dependence. The latter is common during systemic crises, with uncertainty about the resilience of the banking system, cf the literature on bank runs (De Graeve & Karas, 2014; Diamond & Dybvig, 1983). Third, and related, causal inference should make a compelling case that equity market responses and (systemic) risk reactions are solely attributable to TARP rather than various other measures taken by the Federal Reserve System, e.g. emergency liquidity facilities (Berger, Black, Bouwman, & Dlugosz, 2017). The objective of this article is to consider the counterfactual question: what would have happened to those banks that did in fact receive bailout funds if they had not received the bailout? Clearly, this exact counterfactual is not observable as a single bank cannot simultaneously receive and not receive a bailout. This problem is referred to as the fundamental problem of causal inference (Holland, 1986). To address this problem we use propensity score stratification matching to select a control group of non-bailout banks that is closely matched to the group of bailed-out banks to artificially create such twins. We then use the matched groups to estimate the market's response to banks' bailout decisions in terms of stock market returns and systemic tail risk.

A causal effect is defined as the difference in outcome between a world in which the bank receives the treatment and a counterfactual world in which the same bank does not. The treatment is acceptance of TARP bailouts by certain banks and financial institutions. Estimates of effects in this framework are the effect of treatment on the treated (ETT) on those banks that accepted the bailout. In other words, in estimating the effect of TARP bailouts, we are estimating the effect on those banks in the data who actually accepted bailout funds, not the hypothetical effect of bailouts on any bank which could conceivably have received bailout funds. In addition, the estimates from the model are estimates of the average treatment effect, rather than the effect on each individual bank.

Whilst TARP funding issues have been researched by scholars including Bayazitova and Shivdasani (2012) and Veronesi and Zingales (2010) among others, this to our knowledge, is the first article to examine the market's response to TARP funding receipt events as reflected in stock returns. Most significantly, we allow for non-random selection into the TARP bailout program by using propensity score matching methods. This strategy permits a counterfactual interpretation of the data. Nevertheless, all counterfactual experiments are

subject to the Lucas critique that the robustness of the results are questionable and need to be interpreted with caution. The empirical methods used in earlier studies listed in the literature review below cannot provide credible empirical evidence of causality between TARP bailouts and outcomes of policy interest. In other words, the methods cannot estimate the average treatment effect on the treated. Neither do any of the previous methods account for unobservable heterogeneity. The decision to receive bailouts is not exogenous to banks. Each bank self-selects into either the bailout or no-bailout regime. Therefore, estimates that do not account for self-selection may be biased. In order to correct for such bias, Heckman selection or instrumental variable approaches could be used. Yet, these approaches still assume that the outcome equations would differ only by a constant term between bailout and non-bailout banks. In reality, differences between the two groups may be more systematic. That is, there may be interactions between bailout choice and the other determinants of bank outcomes.

During financial crises, parameter estimation does not capture phenomena outside the crises. In particular, during financial crises the beta of the CAPM of bank stocks increases causing underestimation of future stock returns. Our approach nevertheless seeks to capture the fundamental stock market return, and to interpret the remaining noise as the abnormal return. Lessons continue to be learnt from the crisis and there is much interest in understanding the consequences of regulatory innovation and intervention (Beck, 2014; Mishkin, 2017). However, with the exception of Duchin and Sosyura (2012), previous studies do not construct an appropriate counterfactual group of banks that do not accept bailout funds. Constructing an appropriate counterfactual group of banks is essential for studying the impact of TARP. For example, suppose firm value is seen to decline after TARP. Without a counterfactual one would not be able to determine whether it would have declined even more if firms that actually did accept bailout funds had not accepted bailout funds. Even though this cannot be observed, their hypothetical behavior can be proxied by the behavior of a sample of other banks that did not accept bailout funds.

Attempts to use propensity score matching alone, without some form of structural model, are futile because of the inability of capturing the policy impact of interest, i.e. the average effect of the treatment (receipt of bailout funds) on the treated (banks receiving these funds). Propensity score matching can deal with structural differences between bailout and non-bailout banks, but only to the extent that these differences are based on observables. When unobserved factors simultaneously influence banks' bailout decisions, and the financial health of the banks, such as managerial skills, ability, or motivation, then propensity score matching may still result in biased estimates. For the CoVaR calculation, using only the market value of bank assets would be problematic. Book leverage is only observed a few times per year, and during the crisis it was possible for leverage to change quickly and dramatically. This could create artificial drops in the estimated market value of bank assets, and thus create error with estimating values of CoVaR. The article is organized as follows. The next section provides a literature review and discusses the background and events leading up to TARP. The section thereafter describes the data and methodology, and the characteristics of banks in our sample. The section thereafter presents the results including empirical evidence on the impact of TARP bailout events on stock returns. The final section concludes. In a subsequent article, Ncube and Hausken (2019) consider TARP bailout size, buy and hold returns, and tail risk.

LITERATURE REVIEW AND BACKGROUND

Literature Review

Recognizing the difficulty of pinpointing causal effects in empirical social science research, a large and influential body of work has developed methods for credible causal inference of the effects of a policy, program or treatment, including J. J. Heckman (1979); J. Heckman (1990); Angrist, Imbens, and Rubin (1996); Abadie, Angrist, and Imbens (2002); and Angrist (2004). Scholars have attempted to evaluate the costs and benefits of TARP, and the impact of TARP on the real economy and on bailout policies. For

instance, Veronesi and Zingales (2010) estimate the costs and benefits of TARP (which they refer to as Paulson's gift) and show that this government intervention increased the value of banks' financial claims by US $130 billion at a taxpayers' cost of $21–44 billion with a net benefit between $86–109 billion. Taliaferro (2009) studies the way banks used new capital under TARP. He finds that participating banks used roughly 13 cents of every program dollar to support new lending, while they retained a considerable portion, about 60 cents of every dollar, to shore up their capital ratios. Bayazitova and Shivdasani (2012) study selection into TARP and subsequent stock price reactions, suggesting a positive announcement effect. Ivashina and Scharfstein (2010) demonstrate a relationship between credit line commitments and loan growth during the 2008 crisis.

Aït-Sahalia, Andritzky, Jobst, Nowak, and Tamirisa (2012) do not find strong evidence that either macroeconomic or financial policies had an advantage in calming interbank markets during the global financial crisis. Duchin and Sosyura (2012) study the political influences on TARP fund distributions reporting that political connections enhanced the likelihood of TARP capital infusion. Whilst Li (2013) argues that there is not much to support loans made by TARP banks being of lower quality than those by non-TARP banks, Cornett, Li, and Tehranian (2012) suggest that TARP 'underachievers' have some weaknesses in income production, though these are not consistent, whereas 'overachievers' have liquidity issues which affect their ability to continue lending. Harvey (2008), Bebchuk (2009), and Coates and Scharfstein (2009) critique the design of TARP and discuss various inefficiencies of the program. More generally, the impact of the US program was watched globally. The global financial crisis spread worldwide. The performance of banks in other major economies was impacted (Ding, Wu, & Chang, 2013). Furthermore, there is evidence that high levels of CEO pay were associated with banks being significantly more likely to "escape" TARP (Wilson & Wu, 2012) implying that early TARP exit was associated with resumption of financial health (Li, 2013). Also, compensation of banks was associated with enhancing banks' unwillingness to accept TARP funds (Cadman, Carter, & Lynch, 2012).

Background to TARP

As part of the government's measures in response to the global financial crisis, the Troubled Assets Relief Program (TARP) was the largest government bailout in US history. A brief history of US government bailouts is summarized in Appendix 1. The genesis of TARP lies in the days following the collapse of Lehman Brothers and the rescue of AIG in mid-September 2008. In the aftermath of these events, funding costs for financial institutions escalated sharply due to the widespread fear of a domino effect of collapse among financial institutions that were unable to fund obligations and concerns about counterparty risk. On September 20, 2008, Treasury Secretary Henry Paulson and Federal Reserve Chairman Ben Bernanke sent a financial rescue plan to Congress requesting approval to stabilize the financial system by purchasing troubled assets, primarily those related to mortgage-backed securities (MBS), from banks and other financial institutions. Though this initial plan was rejected by Congress, a modified version was approved on October 3, 2008. President George W. Bush signed into law the Emergency Economic Stabilization Act of 2008 (EESA) which authorized spending of up to $700 billion to purchase or insure troubled assets, in an attempt to unlock credit markets and restore confidence in the banking system. See Bloomberg, October 3, 2008, quoting Representative John Yarmuth in his decision to reverse his vote in favor of the bill "the stock market drop on Monday served as a wake-up call to a lot of people". According to EESA, the term "troubled assets" was defined as:

> *"(i) Residential or commercial mortgages and any securities, obligations, or other instruments that are based on or related to such mortgages, that in each case was originated or issued on or before March 14, 2008, the purchase of which the Secretary determines promotes financial market stability; and*

> *(ii) Any other financial instrument that the Secretary, after consultation with the Chairman of the Board of Governors of the Federal Reserve System, determines the purchase of which is necessary to promote financial market stability, but only upon transmittal of such determination, in writing, to the appropriate committees of Congress."*

On October 13, 2008 the Treasury announced that it would invest directly in the equity of a broad range of financial institutions and that these equity injections would be targeted at "healthy" firms. On October 14, 2008 the US Treasury unveiled the details of its Capital Purchase Program (CPP) which allocated $250 billion towards purchases of preferred stock and equity warrant of US financial institutions. The nine largest financial institutions, including Bank of America, Bank of New York Mellon, Citigroup, Goldman Sachs, JP Morgan, Merrill Lynch, Morgan Stanley, State Street, and Wells Fargo, were identified as the initial recipients of an aggregate infusion of $125 billion. In addition to the nine institutions identified by the US Treasury list, Wachovia, that had signed a definitive merger agreement with Wells Fargo, also received a capital injection. Of the ten institutions that received TARP capital on October 14, 2008 three were investment banks at the time and were not required to report as bank holding companies. Hence, comparable financial statement data and capital ratios for these three institutions are unavailable and we exclude them in our analyses requiring financial characteristics. In all tests, we also exclude Wachovia due to its merger agreement with Wells Fargo.

Other banks were also allowed to apply for the preferred stock investment by the Treasury until November 14, 2008. Capital injection through the purchase of preferred stock would qualify as Tier 1 capital but not dilute the voting power of the existing common shareholders, and thus was expected to be attractive to banks. On the same day, a program to offer government guarantees on new bank debt issues was unveiled, and the ceiling on the Federal Deposit Insurance Corporation (FDIC) guarantee of non-interest bearing transaction accounts at banks was also increased at this time. The new bank debt guarantee initiative was finalized on November 21, 2008 as the Temporary Liquidity Guarantee Program (TLGP) which guaranteed senior unsecured bank debt, within prescribed limits, issued between October 14, 2008 and June 30, 2009. Under CPP, the US Treasury would purchase non-voting senior preferred stock of qualifying financial institutions (QFIs), and banks could apply for this injection in amounts ranging from 1% to 3% of their risk weighted assets (RWA). In addition to senior preferred stock, the US Treasury would receive warrants with a ten year life to purchase common stock of qualifying banks for an amount equal to 15% of the preferred equity infusion. The dividend on the preferred stock was set at 5%, but would rise to 9% after three years. The financial terms of CPP capital were viewed to be very attractive for banks and substantially below the funding costs obtainable in public capital markets for most banks. However, CPP infusions forbade dividend increases on the common shares until the preferred shares were repaid fully and also set limits on executive compensation whereby senior executive benefit plans, severance, and golden parachute agreements had to be terminated or modified.

Following CPP and TLGP, TARP evolved to include several other components including the Public-Private Investment Program (PPIP) to acquire troubled loans and toxic assets from financial institutions and the Term Asset-Backed Securities Lending Facility (TALF) to support the issuance of asset-backed securities (ABS). Our analysis focuses on the CPP program because it remains the cornerstone of TARP and because it targets specific financial institutions, allowing us to study the characteristics of the banks supported by the capital injections. Henceforth, we refer to capital injections under the CPP program as TARP infusions. Since the initial preferred stock investment of $125 billion into the nine financial institutions on October 14, 2008, TARP capital infusions have been made into a large number of other financial institutions.

To participate in the program, eligible financial institutions had to submit a short application to their primary federal banking regulator, namely the Federal Reserve, the Federal Deposit Insurance Corporation (FDIC), the Office of the Comptroller of the Currency (OCC), or the Office of Thrift Supervision (OTS). After receiving the application, the regulators assessed the financial condition of the applicant based on the

CAMELS rating system. If the initial review by the banking regulator was successful, the application was forwarded to the Treasury's investment committee and then the assistant secretary for financial stability who made the final decision about the investment. By July 30, 2009, more than 2,700 applications were filed. 660 of these received bailout funds. 1,300 were transferred to the Treasury.

With the passage of the TARP legislation, banks across the country faced a difficult decision: Should they accept government aid that could help keep them solvent but also open them to criticism of being bailed out? The banks' choice to apply for TARP funds thus was also a function of their own internal deliberations as to expected costs and benefits, managerial tastes, preferences and private information. The announcement of TARP funding was accompanied also by a simultaneous announcement that nine of the largest US banks would receive sizable equity infusions, totalling $125 billion. Eventually, 758 banks took the deal and accepted funds through TARP. Bank receipts of TARP funding reflected the provision of a funding limit up to 3% of Risk Weighted Assets which most banks applied for. Many banks eager to protect their images or unwilling to accept the program's burdens opted against taking the assistance.

DATA AND METHODOLOGY

Sample Characteristics

To construct our main (universal) sample, we start with data available at the bank holding company level from the Bank Holding Company Database provided by Federal Reserve Bank of Chicago. The dataset includes quarterly financial data on a consolidated basis for all domestic bank holding companies (BHCs) with total assets of $500 million or more. The consolidated bank holding company financial data are desirable because the Troubled Assets Relief Program (TARP) is made at the level of holding companies. Our data covers the period from 2005 Q1 to 2010 Q4. We also cover events after 2010 Q4, such as whether TARP funds were received by September 30, 2011. TARP was passed September 20-October 14, 2008, and closed December 19, 2014 (Isidore, 2014). From the universe we obtain two sub-samples. The first sub-sample is BHCs that accepted TARP bailout funds (bailout banks). The list of bailout banks is obtained via ProPublica's TARP database. The sub-sample of bailout banks is used to conduct our basic event study. The second sub-sample is "matched banks" that did not accept TARP bailout funds but are similar to the bailout recipients according to propensity score matching methods (counterfactuals).

More specifically, for the bailout sub-sample, we obtain data on TARP participant BHC from ProPublica's TARP database, which can be found at http://bailout.propublica.org/main/list/index. The database tracks where taxpayer money has gone in the ongoing bailout of the financial system. By December 30, 2011, 926 institutions had received bailout funds of $700 billion (there is a separate bailout of Fannie Mae and Freddie Mac). Since we retrieve financial reporting data from Consolidated Financial Statements for Bank Holding Companies- FR Y-C (Call Report), we limit our sample to bank holding companies with total consolidated assets above $500 million. In addition, we analyze publicly traded banks because our event study employs stock market data. We limit our bailout sub-sample for the event study to banks that participated in TARP and had ordinary shares listed on NYSE, AMEX, or NASDAQ.

Panel A of Table 1 shows that CPP capital of $640 billion was provided to 926 firms, including 758 bank holding companies who received $236 billion in bailout funds. Of the bank holding companies, 247 are publicly traded on the New York Stock Exchange (NYSE), American Stock Exchange (AMEX), or NASDAQ Stock Market (NASDAQ). For the non-bailout sub-sample, we start with 977 bank holding companies with consolidated assets of $500 million or more as of September 30, 2008, and therefore have consolidated financial information available from Bank Holding Company Data before the announcement of TARP. After removing the bank holding companies that announced their participation in TARP, we end up with our non-bailout sub-sample. Table 1 presents the selection process for our bailout and non-bailout sub-samples.

Table 1: Sample Selection

Selection Criteria	Bailout Amount	Firm Number
Panel A: Bailout Banks		
Firms receiving bailout funds under TARP	$640 billion	926
Retain bank holding companies only	$236 billion	758
Retain bank holding companies with ordinary shares listed on NYSE, AMEX, or NASDAQ	$227 billion	247
Retain bank holding companies with consolidated assets above $500 million by September 30, 2008	$216 billion	187
Panel B: Non-Bailout Banks		
Bank holding companies with consolidated assets above $500 million by September 30, 2008	N.A.	976
Retain bank holding companies with ordinary shares listed on NYSE, AMEX, or NASDAQ	N.A.	318
Retain bank holding companies not receiving TARP bailout funds by September 30, 2011	N.A.	131

Notes: Reported are the sample selection processes for the study. Panel A describes the construction of the sub-sample of bank holding companies that received TARP bailout funds by September 30, 2011 (i.e. bailout banks or treated group). Panel B describes the construction of the sub-sample of bank holding companies that did not receive TARP bailout funds by September 30, 2011 (i.e. non-bailout banks or control group).

Preliminary Analysis

We classify the banks following FDIC and Federal Reserve Guidelines into one of four size groups based on period-end book value of assets:
Greater than $10 billion
Between $3 billion and $10 billion
Between $1 billion and $3 billion
Less than $1 billion

Table 2: Definition of Main Variables and Source of Data

Variable	Definition	Source
Bailout amount (*BA*)	Amount of TARP funds received by a bailout bank ($billions)	Eye on the Bailout
Bailout ratio (*BR*)	Ratio of the amount of TARP funds received by a bailout bank to the bank's Tier 1 capital (%)	Eye on the Bailout; BHC Data (BHCK 8274)
Capital adequacy (*CA*)	Ratio of Tier 1 capital to total risk-weighted assets (%)	BHC Data (BHCK 8274 A223)
Asset quality (*AQ*)	Ratio of noncurrent loans and leases (90 days or more past due or in nonaccrual status) to total loans and leases (%)	BHC Data (BHCK 5525 5526 5369 B529)
Management quality (*MQ*)	Ratio of annualized total non-interest expense to annualized net operating income (%, net operating income is measured as the sum of net interest income and non-interest income)	BHC Data (BHCK 4093 4074 4079)
Earnings (*EAR*)	Ratio of annualized net income to average total assets (%)	BHC Data (BHCK 4340 2170)
Liquidity (*LIQ*)	Ratio of cash and balances due from depository institutions to deposits (%)	BHC Data (BHCK 0081 0395 0397 BHDM 6631 6636 BHFN 6631 6636)
Sensitivity (*SEN*)	Ratio of the absolute difference between earning assets that are repricable within one year and interest-bearing deposit liabilities that are repricable within one year to total assets (% as a measure of sensitivity to interest rate risk)	BHC Data (BHCK 3197 3296 2170)
Bank size (*SZ*)	Natural log of the book value of BHC's total assets (in thousands of US dollar) at quarter-end	BHC Data (BHCK 2170)
Bank age (*AGE*)	Number of years since the entity's general ledger was opened for the first time and/or the date on which the entity became active (years)	BHC Data (RSSD 9950)
Stock return (*R*)	Daily percentage change in stock price (%)	CRSP US Stock
Index return (*MKT*)	Daily return of the CRSP value-weighted index of all NYSE, AMEX, and NASDAQ firms (%)	CRSP US Stock

Notes: Reported are the main variables used in the study along with their definitions and the sources of data. The bailout data is obtained from "Eye on the Bailout" database provided by ProPublica (http://bailout.propublica.org/main/list/index). Accounting information at bank holding company level is collected from Bank Holding Company Database provided by Federal Reserve Bank of Chicago (http://www.chicagofed.org/webpages/banking/financial_institution_reports/bhc_data.cfm). Income and expense attributed to each quarter is annualized and compared to average asset or liability balances for the corresponding quarter. Stock return data is retrieved from CRSP US Stock Database.

Asset sizes of the BHCs as well as all accounting data are available from Bank Holding Company Data from Federal Reserve Bank of Chicago. All domestic bank holding companies with total assets of $500

million or more are required to file FRY-9C on a consolidated basis. For the bank holding companies with data available we constructed a number of demographics, such as bank size and age, as well as financial variables, such as CAMELS. The main variables used in our analysis are listed in Table 2 along with their detailed definition and data sources.

Table 3 reports the summary statistics of the main variables used in the study. Reported are the mean, 25th percentile, median, 75th percentile, and standard deviation of each variable. The statistics for the financial variables reported in Table 3 are computed based on the Bank Holding Company Data released at the end of September 2008, the latest financial information available before the announcement of TARP on October 14, 2008. Appendix 2 reports the summary statistics for the four size groups.

Table 3: Summary Statistics of the Main Variables for Bailout Banks

Variable	Mean	25th Percentile	Median	75th Percentile	Standard Deviation	No. of Obs.
BA	0.97	0.02	0.04	0.13	3.7338	247
BR	29.34%	24.54%	28.71%	32.20%	0.1641	185
CA	10.01%	9.11%	9.80%	10.73%	0.0160	185
AQ	1.91%	1.07%	1.63%	2.29%	0.0141	185
MQ	67.81%	58.85%	65.45%	73.33%	0.2967	185
EAR	–0.02%	0.06%	0.45%	0.76%	0.0186	185
LIQ	4.20%	2.42%	3.01%	3.82%	0.0642	185
SEN	15.42%	6.13%	13.56%	23.42%	0.1088	185
SZ	15.28	13.99	14.71	15.95	1.8899	185
AGE	21.69	11.00	22.00	26.00	15.2418	185

Notes: The table reports the summary statistics of the main variables used in the study. Reported are the mean, 25th percentile, median, 75th percentile, and standard deviation of each variable listed in Table II. The statistics for the financial variables are computed based on the Bank Holding Company Data released at the end of September 2008, the latest financial information available before the announcement of TARP on October 14, 2008. BA represents bailout amount (in billions $), BR bailout ratio, CA capital adequacy, AQ asset quality, MQ management quality, EAR earnings, LIQ liquidity, SEN sensitivity, SZ bank size (natural log of total assets in thousands $), and AGE bank age (number of years). The detailed definition and data source are available in Table 2.

Table 4 reports the summary statistics for the state variables used to estimate the time-varying $CoVaR_t$.

Table 4: Summary Statistics for State Variables Used to Estimate the Time-Varying $Covar_t$

Variable	Mean	Min.	1%	99%	Max.	Std. Dev.
VIX	21.08	10.02	10.08	69.95	79.13	11.48
Liquidity Spread	12.11	–10.00	–6.00	73.00	116.00	17.27
3-month Treasury Change	–0.23	–100.00	–55.00	26.00	59.00	12.52
Term Spread Change	0.12	–87.00	–41.00	51.00	88.00	15.20
Credit Spread Change	0.10	–34.00	–30.00	35.00	51.00	8.98
Equity Return	0.15	–18.39	–7.72	7.43	13.04	2.81
Real Estate Excess Return	–0.21	–11.00	–8.09	6.79	9.50	2.47

Notes: Summary statistics are presented for the state variables used to estimate the time-varying $CoVaR_t$. Following Adrian and Brunnermeier (2016), we include a set of state variables Mt that are well known to capture time variation in conditional moments of asset returns, and are liquid and easily tradable. The factors are: (i) VIX, which captures the implied volatility in the stock market reported by the Chicago Board Options Exchange. (ii) A short term "Liquidity Spread", defined as the difference between the three-month repo rate and the three-month bill rate. This liquidity spread measures short-term liquidity risk. (iii) The change in the three-month Treasury bill rate. The change in the three-month Treasury bill rate because the change, not the level, is found to be the most significant in explaining the tails of financial sector market-valued asset return. (iv) The change in the slope of the yield curve, measured by the yield spread between the ten-year Treasury rate and the three-month bill rate. (v) The change in the Credit Spread between BAA-rated bonds and the Treasury rate with the same maturity of ten years. (vi) The weekly equity market returns from CRSP. (vii) The weekly real estate sector returns in excess of the market returns (from the real estate companies with SIC code 65-66). VIX index and the three-month repo rate are obtained from Bloomberg; the three-month Treasury bill rate, the ten-year Treasury rate, and BAA-rated bond rate are available from the Federal Reserve Board's H.15 release; the return on CRSP index and the return on real estate sector are obtained from CRSP US Stock database. The spreads and spread changes are expressed in basis points, returns in percentage. Reported are the mean, minimum, 1st percentile, 99th percentile, maximum and standard deviation of each state variable defined above over the period of 2005 to 2010.

Table 5 presents the pair-wise correlation among the main variables for the TARP bailout banks. Again, the statistics for the financial variables are computed based on the latest financial information available before the announcement of TARP.

Table 5: Correlation Coefficient Matrix of Main Variables for TARP Bailout Banks

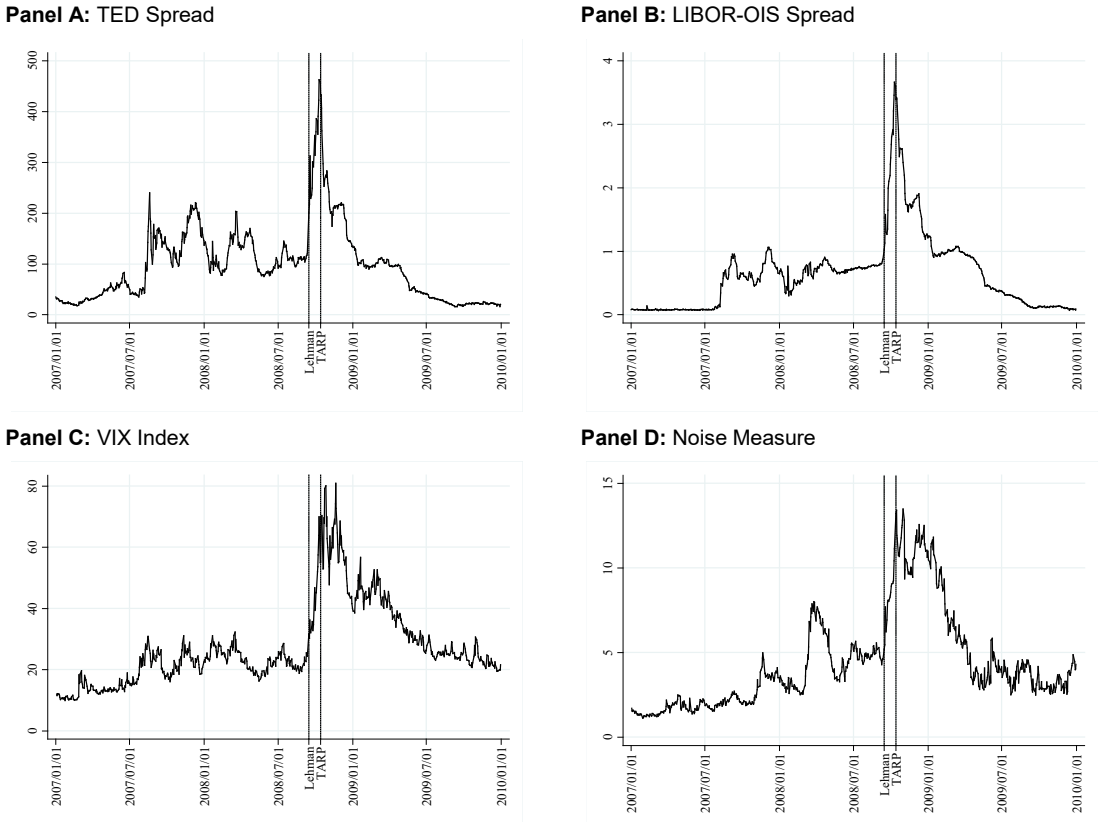
Variable	BA	BR	CA	AQ	MQ	EAR	LIQ	SEN	SZ
BR	0.01	1.00							
CA	–0.29***	–0.25***	1.00						
AQ	0.13*	–0.05	–0.02	1.00					
MQ	–0.01	0.01	–0.18**	–0.23***	1.00				
EAR	0.03	0.01	0.05	–0.33***	–0.48***	1.00			
LIQ	0.21***	–0.02	0.08	–0.07	0.09	–0.01	1.00		
SEN	0.19**	0.07	–0.30***	0.03	0.06	–0.02	0.06	1.00	
SZ	0.74***	0.01	–0.35***	0.13	0.01	0.01	0.37***	0.32***	1.00
AGE	0.57***	0.05	–0.22***	0.08	0.00	–0.01	0.21***	0.13*	0.58***

*Notes: The matrix reports the correlation coefficients between each pair of the main variables used in the study. The financial variables used to estimate the pair-wise correlation coefficients are computed based on the Bank Holding Company Data released at the end of September 2008, the latest financial information available before the announcement of TARP on October 14, 2008. BA represents bailout amount (in billions $), BR bailout ratio, CA capital adequacy, AQ asset quality, MQ management quality, EAR earnings, LIQ liquidity, SEN sensitivity, SZ bank size (natural log of total assets in thousands $), and AGE bank age (number of years). The detailed definition and data source are available in Table 2. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.*

Apart from the bank-level variables, we also collected time series of the TED spread, the LIBOR-OIS spread, the VIX index, and the "Noise" measure (Hu, Pan, & Wang, 2013). The four time series are plotted in the four panels in Figure 1, with vertical reference lines indicating the date that Lehman filed for bankruptcy (15 September 2008) and the date that TARP was announced (14 October 2008), respectively. The time series data is obtained from Bloomberg. The TED spread, determined by the London Interbank Offered Rate (LIBOR) and denominated in basis points, is the disparity between the three-month US government debt, as expressed by the three-month Treasury bill interest rate, and the three-month Eurodollars contract interest rate. The TED spread indicates perceived credit risk in the economy. Treasury bills are perceived to be risk-free. In contrast, LIBOR expresses the credit risk of lending to commercial banks. Increasing TED spread means that lenders perceive increasing interbank loan default risk (counter-party risk). The LIBOR-OIS spread is the disparity between the overnight indexed swap rate and LIBOR. The spread between the two rates measures the health of the banking system. The three-month LIBOR is a financing floating rate. It vacillates contingent on how a lending bank assesses the risk of a borrowing bank.

The OIS is a swap determined by the overnight rate, which is a fixed overnight interest rate. The spread, in the US, is determined by the Federal Reserve Fed Funds rate and the LIBOR Eurodollar rate. That a lending bank lends to a borrowing bank means that LIBOR is risky. The OIS is perceived to be stable since the counter-parties merely swap the floating interest rate for the fixed interest rate. The spread between the two indicators measures the default probability for the borrowing banks. This expresses risk premiums as contrasted with liquidity premiums. The VIX is the ticker symbol for the Chicago Board Options Exchange Market Volatility Index. It measures the implied volatility of S&P 500 index options. Also known as the fear index, it expresses the market's expectation of stock market volatility over the next 30 day period.

Figure 1: TED spread, LIBOR-OIS spread, VIX index and Noise Measure



Notes: The figure plots the time series of TED spread (difference between 3-month US LIBOR and US Treasury Bill), LIBOR-OIS spread (difference between the 3-month US LIBOR and the overnight SWAP rate), the VIX index from the Chicago Board of Option Exchange, and noise measure over the period of January 1, 2007 to January 1, 2010. The vertical reference lines indicate the events of Lehman's bankruptcy and the announcement of TARP respectively.

RESULTS

Empirical Strategy

We conduct a standard event study to gauge the impact of the TARP bailout size on stock returns. We are interested in two event dates. The first date is October 14, 2008 (the day of the announcement of TARP), and this date is the same for all banks in our sample. The second set of dates is the date that each bank in our sample actually received the TARP funds (the day of receipt), and each bank has a unique date. We estimate bank returns using the following two models. The first model is Markowitz' market model which is specified as

$$R_{it} = \alpha_i + \beta_{Mi} MKT_t + \varepsilon_{it}, t \in [t_0, t_1] \quad (1)$$

where t_0 and t_1 denote the beginning and end of the time window where parameters are estimated (i.e. the estimation window), R_{it} is the daily stock market return of bank i between trading dates $t-1$ and t and *MKT* is defined as the daily return of the CRSP value-weighted index of all NYSE, AMEX and NASDAQ firms.

For the second model include the following Fama-French three factors model

$$R_{it} - RF_t = \alpha_i + \beta_{Mi}(MKT_t - RF_t) + \beta_{SMBi}SMB_t + \beta_{HMLi}HMLM_t + \varepsilon_{it} \quad (2)$$

where *SMB* is a size factor (small minus big) and *HML* is a value factor (high minus low).
We estimate the parameters of Equations (1) and (2) with OLS using a window starting from September 17, 2007 to September 17, 2008 (i.e. the normal period), and use the estimated parameters to predict returns in windows of 2*T*+1 days around the event, i.e. 21 days, 11 days, 7 days, 3 days and 1 day before and after each event, or in other words $[-10, +10]$, $[-5, +5]$, $[-3, +3]$, $[-1, +1]$, and $[-1,0]$, where 0 is the day of the event. The collapse of Lehman Brothers on September 15, 2008, the takeover of Merrill Lynch by Bank America of September 15, 2008, and the bailout of AIG on September, 16 2008, marked the end of the 'normal period' and beginning of the 'crisis period' which triggered the TARP bailout program. The Secretary to the Treasury proposed the first version of the TARP program on September, 20 2008 which was rejected by Congress on September 29, 2008. The revised version of TARP was approved by Congress on October 3 and signed by the President on October 3, 2008. Therefore, what we have considered a 'normal window' in financial markets is at least 12 months before September 17, 2008, before the TARP program was proposed. Later in this section we conduct robustness tests on the results, testing for the impact of other events other than TARP and mere price movement momentum effects. Using the estimated parameters for the Markowitz market model (1), we define Market-adjusted return as

$$\hat{a}_{it} = \hat{\alpha}_i + \varepsilon_{it} \quad (3)$$

Similarly, using the estimated parameters for the Fama-French model (2), we define Fama-French adjusted return as

$$\hat{a}_{it} = RF_t + \hat{\alpha}_i + \varepsilon_{it} \quad (4)$$

We compute the abnormal returns of bank *i* as the deviation of the actual returns from those predicted by the Markowitz market model (1) and the Fama-French three factors model (2). The Fama-French benchmark factors are obtained from Kenneth R. French Data Library. Market capitalization and daily stock returns are retrieved from CRSP database. For the Markowitz market model, the abnormal returns are computed from the equation

$$\hat{\varepsilon}_{it} = R_{it} - \hat{\alpha}_i - \hat{\beta}_{Mi}MKT_t, t \in [t_0, t_1] \quad (5)$$

Similarly for the Fama-French model, we define the abnormal returns as follows

$$\hat{\varepsilon}_{it} = (R_{it} - RF_t) - \hat{\alpha}_i - \hat{\beta}_{Mi}(MKT_t - RF_t) - \hat{\beta}_{SMBi}SMB_t - \hat{\beta}_{HMLi}HML_t \quad (6)$$

The individual banks' abnormal returns are aggregated using $\hat{\varepsilon}_{it}$ from either Equation (5) or Equation (6) for each trading day (*t*) within the estimation window $[t^* - T, t^* + T]$. The aggregated abnormal return for trading day *t* is

$$AR_t = \frac{1}{N}\sum_{i=1}^{N} \hat{\varepsilon}_{it} \quad (7)$$

Average cumulative abnormal returns CAR_t are derived by summing the abnormal returns over various intervals, i.e.

$$CAR_t = \sum_{\tau=t^*-T}^{\tau} AR_\tau \quad (8)$$

The Announcement of TARP

Table 6 presents the mean, median and standard deviation of the following variables around the day of the announcement of TARP: (a) raw stock returns (b) market adjusted stock returns (c) Fama-French adjusted stock returns (d) market abnormal returns (e) Fama-French abnormal returns (f) cumulative abnormal returns for the market model (g) cumulative abnormal returns for the Fama-French model. The statistical significance of all the above variables are tested and indicated at the 1%, 5% and 10% significance levels, respectively. Standard errors are adjusted for heteroskedasticity and autocorrelation. As shown in the table, even though the average row stock returns of bailout banks in the sample are negative over the event windows of $[-10, +10]$ and $[-5, +5]$ around the announcement of TARP, the adjusted returns, abnormal returns, cumulative abnormal returns are uniformly positive regardless of the model specification and the event window chosen. Bailout banks' stocks responded to the announcement of TARP favorably, implying that the launch of TARP indeed restored investors' confidence in the financial system.

Table 6: Returns Around the Announcement of TARP

Event Window	Variable	Mean	Median	Standard Deviation
[–10, +10]	Raw stock returns	–0.2688	–0.6452	8.3692
	Market-adjusted	0.5314	0.2064	8.0714
	Fama-French adjusted	0.9728	0.7105	7.1287
	Market abnormal	0.5389	0.2593	8.0659
	Fama-French abnormal	1.0452	0.7701	7.1252
	Market CARs	11.3174	10.3874	22.6704
	Fama-French CARs	21.9494	20.3621	28.9470
[–5, +5]	Raw stock returns	–0.3090	–0.7092	9.3334
	Market-adjusted	0.4180	–0.1989	8.9879
	Fama-French adjusted	0.7862	0.3420	7.6155
	Market abnormal	0.4256	–0.1708	8.9862
	Fama-French abnormal	0.8587	0.3821	7.6162
	Market CARs	4.6818	4.0306	12.3306
	Fama-French CARs	9.4462	9.5255	14.2313
[–3, +3]	Row stock returns	0.7431	0.0000	10.5482
	Market-adjusted	1.1624	0.1088	10.2629
	Fama-French adjusted	1.0865	0.5231	8.4742
	Market abnormal	1.1699	0.1840	10.2616
	Fama-French abnormal	1.1590	0.5495	8.4770
	Market CARs	8.1896	7.3756	11.7458
	Fama-French CARs	8.1131	7.0935	11.7179
[–1, +1]	Raw stock returns	1.6564	0.2207	10.3629
	Market-adjusted	1.1580	0.8671	11.3399
	Fama-French adjusted	1.9108	1.3649	9.1580
	Market abnormal	1.1656	0.8097	11.3543
	Fama-French abnormal	1.9834	1.4312	9.1702
	Market CARs	3.4967	1.5815	12.7179
	Fama-French CARs	5.9502	4.8520	11.9421
[0]	Raw stock returns	3.7565	2.0313	10.7747
	Market-adjusted	4.5966	2.4801	10.8843
	Fama-French adjusted	2.9488	2.3082	9.8143
	Market abnormal	4.6041	2.4352	10.9128
	Fama-French abnormal	3.0213	2.3408	9.8427
	Market CARs	4.6041	2.4352	10.9128
	Fama-French CARs	3.0213	2.3408	9.8427

Notes: Summary statistics are presented for the returns of the bailout banks around October 14, 2008 (the day of the announcement of TARP). The sample of banks that accepted TARP bailout funds during the October 2008 to December 2009 period is obtained from ProPublicas TARP database. Stock return data is retrieved from CRSP US Stock database. Reported are mean, median, and standard deviations of raw stock returns, market-adjusted stock returns, Fama-French adjusted returns, market abnormal returns, Fama-French abnormal returns, market CARs, and Fama-French CARs in event windows of 2T+1 trading days around the announcement of TARP, i.e. 21 days, 11 days, 7 days, 3 days and 1 day around October 14, 2008. The return variables are defined in the text.

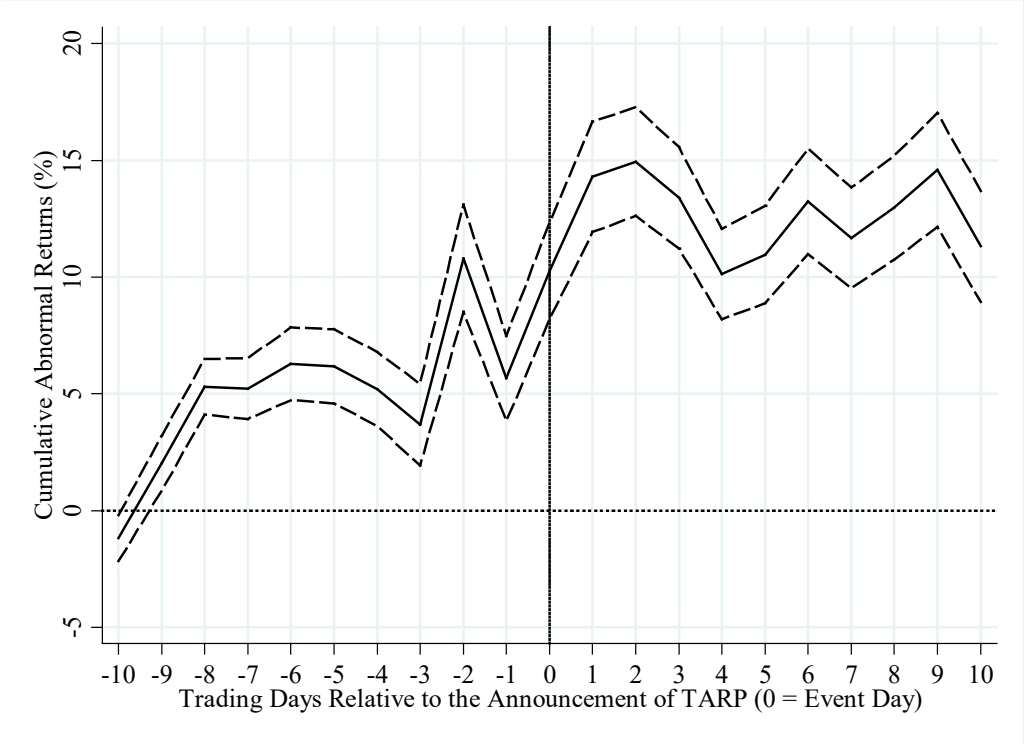
Table 7 shows the point and cumulative estimates of the average abnormal returns around the day of the announcement of TARP (i.e. October 14, 2008) estimated using one-factor market model. Figure 2 provides a graphical overview of the average CARs by plotting the average CARs against trading days relative to the day of the announcement of TARP along their 90% confidence bands. The point (daily average) and cumulative (relative to 10 days before the event) abnormal returns estimated using one-factor market model confirm the observation from Table 6. The average abnormal returns are significantly positive on the day of the announcement of TARP as well as the day after, both are greater than 4%, suggesting the event had an immediate effect on banks' stock performance. Even if we control for the pre-event trend (average daily abnormal return of 0.56% pre-event), the bailout banks' cumulative abnormal returns after the announcement of TARP are still significantly positive.

Table 7: Point and Cumulative Market Abnormal Returns Around the Announcement of TARP

Event Day	Point Estimation		CAR Estimation	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**
–10	–1.1797**	0.5995	–1.1797**	0.5995
–9	3.2076***	0.4783	2.0279***	0.7144
–8	3.2726***	0.3762	5.3005***	0.7246
–7	–0.0726	0.3214	5.2278***	0.7879
–6	1.0556**	0.4689	6.2834***	0.9428
–5	–0.1050	0.3486	6.1784***	0.9646
–4	–0.9712**	0.4053	5.2072***	0.9615
–3	–1.5332***	0.4652	3.6740***	1.0621
–2	7.1279***	0.8051	10.8019***	1.3917
–1	–5.1411***	0.7728	5.6609***	1.1023
0	4.6041***	0.6944	10.2650***	1.2588
1	4.0336***	0.4975	14.2986***	1.4356
2	0.6496	0.4648	14.9482***	1.4079
3	–1.5513***	0.3725	13.3969***	1.3123
4	–3.2654***	0.3706	10.1315***	1.1757
5	0.8337**	0.3329	10.9652***	1.2634
6	2.2857***	0.3874	13.2509***	1.3685
7	–1.5725***	0.3873	11.6785***	1.3074
8	1.2891***	0.3207	12.9676***	1.3491
9	1.6307***	0.3458	14.5982***	1.4816
10	–3.2808***	0.4429	11.3175***	1.4425

*Notes: The table shows the point and cumulative abnormal returns estimated using Markowitz' market model in a window of ten days before and ten days after October 14, 2008 (the day of the announcement of TARP). The point and cumulative estimate of the average returns for the event are reported along their standard error. Standard errors are adjusted for heteroskedasticity and autocorrelation. The return variables are defined in the text. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.*

Figure 2: The Evolution of Market *CARs* Around the Announcement of TARP



Notes: The figure shows the average cumulative returns of the bailout banks in the sample in a window of ten days before and after October 14, 2008 (the day of the announcement of TARP), along their 90% confidence bands. CARs plotted in this figure are estimated using Markowitz market model.

Table 9 shows the point and cumulative estimates of the average abnormal returns around the day of the announcement of TARP estimated using Fama-French model. Figure 3 provides a graphical overview of the average CARs by plotting the average CARs against trading days relative to the day of the announcement of TARP (i.e. October 14, 2008) along their 90% confidence bands. The point and cumulative abnormal returns estimated using three-factor Fama-French model are more positive and more significant than their one-factor market model counterparts around the event window of 10 days before and after the announcement of TARP, confirming that the TARP to a great extent restored investors' confidence in financial system. The cumulative Fama-French abnormal return over the entire event window is as high as 21.95%. The difference between Figure 2 and Figure 3 may be explained by the size effect that large banks responded to the announcement of TARP more positively thank the small banks. To provide further insights, we split the bailout banks in our sample into 5 sub-samples based on their book value of assets as of the quarter-end of the announcement of TARP, i.e. 31 December, 2008. The cumulative abnormal return over the event window of 10 days before and after the event are reported for each of the 5 sub-samples, see Table 8 Panel A.

Table 8: Size-Group Summary Statistics for Cumulative Abnormal Returns Around the Announcement of TARP and the Receipt of TARP Funds

Panel A: Announcement Of TARP				
Total Assets	**Variable**	**Mean**	**Median**	**Std. Dev.**
≥ $10 billion	Market CARs	33.3835	28.2897	22.1362
	Fama-French CARs	44.0947	40.7852	23.4070
≤ $10 billion &	Market CARs	21.6413	21.3172	13.0647
≥ $3 billion	Fama-French CARs	45.2512	44.8689	18.1609
≤ $3 billion &	Market CARs	4.7970	5.5016	17.0882
≥ $1 billion	Fama-French CARs	17.9209	15.1201	25.7686
≤ $1 billion	Market CARs	–2.4887	–0.7948	15.0287
	Fama-French CARs	–1.5640	–0.6923	14.2551
Panel B: Receipt of TARP Funds				
Total Assets	**Variable**	**Mean**	**Median**	**Std. Dev.**
≥ $10 billion	Market CARs	–9.5270	–5.6087	20.0500
	Fama-French CARs	–1.4968	1.9461	18.4915
≤ $10 billion &	Market CARs	–9.9341	–9.1864	20.6067
≥ $3 billion	Fama-French CARs	–4.5483	–6.0440	20.2869
≤ $3 billion &	Market CARs	–5.6314	–5.7627	19.0473
≥ $1 billion	Fama-French CARs	–3.0392	–4.0684	19.5482
≤ $1 billion	Market CARs	5.3646	6.3623	21.0709
	Fama-French CARs	6.9637	7.1343	20.8991

Notes Panel A : Summary statistics are presented for the cumulative abnormal returns of the bailout banks in each of the sub-samples around October 14, 2008 (the day of the announcement of TARP). The sample of banks that accepted TARP bailout funds during this period is obtained from ProPublicas TARP database. Stock return data is retrieved from CRSP US Stock database. Following, FDIC and Federal Reserve Guidelines, the bailout banks in the sample are split into 4 subsamples based on their book value of total assets as of at the quarter-end of the announcement of TARP (December 31, 2008). Reported are mean, median, and standard deviations of market CARs, and Fama-French CARs in event windows of 10 trading days before and after the date that TARP was announced. The cumulative abnormal return variables are defined in the text. Notes Panel B: Of the sub-samples around the day that each bank in the sample actually received the TARP funds. This event date is specific to each bailout bank, ranging from October 2008 to December 2009. The sample of banks that accepted TARP bailout funds during this period is obtained from ProPublicas TARP database. Stock return data is retrieved from CRSP US Stock database. Following, FDIC and Federal Reserve Guidelines, the bailout banks in the sample are split into 4 sub-samples based on their book value of total assets as of at the end of the quarter that they received TARP funds. Reported are mean, median, and standard deviations of market CARs, and Fama-French CARs in event windows of 10 trading days before and after the date that TARP was announced. The cumulative abnormal return variables are defined in the text.

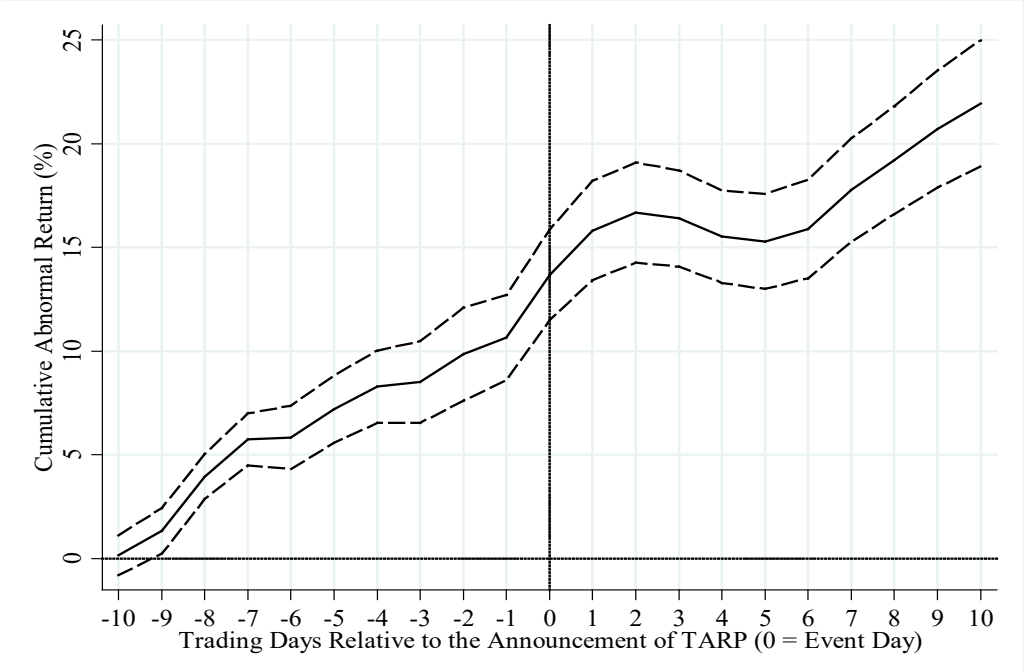
It clearly shows that the large banks were performing significantly better than the small banks when the TARP was announced. This difference may be because the large banks are more likely to be bailed out if it is needed in the future.

Table 9: Point and Cumulative Fama-French Abnormal Returns, Using the Market Model, around the Announcement of TARP

Event Day	Point Estimation		CAR Estimation	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**
–10	0.1653	0.5822	0.1653	0.5822
–9	1.1677***	0.4582	1.3330**	0.6633
–8	2.6207***	0.3640	3.9537***	0.6573
–7	1.7938***	0.3458	5.7475***	0.7581
–6	0.0955	0.4566	5.8429***	0.9229
–5	1.3640***	0.3818	7.2069***	0.9809
–4	1.0793***	0.4109	8.2862***	1.0577
–3	0.2222	0.4738	8.5085***	1.1922
–2	1.3553**	0.6742	9.8637***	1.3584
–1	0.7876	0.6538	10.6513***	1.2451
0	3.0213***	0.6263	13.6727***	1.3190
1	2.1412***	0.4406	15.8139***	1.4506
2	0.8704**	0.4359	16.6843***	1.4585
3	–0.2849	0.3600	16.3994***	1.4062
4	–0.8778***	0.3328	15.5216***	1.3467
5	–0.2324	0.3210	15.2892***	1.3857
6	0.6062**	0.3574	15.8954***	1.4431
7	1.8690***	0.4024	17.7644***	1.5116
8	1.4465***	0.3216	19.2109***	1.5751
9	1.4977***	0.3391	20.7086***	1.7110
10	1.2408***	0.4435	21.9494***	1.8419

*Notes: The table shows the point and cumulative abnormal returns estimated using Fama-French three-factor model in a window of ten days before and ten days after October 14, 2008 (the day of the announcement of TARP). The point and cumulative estimate of the average returns for the event are reported along their standard error. Standard errors are adjusted for heteroskedasticity and autocorrelation. The return variables are defined in the text. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.*

Figure 3: The Evolution of Fama-French *Cars* Around the Announcement of TARP



Notes: The figure shows the average cumulative returns of the bailout banks in the sample in a window of ten days before and after October 14, 2008 (the day of the announcement of TARP), along their 90% confidence bands. CARs plotted in this figure are estimated using Fama-French three-factor model.

The Receipt of TARP Funds

Table 10 presents the mean, median and standard deviation of the same set of variables as defined in Table 6, but the event date is set to be the day that each bailout bank in our sample actually received the TARP funds, i.e. the day of receipt. The event date is chosen to be the date of receipt of the funds, as opposed to the mere announcement of that the bank will be receiving (or rejecting) the funds, as this is confirmation that the bank has accepted to receive the funds and the amount received is also quantifiable. As will be evident in the analysis in the tables below, the analysis considers different windows of 0, 1, 3, 5 and 10 days before and after the receipt date, as a way to check for consistency of results and eliminate the impact of other events such as stock-splits, management changes, corporate control related events. The results are generally consistent across the 5 observation windows. This establishes a pattern that has been reported in the literature (Bayazitova & Shivdasani, 2012).

Table 10: Returns Around the Receipt of TARP Funds

Event Window	Variable	Mean	Median	Standard Deviation
[–10, +10]	Raw stock returns	–0.2144	–0.1300	7.4602
	Market-adjusted	–0.1937	–0.2594	6.6341
	Fama-French adjusted	–0.0728	–0.1534	6.5758
	Market abnormal	–0.1862	–0.2798	6.6376
	Fama-French abnormal	0.0009	–0.0917	6.5784
	Market CARs	–3.9096	–3.6984	20.6118
	Fama-French CARs	0.0184	–1.2966	20.1531
[–5, +5]	Raw stock returns	–0.3758	–0.3596	7.7510
	Market-adjusted	–0.1881	–0.2196	7.0529
	Fama-French adjusted	0.0409	–0.0512	7.0174
	Market abnormal	–0.1805	–0.2220	7.0558
	Fama-French abnormal	0.1145	–0.0091	7.0200
	Market CARs	–1.9856	–2.4537	14.1084
	Fama-French CARs	1.2593	–0.9079	14.8878
[–3, +3]	Raw stock returns	–0.2312	–0.3223	7.7341
	Market-adjusted	–0.2338	–0.2337	7.0137
	Fama-French adjusted	–0.0617	–0.0964	7.0199
	Market abnormal	–0.2263	–0.2354	7.0153
	Fama-French abnormal	0.0118	–0.0525	7.0219
	Market CARs	–1.5838	–2.5484	14.4073
	Fama-French CARs	0.0826	–0.9841	14.4458
[–1, +1]	Raw stock returns	–0.3670	–0.5278	8.1077
	Market-adjusted	–0.4157	–0.2545	7.4903
	Fama-French adjusted	–0.1354	–0.1101	7.3808
	Market abnormal	–0.4082	–0.2121	7.4915
	Fama-French abnormal	–0.0619	–0.0382	7.3806
	Market CARs	–1.2245	–1.3223	10.9505
	Fama-French CARs	–0.1858	–0.1244	10.6885
[0]	Raw stock returns	0.9151	0.0000	8.5662
	Market-adjusted	–0.2565	–0.3593	8.1581
	Fama-French adjusted	0.0776	–0.2835	8.1485
	Market abnormal	–0.2489	–0.2121	8.1574
	Fama-French abnormal	0.1511	–0.2458	8.1434
	Market CARs	–0.2489	–0.2121	8.1574
	Fama-French CARs	0.1511	–0.2458	8.1434

Notes: Summary statistics are presented for the returns of the bailout banks around the day that each bank in the sample actually received the TARP funds. This event date is specific to each bailout bank, ranging from October 2008 to December 2009. The sample of banks that accepted TARP bailout funds during this period is obtained from ProPublica's TARP database. Stock return data is retrieved from CRSP US Stock database. Reported are mean, median, and standard deviations of Raw stock returns, market-adjusted stock returns, Fama-French adjusted returns, market abnormal returns, Fama-French abnormal returns, market CARs, and Fama-French CARs in event windows of 2T+1 trading days around the date that each bank received the TARP funds, i.e. 21 days, 11 days, 7 days, 3 days and 1 day around the day of receipt. The return variables are defined in the text.

In contrast to the results presented in Table 6, the bailout banks' stock returns around the day of the receipt of TARP funds are negative according to most of the measures, especially in the event window of 1 day before and after the event. However, the one-factor market model and three-factor Fama-French model give us conflicting results if alternative event windows are considered. Returns estimated using one-factor market model show a negative market reaction to the receipt of the bailout funds, while returns estimated using Fama-French three-factor model are all positive even though their magnitudes are fairly small (close to zero). The medians of the returns are consistently negative regardless of the model specification and event window considered. Our empirical results are consistent with the findings of Bayazitova and Shivdasani (2012) that the receipt of TARP funds did not have meaningful certification effect.

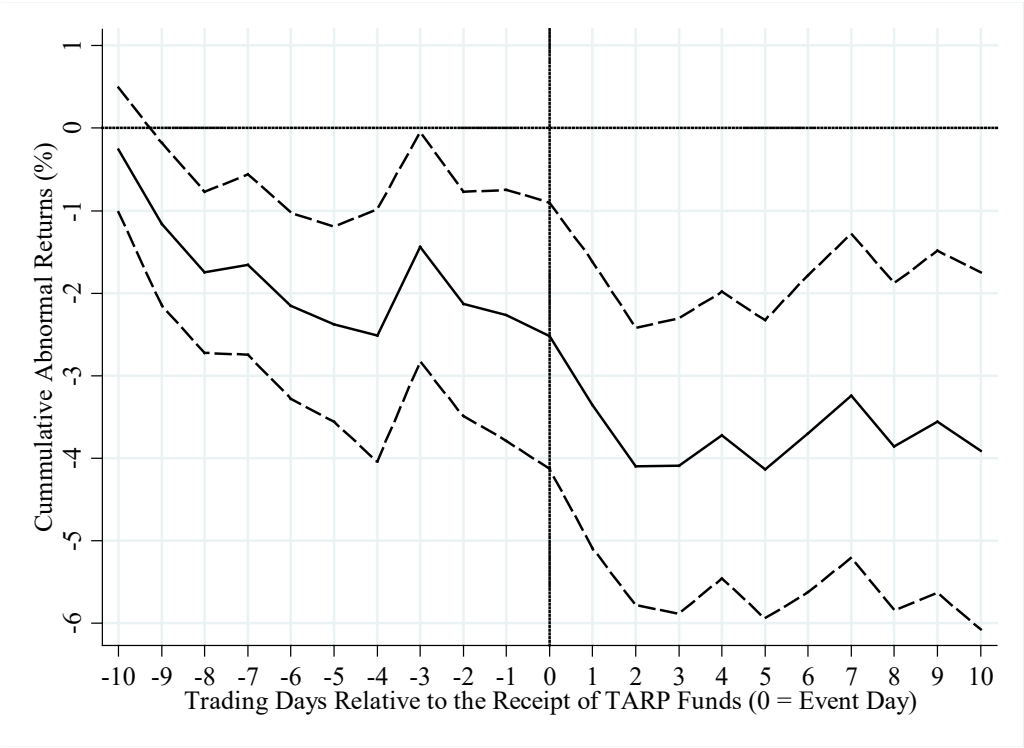
Table 11 reports the point and cumulative estimates of the average abnormal returns around the day of the receipt of TARP funds using market model. Figure 4 provides a graphical overview of the average CARs by plotting the dynamics of the average CARs against trading date relative to the day of the receipt of TARP funds along their 90% confidence bands. In line with the results reported in Table 10, the cumulative abnormal returns estimated using one-factor market model remain negative throughout the entire event window of 10 days before and after the banks actually received the bailout funds. The bailout bank experienced significantly negative abnormal returns immediately after the receipt of TARP funds. Although the bailout banks underperformed the market before they received the bailout funds, they performed even worse after the event. The negative cumulative abnormal returns are still significant even if we control for the pre-event downward trend. This may suggest that the receipt of TARP funds conveyed a signal that the bank is in trouble to the market, therefore the event was interpreted as bad news by the outside investors.

Table 11: Point and Cumulative Market Abnormal Returns Around the Receipt of TARP Funds

Event Day	Point Estimation		CAR Estimation	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**
–10	–0.2615	0.4571	–0.2615	0.4571
–9	–0.9011**	0.4222	–1.1627*	0.5972
–8	–0.5859	0.3877	–1.7486***	0.5915
–7	0.0942	0.4259	–1.6544**	0.6610
–6	–0.4960	0.3999	–2.1504***	0.6831
–5	–0.2266	0.4051	–2.3771***	0.7165
–4	–0.1345	0.5779	–2.5116***	0.9269
–3	1.0749**	0.4933	–1.4367*	0.8428
–2	–0.6945**	0.3428	–2.1313**	0.8238
–1	–0.1377	0.4487	–2.2690**	0.9216
0	–0.2489	0.5190	–2.5179**	0.9776
1	–0.8379*	0.4600	–3.3557***	1.0529
2	–0.7471*	0.4066	–4.1028***	1.0186
3	0.0075	0.4248	–4.0954***	1.0850
4	0.3745	0.4150	–3.7208***	1.0519
5	–0.4153	0.3922	–4.1361***	1.0947
6	0.4329	0.3655	–3.7032***	1.1637
7	0.4601	0.3726	–3.2431***	1.1885
8	–0.6175*	0.3270	–3.8606***	1.2005
9	0.3006	0.3526	–3.5599***	1.2553
10	–0.3497	0.3794	–3.9096***	1.3115

*Notes: The table shows the point and cumulative abnormal returns estimated using Markowitz' market model in a window of ten days before and ten days after the day of the receipt of TARP funds (the event day is specific to each bailout bank). The point and cumulative estimate of the average returns for the event are reported along their standard error. Standard errors are adjusted for heteroskedasticity and autocorrelation. The return variables are defined in the text. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.*

Figure 4: The Evolution of Market *Cars* Around the Receipt of TARP Funds



Notes: The figure shows the average cumulative returns of the bailout banks in the sample in a window of ten days before and after the bailout banks in the sample received the TARP funds (this event day is specific to each bank), along their 90% confidence bands. CARs plotted in this figure are estimated using Markowitz' market model.

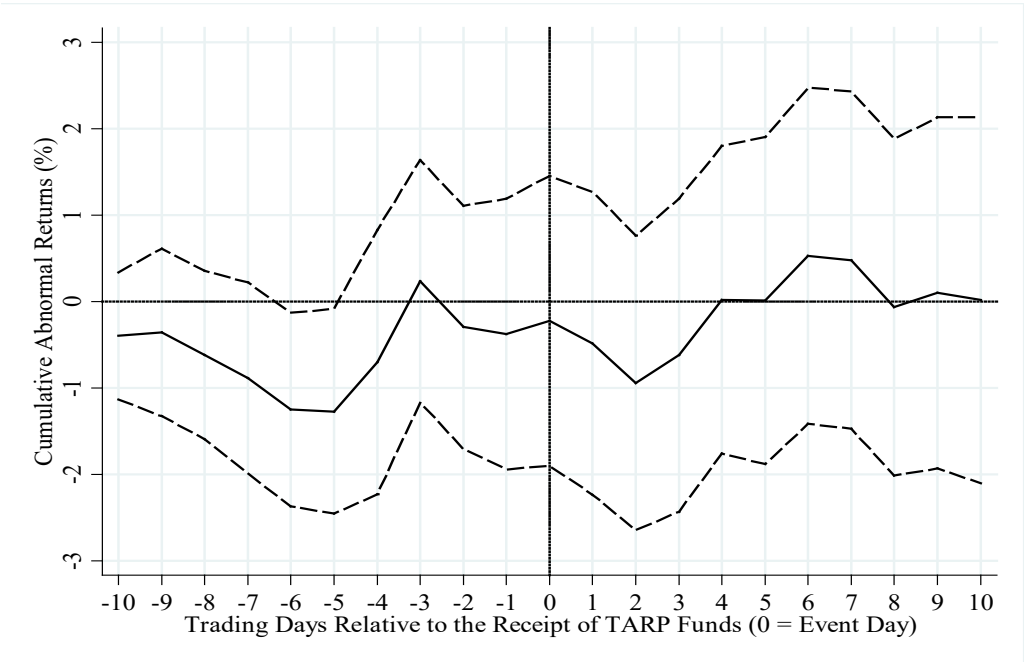
Table 12 shows the point and cumulative estimates of the average abnormal returns around the day of the receipt of TARP funds using Fama-French model. Figure 5 provides a graphical overview of the average CARs by plotting the average CARs against trading days relative to the day of the receipt of TARP funds along their 90% confidence bands. The point and cumulative abnormal returns estimated using Fama-French three-factor model show that the cumulative abnormal returns are not significantly different from zero during the period of 10 days before and after the banks received their bailout funds. Again, the difference between the three-factor Fama-French model results and the one-factor market model results may be caused by the size effect, which means the significantly negative abnormal return obtained using one-factor market model can largely be explained by the size factor included in the Fama-French three-factor model. To provide further evidence, we also report the sub-sample summary statistics for the cumulative abnormal returns for the 4 size groups as defined above, see Table 8 Panel B. It seems that on average the big banks' cumulative abnormal returns over the period of 10 trading days before and after the receipt of the TARP funds are more negative than that of small banks. The smallest banks with book value of total assets less than $1 billion experienced positive cumulative abnormal returns over the event window.

Table 12: Point and Cumulative Fama-French Abnormal Returns Around the Receipt of TARP Funds

Event Day	Point Estimation		Car Estimation	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**
–10	–0.3969	0.4451	–0.3969	0.4451
–9	0.0411	0.4190	–0.3557	0.5870
–8	–0.2615	0.3935	–0.6172	0.5910
–7	–0.2675	0.4369	–0.8847	0.6699
–6	–0.3636	0.3910	–1.2482*	0.6799
–5	–0.0221	0.3972	–1.2703*	0.7174
–4	0.5682	0.5732	–0.7021	0.9268
–3	0.9399*	0.4942	0.2378	0.8496
–2	–0.5330	0.3580	–0.2953	0.8514
–1	–0.0795	0.4355	–0.3748	0.9487
0	0.1511	0.5182	–0.2237	1.0167
1	–0.2573	0.4526	–0.4810	1.0611
2	–0.4594	0.4127	–0.9404	1.0329
3	0.3209	0.4359	–0.6195	1.0976
4	0.6417	0.4183	0.0222	1.0777
5	–0.0112	0.3700	0.0110	1.1462
6	0.5199	0.3563	0.5310	1.1789
7	–0.0494	0.3671	0.4816	1.1827
8	–0.5459*	0.3094	–0.0643	1.1798
9	0.1660	0.3428	0.1016	1.2307
10	–0.0833	0.3723	0.0184	1.2823

*Notes: The table shows the point and cumulative abnormal returns estimated using Fama-French three-factor model in a window of ten days before and ten days after the day of the receipt of TARP funds (the event day is specific to each bailout bank). The point and cumulative estimate of the average returns for the event are reported along their standard error. Standard errors are adjusted for heteroskedasticity and autocorrelation. The return variables are defined in the text. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.*

Figure 5: The Evolution of Fama-French *CARs* Around the Receipt of TARP Funds



Notes: The figure shows the average cumulative returns of the bailout banks in the sample in a window ten days before and after the bailout banks in the sample received the TARP funds (this event day is specific to each bank), along their 90% confidence bands. CARs plotted in this figure are estimated using Fama-French three-factor model.

It is important check for the robustness of the results, by comparing the cumulative abnormal returns of the two groups of banks (treated and untreated), which are matched in terms of bank characteristics such as bank size, age, earnings, management quality, inter alia. This will establish the banks' reaction in each group by type of characteristics. This is the subject of the next section.

Counterfactual Analysis

We employ propensity score matching methods to check the robustness of our baseline results. We match bailout banks (treated) and non-bailout banks (untreated) on their financial variables (i.e. CAMELS variables) as well as demographic variables (i.e. bank size and age) as observed at the end of September 2008, the latest financial information available before the announcement of TARP. The matched bailout and their counterfactuals, i.e. non-bailout banks with similar background characteristics, are used to compare the performance in the event window of 3 days surrounding the receipt of TARP funds. The difference in performance between each bailout bank and its counterfactual is calculated. The average of the differences across all observations is the estimated average treatment effect on the treated (ATT). We use the nearest neighbor method to match bailout bank to their counterfactuals. More specifically, we assign each matched counterfactual (non-bailout bank) a (fake) event day which is identical to the day of its bailout counterpart received the TARP funds. We then estimate and compute the cumulative abnormal return of the counterfactual 3 days before and after its fake event day. The difference from the observed outcome, which in this case is the accumulative abnormal return in the event window, for the bailout banks and their counterfactuals is the average causal effect. The estimated results for the causal model with outcomes are reported in Table 13.

Table 13 presents the propensity score matching estimate of the average effect of the receipt of TARP funds on bailout banks. Panel A reports the estimated results for the logistic regression of receiving TARP funds on bank-level characteristics. The probability of receiving TARP funds is highly significantly related to a bank's capital adequacy. Banks with lower tier 1 capital to total risk-weighted assets ratio are more likely to receive bailout funds, suggesting that TARP mainly targets at low capital banks. Besides, earnings EAR is also an important determinant of the probability of receiving bailout funds which has p-value 0.14. Bank size SZ has p value 0.01. The other variables are statistically insignificant. The estimated logistic regression is then used to predict the propensity score, i.e. the probability of the receiving TARP funds for all the sample banks. According to the predicted propensity score, each bailout bank is matched to its "nearest neighbor" who did not actually receive bailout funds.

Panel B of Table 13 reports the estimated difference in balance of the bank characteristics variables before and after propensity score matching. Substantial decreases in means between bailout banks and their counterfactuals are observed in all the characteristics variables except management quality variables (*MQ*). The percentage reductions in imbalance due to matching for capital adequacy (*CA*) and earnings (*EAR*) are 91.70% and 90.10%, respectively. Panel C of Table 13 reports the propensity matching estimate of ATT, which in this case is the average effect of the receipt of TARP funds on bailout banks. The average cumulative abnormal return for the matched bailout banks in the event window of 3 days before and after the receipt of their TARP fund is -2.08%, while that for non-bailout banks is -0.03%. Therefore, average treatment effect on the treated is -2.05%. Since the propensity score estimate effectively controls the observed confounding variables, i.e. CAMELS variables, bank size and age, the estimated difference of -2.05% in performance between bailout banks and their counterfactuals can be reasonably interpreted as the effect of the acceptance of TARP funds on the bailout banks.

Table 13: Propensity Matching Estimate of the Effect of Receiving TARP Funds on the Bailout Banks

Panel A: Logistic Regression of Receiving TARP Funds on Bank Characteristics						
Variable	**Coefficient**	**Std. Dev.**	***z*-statistic**	***p*-value**	**95% Confidence interval**	
CA	–16.6126	6.3852	–2.60	0.01	–29.13	–4.10
AQ	13.9568	6.2954	2.22	0.03	1.62	26.30
MQ	0.0193	0.1666	0.12	0.91	–0.31	0.35
EAR	7.2442	4.9073	1.48	0.14	–2.37	16.86
LIQ	–3.3221	2.0722	–1.60	0.11	–7.38	0.74
SEN	–0.4131	1.1382	–0.36	0.72	–2.64	1.82
SZ	0.2619	0.1056	2.48	0.01	0.05	0.47
AGE	0.0094	0.0122	0.77	0.44	–0.01	0.03
Constant	–1.8016	1.7748	–1.02	0.31	–5.28	1.68
Panel B: Estimate Difference in Balance						
Variable	**Sample**	**Treated**	**Control**	**% bias**	**% reduce**	***t*-statistic**
CA	Unmatched	0.0990	0.1143	–26.70		–2.38
	Matched	0.0990	0.0977	2.20	91.70	0.60
AQ	Unmatched	–0.0202	–0.0274	28.40		2.52
	Matched	–0.0202	–0.0175	–10.50	63.00	–1.66
MQ	Unmatched	–0.4277	–0.4118	–2.10		–0.18
	Matched	–0.4277	–0.3522	–9.80	–374.40	–0.97
EAR	Unmatched	0.0000	–0.0076	22.00		1.96
	Matched	0.0000	–0.0007	2.20	90.10	0.38
LIQ	Unmatched	0.0405	0.0718	–14.60		–1.30
	Matched	0.0405	0.0362	2.00	86.20	0.93
SEN	Unmatched	0.1530	0.1351	15.90		1.40
	Matched	0.1530	0.1649	–10.60	33.00	–0.84
SZ	Unmatched	15.4600	14.6300	49.90		4.39
	Matched	15.4600	15.2390	13.30	73.40	1.15
AGE	Unmatched	24.0380	19.9800	31.80		2.80
	Matched	24.0380	22.3400	13.30	58.10	1.16
Panel C: Estimate of Average Effect of the Receipt of TARP Funds on Bailout Banks						
Variable	**Sample**	**Treated**	**Controls**	**Difference**	**S.E.**	***t*-statistic**
$CAR_{-10,\,10}$	ATT	–2.0761	–0.0303	–2.05	1.16	–1.77

Notes: The table reports propensity score matching estimate of the average effect of the receipt of TARP funds on the stock performance of the bailout banks. Panel A reports the estimation results for the logistic regression of a binary bailout variable (bank actually received TARP funds=1, and bank did not actually receive TARP funds=0) on bank characteristics. The estimated logistic regression is then used to predict each bank's propensity score, i.e. the probability of receiving TARP funds. According to the predicted propensity score, each bailout bank is matched to its "nearest neighbor" who did not actually receive bailout funds. Panel B assesses balance between treated and control groups. Reported are the estimated difference in means between bailout banks and non-bailout banks for bank characteristics variables before and after matching. A decrease in difference implies an increase in balance with respect to that covariate. Panel C reports the propensity matching estimate of the average effect of the receipt of TARP funds on the banks who actually received TARP funds. The outcome variable is defined as the cumulative abnormal return over the event window of 3 days before and after the receipt of TARP funds.

Robustness Checks

Our benchmark results (reported in Tables 6 and 9, parallel with Figures 2 and 4 respectively) show that abnormal returns were significantly positive around the announcement of TARP, while they were significantly negative around the receipt of TARP funds. A concern in any event study is that the findings are simply price momentum around the event dates. The price momentum around the event dates may either react pre-existing information flows or trading activities unrelated to the events. To check the robustness of our benchmark results, we test whether the abnormal returns are greater in the 3 days right after the events (i.e. day 0, day 1, and day 2) than in the average of the 10 days surrounding the events. The regression is specified as

$$\hat{\varepsilon}_{it} = \gamma_i + \gamma_{Dummy} Dummy3_t + \sigma_{it}, t \in [t^* - T, t^* + T] \quad (9)$$

where $\hat{\varepsilon}_{it}$ is the abnormal return for bank *i* on day *t* estimated using Markowitz' market model, γ_i is a bank-specific constant term, and $Dummy3_t$ is a dummy variable which is equal to 1 for the 3 days right after the event, and 0 otherwise. If the abnormal returns are greater in the 3 days right after the event, the coefficient

on the dummy variable γ_{Dummy} is expected to be statistically significant. Alternatively, we include a control that interacts the bailout size with a dummy that is equal to 1 for the 3 days right after the event and 0 otherwise. Thus, the interaction term is a variable that takes on the value of the amount of bailout received by a bank for the 3 days right after the event, and 0 otherwise. The alternative specification of the robustness test regression is specified as

$$\hat{\varepsilon}_{it} = \gamma_i + \gamma_{Interaction}(B_i \times Dummy3_t) + \sigma_{it}, t \in [t^* - T, t^* + T] \quad (10)$$

where B_i measures the amount of bailout funds that a bank accepted ($ billions). Equations (9) and (10) are estimated for both the announcement of TARP and the receipt of funds to check the robustness of our baseline results. The estimated coefficients of interest, i.e. γ_{Dummy} and $\gamma_{Interaction}$, are reported in Table 14. We also estimate Equations (9) and (10) using Fama-French abnormal returns as dependent variable for comparison purposes, testing Fama-French abnormal returns in the 3 days right after the event are significantly higher than the average over the entire event window. The results of the robustness check reported in Panel A clearly show that the abnormal returns are indeed significantly higher in the 3 days immediately after the announcement of TARP than the average of 10 days before and after the event, regardless of the specification of the test. The interaction term that interacts with the dummy variable with the bailout size is also significantly positive. It should be noted that the amount of bailout funds received by the banks was not known at the time when TARP was announced. The significantly positive coefficient on the interaction term may imply that the abnormal returns immediately after the announcement of TARP are higher for the banks that were expected to receive more bailout funds in the future. Hence, the results presented in Panel A confirm that the announcement of TARP indeed had a positive effect on the performance of banks who received TARP funds later on.

Table 14: Abnormal Returns Immediate After TARP Events

Dependent Variable	Coefficient	Estimate	Standard Deviation
Panel A: Announcement of TARP			
Market abnormal return	γ_{Dummy}	2.9830***	0.3209
	$\gamma_{Interaction}$	0.3445***	0.0895
Fama-French abnormal return	γ_{Dummy}	1.1267***	0.2828
	$\gamma_{Interaction}$	0.1577***	0.0538
Panel B: Receipt of TARP Funds			
Market abnormal return	γ_{Dummy}	–0.4960**	0.2408
	$\gamma_{Interaction}$	–0.2230***	0.0616
Fama-French abnormal return	γ_{Dummy}	–0.2210	0.2710
	$\gamma_{Interaction}$	–0.1431***	0.0516

*Notes: The robustness tests check whether the abnormal returns are greater in the 3 days right after the event than in the average over the entire event window under consideration. The robustness tests are specified as $\hat{\varepsilon}_{it} = \gamma_i + \gamma_{Dummy} Dummy3_t + \sigma_{it}$ (Equation (9)) where $Dummy3_t$ is a dummy variable which is equal to 1 for the 3 days right after the event, and 0 otherwise. Alternatively, we interact the dummy with the amount of bailout funds received by a bank (US dollar in billions), and estimate $\hat{\varepsilon}_{it} = \gamma_i + \gamma_{Interaction}(B_i \times Dummy3_t) + \sigma_{it}$ (Equation (10)), where the interaction term takes on the value of the amount of bailout received by a bank for the 3 days right after the event, and 0 otherwise. If the abnormal returns are greater in the 3 days right after the event than the average over the entire window, the coefficients on the dummy variable γ_{Dummy} and the interaction term $\gamma_{Interaction}$ are expected to be statistically significant. Reported are estimated coefficients of interest, i.e. γ_{Dummy} and $\gamma_{Interaction}$, along their standard error. Standard errors are adjusted for heteroskedasticity and autocorrelation. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.*

The results based on the abnormal return estimated using market model in Panel B show that, even if we take the price momentum around the receipt date into account, the stock price declines of the banks are still significant for the 3 days immediately after they received TARP funds. The negative abnormal stock returns are even more statistically significant for the banks that received larger amount of TARP funds. However, the abnormal returns estimated using the Fama-French model are not significantly greater in the 3 days right after the banks received bailout funds, even though on average the Fama-French abnormal returns are lower in the 3-day window. Once we interact the dummy with the bailout size, the coefficient becomes

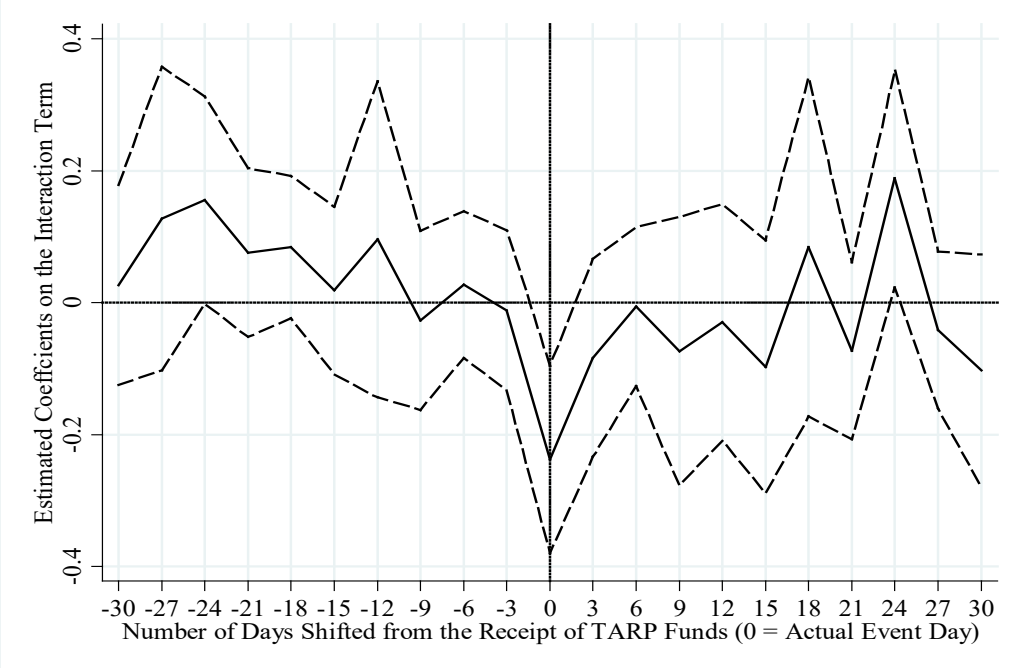
highly significant, confirming that the market interprets the receipt of TARP funds as bad news, and thus penalizes the recipients of TARP funds, especially those who received large amounts.

As additional evidence that our results are not an artifact of the data, we re-estimate Equation (10) on a set of placebo dates. We shift the 3-day window forwards as well as backwards by 3*S* days, i.e. 3, 6, 9, 12, 15, 18, 21, 24, 27, and 30 days. For each 3*S* day shift, we estimate

$$\hat{\varepsilon}_{it} = \gamma_i + \gamma_{Interaction3S}(B_i \times Dummy3_{t+3S}) + \sigma_{it}, S = 0,1,2,3,\ldots,10 \quad (11)$$

We graph our estimates of the coefficient on the interaction term against the number of days shifted from the actual receipt of TARP funds in Figure 6. The thick line plotted in Figure 6 indicates the estimated coefficients for a regression of daily abnormal returns estimated using Markowitz' market model on an indicator for placebo receipt date interacted with the size of TARP funds received by the bailout banks. Out of the 21 time-shifted regressions, $\gamma_{Interaction3S}$, is only significantly negative at 1% significance level for $S = 0$, which is identical to the actual receipt date. The estimated coefficients using the other 20 placebo dates are all smaller in absolute value and statistically less significant. The estimate is also significant at the 1% significance level for $S = 8$, i.e. shifting the event day forward by 24 days, but with positive sign. The placebo estimates reinforce that there were sizable negative abnormal returns just after the receipt of TARP funds, and the decline in bailout banks' stock prices was caused by the acceptance of TARP funds.

Figure 6: Time-Shifted Placebos



Notes: The time-shifted placebos test whether the results are an artifact of the data, by re-estimating Equation (3) days right after the event interacted on a set of placebo dates. We shift the 3-day window forwards as well as backward by 3S days, i.e. 3, 6, 9, 12, 15, 18, 21, 24, 27, and 30 days. For each 3S day shift, we estimate $\hat{\varepsilon}_{it} = \gamma_i + \gamma_{Interaction3S}(B_i \times Dummy3_{t+3S}) + \sigma_{it}$, *where* $S = 0,1,2,3,\ldots,10$ *(Equation (11)). The solid line plots the estimated coefficients on the interaction term (*$\gamma_{Interaction3S}$*). The horizontal axis labels denote the number of days by which we shift the receipt of TARP. The dashed lines represent the 99% confidence intervals using standard errors that are adjusted for heteroskedasticity and autocorrelation.*

Note that this robustness test is not applicable to the announcement of TARP, because in that case the event date is common to all the banks. Even if the time-shifted regression is estimated, the coefficient of interest ($\gamma_{Interaction3S}$) is still highly likely to be statistically significant since the interaction term may capture

either size effect (large amount of bailout funds are expected to committed to larger banks, and thus positively correlated) or other market factors that affect sample banks' abnormal returns systematically on the placebo dates.

CONCLUDING COMMENTS

In the face of the worst global financial shock in a century, the US government launched a number of bailout plans to fix the financial system, but none has proven to be as controversial as the Troubled Assets Relief Program, or TARP, which authorized the US Treasury to make injections of capital into banks, as well as unlimited deposit insurance (for non-interest-bearing accounts), and guarantees of new senior debt. TARP, was highly unpopular with the public, a punching bag for congressional opponents and baggage for its supporters, even as new data indicated the program would cost a small fraction of its original price tag. This article is to our knowledge the first to examine how the market responsed to the launch of TARP and the receipt of bailout funds as reflected in stock returns. More prominently, we allow for non-random selection into the TARP bailout program by using propensity score matching methods. This strategy permits a counterfactual interpretation of the data and provides the first credible empirical evidence to answer the research question "what would have happened to those banks that did in fact receive bailout funds if they had not received the bailout". The empirical evidence presented in this article shows favorable market response to the announcement of TARP, which suggests that the launch of the bailout program indeed helped restore investors' confidence in the financial system. However, the market seemed to react negatively to the receipt of TARP bailout funds. The stock price decreased more for banks being given greater bailouts. Thus, receiving bailouts generated an adverse market signal, instead of ensuring certification. In a future article, Ncube and Hausken (2019) consider TARP bailout size, buy and hold returns, and tail risk.

APPENDICES

Appendix 1: History of US Government Bailouts

Year	Target	Event	Size
1970	Penn Central Railroad	In May 1970, Penn Central Railroad, then on the verge of bankruptcy, appealed to the Federal Reserve for aid on the grounds that it provided crucial national defense transportation services. The Nixon administration and the Federal Reserve supported providing financial assistance to Penn Central, but Congress refused to adopt the measure. Penn Central declared bankruptcy on June 21, 1970, which freed the corporation from its commercial paper obligations. To counteract the devastating ripple effects to the money market, the Federal Reserve Board told commercial banks it would provide the reserves needed to allow them to meet the credit needs of their customers.	$3.2 billion
1971	Lockheed	In August 1971, Congress passed the Emergency Loan Guarantee Act, which could provide funds to any major business enterprise in crisis. Lockheed was the first recipient. Its failure would have meant significant job loss in California, a loss to the GNP and an impact on national defense.	$1.4 billion
1974	Franklin National Bank	In the first five months of 1974, Franklin National Bank lost $63.6 million. The Federal Reserve stepped in with a loan of $1.75 billion.	$7.8 billion
1975	New York City	During the 1970s, New York City became over-extended and entered a period of financial crisis. In 1975 President Ford signed the New York City Seasonal Financing Act, which released $2.3 billion in loans to the city.	$9.4 billion
1980	Chrysler	In 1979 Chrysler suffered a loss of $1.1 billion. That year the corporation requested aid from the government. In 1980 the Chrysler Loan Guarantee Act was passed, which provided $1.5 billion in loans to rescue Chrysler from insolvency.	$4.0 billion

Appendix 2: History of US Government Bailouts (Continued)

Year	Target	Event	Size
1984	Continental Illinois National Bank and Trust Company	Then the nation's eighth largest bank, Continental Illinois had suffered significant losses after purchasing $1 billion in energy loans from the failed Penn Square Bank of Oklahoma. The FDIC and Federal Reserve devised a plan to rescue the bank that included replacing the bank's top executives.	$9.5 billion
1989	Savings & Loan	After the widespread failure of savings and loan institutions, President George H.W. Bush signed and Congress enacted the Financial Institutions Reform Recovery and Enforcement Act in 1989.	$293.3 billion
2001	Airline Industry	The terrorist attacks of September 11 crippled an already financially troubled industry. To bail out the airlines, President George W. Bush signed into law the Air Transportation Safety and Stabilization Act, which compensated airlines for the mandatory grounding of aircraft after the attacks. The act released $5 billion in compensation and an additional $10 billion in loan guarantees or other federal credit instruments.	$18.6 billion
2008	Bear Stearns	JP Morgan Chase and the federal government bailed out Bear Stearns when the financial giant neared collapse. JP Morgan purchased Bear Stearns for $236 million; the Federal Reserve provided a $30 billion credit line to ensure the sale could move forward.	$30 billion
2008	Fannie Mae / Freddie Mac	On September 7, 2008, Fannie and Freddie were essentially nationalized: placed under the conservatorship of the Federal Housing Finance Agency. Under the terms of the rescue, the Treasury has invested billions to cover the companies' losses. Initially, Treasury Secretary Henry Paulson put a ceiling of $100 billion for investments in each company. In February 2009, Tim Geithner raised it to $200 billion. The money was authorized by the Housing and Economic Recovery Act of 2008.	$400 billion
2008	American International Group	On four separate occasions, the government offered aid to AIG to keep it from collapsing, rising from an initial $85 billion credit line from the Federal Reserve to a combined $180 billion effort between the Treasury ($70 billion) and Fed ($110 billion). $40 billion of the Treasury's commitment is also included in the TARP total.	$180 billion
2008	Auto Industry	In late September 2008, Congress approved a more than $630 billion spending bill, which included a measure for $25 billion in loans to the auto industry. These low-interest loans are intended to aid the industry in its push to build more fuel-efficient, environmentally-friendly vehicles. The Detroit 3, i.e. General Motors, Ford and Chrysler, were the primary beneficiaries.	$25 billion
2008	Troubled Asset Relief Program	In October 2008, Congress passed the Emergency Economic Stabilization Act, which authorized the Treasury Department to spend $700 billion to combat the financial crisis. Treasury doled out the money via an alphabet soup of different programs.	$700 billion
2008	Citigroup	Citigroup received a $25 billion investment through the TARP in October and another $20 billion in November. Additional aid came in the form of government guarantees to limit losses from a $301 billion pool of toxic assets. In addition to the Treasury's $5 billion commitment, the FDIC has committed $10 billion and the Federal Reserve up to about $220 billion.	$280 billion
2009	Bank of America	Bank of America received $45 billion through the TARP, which includes $10 billion originally meant for Merrill Lynch. In addition, the government has made guarantees to limit losses from a $118 billion pool of troubled assets. In addition to the Treasury's $7.5 billion commitment, the FDIC has committed $2.5 billion and the Federal Reserve up to $87.2 billion.	$142.2 billion

Notes: Adopted from ProPublica website http://www.propublica.org/special/government-bailouts#tarp. The relative size of each US government bailout is calculated in 2008 dollars.

Appendix 3: Summary Statistics for the Four Size Groups

Variable	Mean	25th Percentile	Median	75th Percentile	Standard Deviation	No. of Obs.
Panel A: Total Assets ≥ $10 billion						
BA	4.94	0.33	1.49	3.50	7.7040	42
BR	29.88%	24.54%	30.55%	34.05%	0.1154	42
CA	9.20%	8.15%	8.88%	9.43%	0.0167	42
AQ	2.28%	1.40%	2.03%	3.03%	0.0118	42
MQ	63.81%	53.63%	62.47%	69.90%	0.1445	42
EAR	0.12%	–0.14%	0.26%	0.71%	0.0121	42
LIQ	7.79%	2.72%	3.81%	5.18%	0.1262	42
SEN	21.59%	13.88%	23.94%	29.07%	0.1085	42
SZ	18.15	16.60	17.98	18.98	1.7415	42
AGE	33.81	22.00	34.00	40.00	22.3893	42
Panel B: $10 billion ≥ Total Assets ≥ $3 billion						
BA	0.13	0.08	0.10	0.15	0.0538	37
BR	29.00%	26.45%	30.10%	32.15%	0.0598	37
CA	9.79%	9.23%	9.75%	10.13%	0.0092	37
AQ	1.82%	0.85%	1.54%	2.24%	0.0130	37
MQ	79.95%	59.39%	65.45%	75.42%	0.4899	37
EAR	–0.58%	–0.10%	0.60%	0.88%	0.0328	37
LIQ	3.07%	2.13%	2.91%	3.45%	0.0136	37
SEN	16.01%	8.46%	16.53%	24.16%	0.0970	37
SZ	15.47	15.17	15.42	15.86	0.3845	37
AGE	22.22	15.00	25.00	26.00	8.2568	37
Panel C: $3 billion ≥ Total Assets ≥ $1 billion						
BA	0.04	0.03	0.04	0.05	0.0483	70
BR	29.41%	23.12%	28.60%	31.41%	0.2298	70
CA	10.32%	9.34%	10.17%	11.10%	0.0162	70
AQ	1.89%	1.00%	1.38%	2.19%	0.0167	70
MQ	62.52%	59.29%	66.35%	72.17%	0.2852	70
EAR	0.19%	0.07%	0.47%	0.71%	0.0111	70
LIQ	3.06%	2.36%	2.82%	3.42%	0.0139	70
SEN	12.29%	4.73%	9.37%	17.48%	0.0984	70
SZ	14.36	14.11	14.31	14.62	0.3126	70
AGE	18.66	10.00	20.50	25.00	10.8252	70
Panel D: $1 billion ≥ Total Assets						
BA	0.02	0.01	0.02	0.02	0.0119	36
BR	28.93%	25.39%	27.51%	31.06%	0.1347	36
CA	10.61%	9.38%	10.40%	11.12%	0.0168	36
AQ	1.64%	0.83%	1.59%	2.12%	0.0113	36
MQ	70.29%	64.86%	70.39%	76.41%	0.0856	36
EAR	–0.02%	0.16%	0.45%	0.77%	0.0160	36
LIQ	3.36%	2.46%	2.95%	3.57%	0.0211	36
SEN	13.70%	4.92%	11.28%	20.81%	0.1133	36
SZ	13.52	13.37	13.50	13.73	0.2211	36
AGE	12.92	7.00	12.50	16.50	7.6695	36

Notes: The table reports the summary statistics of the main variables used in the study. Reported are the mean, 25th percentile, median, 75th percentile, and standard deviation of each variable listed in Table II. The statistics for the financial variables are computed based on the Bank Holding Company Data released at the end of September 2008, the latest financial information available before the announcement of TARP on October 14, 2008. BA represents bailout amount (in billions $), BR bailout ratio, CA capital adequacy, AQ asset quality, MQ management quality, EAR earnings, LIQ liquidity, SEN sensitivity, SZ bank size (natural log of total assets in thousands $), and AGE bank age (number of years). The detailed definition and data source are available in Table 2.

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