The Unconventional Effects of Large-scale Asset Purchases: A Firm-level Analysis*

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Abstract

This paper examines the impact of large-scale asset purchases (LSAPs) on corporate financing and investment. We find that LSAPs increased corporate financing relative to the pre-LSAP crisis period and shifted the corporate financing pattern towards greater equity financing. Specifically, LSAPs enabled noninvestment-grade firms to issue more public equity, and allowed investment-grade firms to issue more bonds. After raising capital, public equity issuers used the proceeds to avoid bankruptcy, whereas debt issuers used the funds to expand their businesses. Therefore, unlike traditional monetary policy tools that affect bank lending, LSAPs stimulate the real economy by spurring the stock and bond markets and thereby providing firms with alternative sources of financing.

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1. Introduction

In response to the most severe financial crisis since the Great Depression, and after the federal funds rate had already been reduced to effectively zero, the Federal Reserve resorted to unconventional monetary policy tools. These tools included the unprecedented expansion of the Federal Reserve's balance sheet through the acquisition of agency debt, agency mortgage-backed securities (MBS) and longer-term Treasury securities. These large-scale asset purchases (LSAPs), usually referred to as quantitative easing (QE), were intended to exert downward pressure on longer-term interest rates and ease overall financial conditions. As other unconventional tools expired soon, LSAPs dominated in providing the credit (Gagnon et al. 2011). Other central banks, most notably the Bank of Japan and the Bank of England, implemented similar programs either before or during the crisis. Despite the worldwide adoption of LSAPs, their effectiveness has been intensely debated. Among others, Cochrane (2010) contends that LSAPs are of no use in increasing bank lending because the banking system is already awash in liquidity. To prove the effectiveness of LSAPs, the extant literature primarily focuses on LSAPs' ability to reduce longer-term interest rates. However, a much more important issue in assessing LSAPs is their impact on corporate financial conditions.

The aim of this paper is to examine how LSAPs affect corporate financing and subsequent corporate investment. Because the LSAPs undertaken by the Federal Reserve involved the purchase of substantial amounts of longer-term securities, they enhanced market functioning and liquidity of these longer-term assets and lowered their yields (Gagnon et al., 2011). As investors balanced their portfolios by purchasing similar securities as substitutes for the securities purchased by the Federal Reserve, the yields on other longer-term securities, including corporate bonds, also declined. By reducing the aggregate risk held by the private sector, LSAPs might also reduce general risk aversion and risk premiums. Therefore, LSAPs improve market conditions in the supply side of capital for firms and are expected to have a direct effect on corporate financing. Moreover, as the ability to raise capital enhances, firms may choose to increase their investments, thereby accelerating economic recovery.

Specifically, firms raise external funds through three main sources. The predominant source of external financing is bank loans (Gorton and Winton, 2003). During the crisis,

banks significantly reduced lending activities due to off-balance-sheet liquidity risks (Cornett et al., 2011). Because the reduction of the federal funds rate to effectively zero failed to stimulate bank lending, and the banking system is already awash in liquidity (Cochrane, 2010), it is unlikely that the new liquidity provided by LSAPs will encourage banks to increase lending. The second main source of financing is the public bond market. LSAPs have been found to reduce corporate bond yields. As the cost of borrowing decreases, firms are expected to issue more public bonds. However, because there is a flight to quality during economic downturns (Erel et al., 2012), lower-quality bonds may still face relatively high yields. Therefore, although higher-quality firms may issue more bonds after LSAPs, whether lower-quality firms will also issue more bonds is unclear. The third main source of external funding is public equity. By rebuilding market confidence and removing the risk from the private sector, LSAPs may reduce investors' risk aversion. If investors are willing to bear more risk, the required return on stocks will decrease. Moreover, because LSAPs reduce corporate credit risk (Gilchrist and Zakrajsek, 2013) and lower firms' cost of capital, firms will have higher future cash flows, which in turn will increase stock prices. As stock prices rise, firms may become more willing to issue equity.

To examine how LSAPs affect corporate financing, we employ a logit regression to investigate whether LSAPs increase the probability of external financing, and a multinomial logit regression to analyze the impact of LSAPs on firms' choices among seasoned equity offerings (SEOs), syndicated loans and public bonds to raise funds. We use both qualitative and quantitative measures of LSAPs. The qualitative measure includes three dummy variables to denote different phases of the LSAP program, whereas the quantitative measure uses changes in the Federal Reserve's positions in the three types of securities involved in LSAPs to quantify the newly injected liquidity.

The empirical results demonstrate that LSAPs increased corporate financing relative to the pre-LSAP crisis period and caused a drastic change in corporate financing choices. During the pre-LSAP crisis period, firms' issuance of all types of securities declined significantly. However, after the introduction of LSAPs, the probability of firms' issuing public equity increased significantly, reaching a level that was much higher than the pre-crisis level. The probability of bond financing also increased but remained lower than the pre-crisis level.

There was no monotonic change in the probability of financing through loans, suggesting that LSAPs failed to encourage bank lending. These results are not caused by a change in aggregate demand and are robust to several alternative specifications.

Because the effects of macroeconomic conditions on capital raising depend on corporate credit quality (Erel et al., 2012), we also analyze the incremental financing choices of investment- and noninvestment-grade firms separately. After the introduction of LSAPs, investment-grade firms issued significantly more public bonds to raise external financing, whereas the issuance of bonds by noninvestment-grade firms increased only slightly. More important, the issuance of public equity by investment-grade firms did not change significantly; rather, the dramatic increase in public equity offerings after the implementation of LSAPs was due to increased equity issuance by noninvestment-grade firms.

Next, we investigate why LSAPs increased public equity offerings, especially offerings by noninvestment-grade firms. First, we use event-study and time-series analyses to show that LSAPs affected the stock market. Second, we examine why firms issued public equity. Compared with the control group, we find that SEO issuers enjoyed significantly larger increases in their stock prices before the issuance but not after the issuance, which suggests that SEO issuers timed the market.

Finally, an analysis of how firms used external funds is crucial for determining whether LSAPs affected the real economy. By regressing corporate quarterly investment on the amounts of different securities issued in the previous quarter (controlling for Tobin's Q, cash flow and firm fixed effects), we find that SEO issuers tended to use the proceeds to repay short-term debt and increase cash holdings, loan issuers tended to make more acquisitions, and bond issuers tended to increase both capital investments and acquisitions.

Taken together, these results demonstrate that LSAPs not only reduced the longer-term interest rate, thereby allowing investment-grade firms to expand their businesses by issuing more public bonds, but also caused a boom in the stock market, which enabled noninvestment-grade firms to issue more public equity and thereby to avoid bankruptcy. However, unlike traditional monetary policy tools, LSAPs did not increase bank lending.

This paper contributes to the literature in at least two respects. First, although the existing literature has examined the impact of LSAPs on numerous phenomena, including Treasury

yields (Gagnon et al., 2011; Swanson, 2011; Krishnamurthy and Vissing-Jorgensen, 2011; Hamilton and Wu, 2012; D'Amico et al., 2012; D'Amico, and King, 2013), MBS spreads (Fuster and Willen, 2010; Hancock and Passmore, 2011; Stroebel and Taylor, 2012), other longer-term interest rates (Gagnon et al., 2011; Krishnamurthy and Vissing-Jorgensen, 2011; Wright, 2012), corporate credit risk (Gilchrist and Zakrajsek, 2013), and international assets (Neely, 2013), and some studies have also analyzed the possible mechanisms by which LSAPs affect these phenomena (Krishnamurthy and Vissing-Jorgensen, 2011; D'Amico et al., 2012; D'Amico, and King, 2013; Greenwood and Vayanos, 2014), this paper is the first to discuss the impact of LSAPs on the three primary markets for external financing: the syndicated loan market, the public bond market and the stock market. Second, by examining their impact on corporate financing and investment, this paper establishes one micro-foundation for LSAPs' stimulation of the real economy and can provide valuable guidance for future monetary policy to combat financial crises. The results indicate that although LSAPs did not restore bank lending, they did provide alternative financing choices to firms by stimulating the stock and bond markets.

The remainder of this paper is organized as follows. Section 2 provides background information on LSAPs, and derives testable predictions regarding the impact of LSAPs on corporate financing. Section 3 describes the data and methodology. Empirical results are analyzed in Section 4. Section 5 concludes the paper.

2. Background information and testable predictions

After the recent financial crisis impaired access to capital, corporate financing dropped significantly. The crisis involved a run on the shadow banking system (Gorton, 2009; Gorton and Metrick, 2012) and thus severely reduced bank lending. Banks not only decreased total lending (Ivashina and Scharfstein, 2010) but also made smaller loans and charged higher spreads (Santos, 2011). Corporate bond yields also increased as the liquidity premium rose (Dick-Nielsen, Feldhutter and Lando, 2012) and because institutional investors propagated the crisis from securitized bonds to corporate bonds by electing to sell corporate bonds facing redemption (Manconi, Massa, and Yasuda, 2012), and firms failed to increase public debt offerings to replace the reduction in bank lending (Flannery, Giacomini and Wang, 2013). In

addition, stock prices declined steeply and net equity issuance fell significantly before 2009 (Kahle and Stulz, 2013).

To contain the crisis, the Federal Reserve first reduced the federal funds rate to effectively zero; then, beginning in late 2008, it conducted three rounds of LSAPs[1] and one maturity extension program. The first round (LSAP1) was announced on November 25, 2008, and the purchases were conducted between December 2008 and March 2010. The total assets purchased represented 22 percent of the outstanding stock of the affected securities (Gagnon et al. 2011), including $1.25 trillion of agency MBS, $175 billion of agency debt, and $300 billion of longer-term Treasury securities. Beginning August 2010, the principal payments from agency debt and agency MBS were reinvested in longer-term Treasury securities. On November 3, 2010, the Federal Reserve launched the second round of LSAPs (LSAP2) to purchase an additional $600 billion of longer-term Treasury securities by the end of June 2011. After the completion of LSAP2, the Federal Reserve initiated the maturity extension program (MEP) on September 21, 2011, under which the Federal Reserve purchased a total volume of $667 billion par in longer-term Treasury securities and sold an equal par amount of shorter-term Treasury securities by the end of 2012. Moreover, the Federal Reserve adjusted its reinvestment policy and began to reinvest principal payments from agency debt and agency MBS back into agency MBS. On September 13, 2012, the third round of LSAPs (LSAP3) was announced; this round increased the purchase of agency MBS by $40 billion per month. It also increased the purchase of longer-term Treasury securities at a pace of $45 billion per month after the MEP was completed. As economic activity and labor market conditions improved, the Federal Reserve began to wind down its purchases under LSAP3 from December 2013, and ended these purchases in October 2014 after accumulating $4.5 trillion in assets.

LSAPs have been documented to be effective at reducing longer-term interest rates, including corporate bond yields, based on event studies. Gagnon et al. (2011) find that longer-term interest rates on a range of securities significantly decreased around the major announcements of LSAP1. Swanson (2011) predicts a significant but moderate effect of LSAP2 on longer-term Treasury yields based on the similar Operation Twist. Krishnamurthy

[1] See D'Amico et al. (2012) for a detailed discussion of LSAPs from a historical perspective.

and Vissing-Jorgensen (2011) confirm the significant effects of LSAP1 and LSAP2, and find that those programs affect longer-term interest rates through different channels.

LSAPs may reduce longer-term interest rates through three possible mechanisms. First of all, LSAPs can restore market confidence and encourage dealers and investors to participate in financial markets, which is the liquidity or market functioning channel discussed by Gagnon et al. (2011). This mechanism may be very important at the initial implementation of the LSAP program when the market was highly illiquid. In the long run, LSAPs have been found to reduce the risk premium of long-term securities through the portfolio balance channel. The portfolio balance channel essentially says that the supply of a security can affect both its yield and other securities' yields as investors adjust their portfolios due to imperfect asset substitution (Andrés, López-Salido and Nelson, 2004) or the preferred habitats of investors (Vayanos and Vila, 2009). Based on the preferred-habitat model of Vayanos and Vila (2009), Hamilton and Wu (2012) demonstrate that LSAPs can be effective at reducing longer-term interest rates. D'Amico et al. (2012) then specify the scarcity channel, referring to that the decrease in the supply of securities purchased under LSAPs will lead to lower yields on securities with similar maturities, and the duration channel of LSAPs, referring to that the removal of aggregate duration by LSAPs will reduce securities yields across maturities, and empirically substantiate their importance in the Treasury market. D'Amico and King (2013) further confirm the scarcity channel using security-level data. Finally, similar to traditional monetary policy, LSAPs may also reduce longer-term interest rates by altering the expected path of short-term interest rates. The expectations or signaling theory argues that long-term rates are the efficient forecasts of the expected short-term rates and that monetary policy can only change the expected path of short-term interest rates to affect long-term rates. However, D'Amico et al. (2012) fail to document this expectations or signaling channel of LSAPs in the Treasury market.

As for the macroeconomic impact of LSAPs, before the recent financial crisis, Eggertsson and Woodford (2003) first show that quantitative easing is irrelevant and only changing expectations regarding future policy matters under the New Keynesian model. However, after the crisis, subsequent papers begin to extend monetary models by incorporating the financial frictions manifested and calibrate the impact of LSAPs on macroeconomic variables such as

output and inflation. Based on the FRB/US model, Chung et al. (2011) estimate that the first two rounds of LSAPs raise the level of real GDP by almost 3 percent and lower the unemployment rate by 1 and a half percentage points, which is equivalent to approximately 3 percent cut in the federal funds rate. Gertler and Karadi (2011) add endogenous balance sheet constraints on financial intermediaries to a quantitative monetary DSGE model and show that the welfare benefits from unconventional monetary policy can be substantial particularly when the nominal interest rate hits zero. After introducing credit frictions in private financial intermediation to the New Keynesian model, Curdia and Woodford (2011) demonstrate that pure expansion in the size of the central-bank balance sheet may be ineffective but targeted asset purchases can be effective when financial markets are sufficiently impaired. Farmer (2012) use a general equilibrium model to demonstrate that qualitative easing or changing the composition of the central bank's balance sheet can be welfare enhancing when agent cannot participate in financial markets that open before they are born. In contrast, Chen, Curdia and Ferrero (2012) show that the DSGE model augmented with bond market segmentation predicts modest effects of LSAPs on GDP growth and inflation. Wen (2014) demonstrates that unless LSAPs are highly persistent and extremely large, their macroeconomic effects will be trivial.

There is a gap to link the impact of LSAPs on longer-term interest rates to that on macroeconomic variables, the crucial part of which is their impact on corporate behaviors. By stabilizing and improving financial markets, LSAPs are expected to directly affect corporate financing. The above studies show that LSAPs relieved the illiquidity of financial markets, and decreased longer-term interest rates. By reducing the aggregate risk held by the private sector, LSAPs might also reduce general risk aversion and risk premiums. As conditions in the supply side of capital improved, firms should have a higher probability of obtaining external financing. Therefore, the first prediction is that LSAPs increase corporate financing.

More specifically, publicly listed firms can raise substantial external funds through three main sources. The first major source of external funds is bank loans. Banks' unwillingness to lend during the financial crisis primarily stemmed from the tremendous losses they had suffered in the securitized and structured products and from concerns regarding the uncertainty in the economy, not because of a liquidity shortage. With the zero federal funds

rate and the Troubled Asset Relief Program (TARP)[2], the banking system was awash in liquidity (Cochrane, 2010). Therefore, it is unlikely that the injection of liquidity through LSAPs will affect bank lending. Another source of external funds is the issuance of public bonds. LSAPs reduce corporate bond yields through the portfolio balance channel. As the cost of borrowing declines, firms may issue more bonds. However, because lower-quality bonds are imperfect substitutes for securities purchased under LSAP programs, and there is a flight to quality during economic downturns (Erel et al., 2012), lower-quality firms may continue to face relatively high bond yields and thus may not issue more bonds. The third source of external financing is public equity offerings. By restoring market confidence and decreasing the aggregate risk held by the private sector, LSAPs may reduce investors' risk aversion and convince them to take on risk with a lower return; accordingly, LSAPs may decrease the required return on stocks. In addition, Gilchrist and Zakrajsek (2013) find that corporate credit risk declined around the announcements of LSAPs. By reducing corporate credit risk, LSAPs may reduce firms' cost of capital and increase firms' future cash flows. As the required return decreases and future cash flows increase, stock prices will rise, and firms may issue more equity. Therefore, the prediction regarding corporate incremental financing choices is that although LSAPs may not increase bank lending, they do increase the issuance of higher-quality public bonds and public equity.

3. Data and empirical strategy

3.1 Sample

Due to data limitations, this paper uses US publicly listed firms to examine the impact of LSAPs. Following Erel et al. (2012), three different data sources are used to obtain information regarding corporate incremental financing choices: the SDC Global New Issues Database for public SEOs, the Mergent Fixed Income Securities Database (FISD) for convertible and straight bonds, and the Loan Pricing Corporation's Dealscan for syndicated loans. As mentioned in the previous section, SEOs, syndicated loans, and public bonds are the three types of securities used most often by publicly listed firms to obtain substantial proceeds for corporate activities; thus, these three types of securities are the focus of this

[2] The Troubled Asset Relief Program (TARP) is the largest US government intervention in the history of the banking industry. See Hoshi and Kashyap (2010), Veronesi and Zingales (2010) and Bayazitova and Shivdasani (2012) for assessments of TARP.

paper. For SEOs, we exclude offers of secondary shares and equity issued outside of the US. For public bonds, we exclude those that are denominated in foreign currency, privately placed, or issued in the form of preferred securities. For syndicated loans, we exclude those that are denominated in foreign currency or syndicated outside of the US. Then, we merge the issuance data with financial statement data from Compustat for the last fiscal quarter before the issuance to obtain data on security issues by public firms. We use quarterly financial statement data because the time span of LSAPs is relatively short and the effect is better captured by quarterly data.

Next, we aggregate the issue-level data into firm-month observations, as in Erel et al. (2012). For each firm-month, we calculate the issue amount of each security; if the firm does not issue a particular type of security in that month, this value is set to zero. Based on the value of monthly issuance, we define two dummy variables as proxies for firms' issuance activities. The first variable, External, denotes whether a firm seeks external financing and equals 1 if the monthly issuance amount for any type of security is nonzero and 0 otherwise. The second variable, Issue, identifies the type of security chosen by the firm. This variable equals 1 if the firm issues a larger amount of SEOs than any other security, equals 2 if the firm issues a larger amount of syndicated loans than any other security, equals 3 if the firm issues a larger amount of public bonds than any other security[3], and equals 0 otherwise.

We use both qualitative and quantitative measures of LSAPs. The qualitative measure comprises three dummy variables to denote the different phases of the LSAP program, whereas the quantitative measure uses changes in the Federal Reserve's positions in the three types of securities purchased under LSAPs to quantify the newly injected liquidity. To construct this quantitative measure, which reflects the time-varying intensity of LSAP implementation, System Open Market Account (SOMA) securities holdings data[4] are used. SOMA is the account used by the Federal Reserve to conduct open market operations (OMOs). OMOs refer to the purchase and sale of securities in the open market by a central

[3] In cases where the issue amounts of different securities are equal, we define Issue as equal to the larger number because access to the debt market indicates that a firm is in better financial condition. The empirical results remain unchanged if we exclude all of these cases or define Issue as equal to the smaller number.

[4] SOMA is managed by the Federal Reserve Bank of New York, and SOMA securities holdings data are available at the following webpage: http://www.ny.frb.org/markets/soma/sysopen_accholdings.html.

bank and are a key tool used by the Federal Reserve to maintain the federal funds rate close to the target rate. OMOs can be temporary or permanent. Temporary OMOs involve repurchase and reverse repurchase agreements to temporarily adjust banking reserves, whereas permanent OMOs involve the outright purchase or sale of securities in the open market. Permanent OMOs permanently affect banking reserves and the purchased securities are held in SOMA. Because the recent expansion of SOMA holdings has been driven by LSAPs, monthly changes in SOMA can be used to quantify the intensity of LSAP implementation. In addition, stock information from CRSP is used in the analysis.

The sample period of security issuance data is from January 2003 to August 2012. It begins in January 2003 because the mild 2000-2002 recession might have reduced firms' financing demands (Flannery, Giacomini and Wang, 2013) and ends in August 2012 due to the unavailability of the Roberts Dealscan-Compustat linking table after that time (the construction details of this linking table can be found in Chava and Roberts (2008)). Accordingly, we will focus on the effects of LSAP1, LSAP2 and MEP on corporate financing and leave LSAP3 for future research. The sample period for the analysis of how firms used the capital raised after LSAPs is shorter, running from January 2009 to September 2012.

To obtain the final sample, we exclude financial firms (SIC codes: 6000-6999); utilities (SIC codes: 4900-4999); non-US firms (FIC not equal to USA); non-publicly traded firms and subsidiaries (STKO equal to one or two); firms with missing or non-positive total assets; firms with non-positive sales; and firms with negative firm age, where firm age is defined relative to the year in which the firm first appeared in the Compustat North America Fundamentals Annual database.

3.2 Empirical strategy

Because LSAPs were adopted to ease financial conditions, they should directly affect corporate financing. We focus on corporate incremental financing choices, and use a logit regression to analyze how LSAPs affected the probability of external financing and a multinomial logit regression to examine how LSAPs affected firms' choice among SEOs, syndicated loans and public bonds relative to no issuance. The regression models are shown below.

$$External_{i,t} = Logit(\alpha + \beta LSAP + \gamma Crisis_t + \theta X_{i,q-1} + \varepsilon_{i,t}), (1)$$

$$Issue_{i,t} = Mlogit(\alpha + \beta LSAP + \gamma Crisis_t + \theta X_{i,q-1} + \varepsilon_{i,t}). (2)$$

As mentioned above, the dependent variable External in Equation (1) equals 1 if a firm issues any type of security (SEO, syndicated loan or public bond) in a specific month, 0 otherwise. The dependent variable Issue in Equation (2) equals 1 if a firm issues SEOs and the issue amount of SEOs is the largest issuance by the firm in a specific month, 2 if the issue amount of syndicated loans is the largest for that month, 3 if the issue amount of public bonds is the largest for that month, and 0 otherwise. In both regressions, firms with no issuance are used as the reference category.

The explanatory variables comprise both qualitative and quantitative measures of LSAPs. The qualitative measure includes three dummy variables to distinguish between the different phases of the LSAP program and to better capture the magnitude of change in corporate financing. The three dummies are (i) LSAP1, which denotes the first round of LSAP and equals 1 if the issuance takes place between December 2008 and October 2010 and 0 otherwise; (ii) LSAP2, which denotes the second round of LSAP and equals 1 if the issuance takes place between November 2010 and August 2011 and 0 otherwise; and (iii) MEP, which denotes the maturity extension program and equals 1 if the issuance takes place between September 2011 and August 2012 and 0 otherwise. The coefficients of the dummy variables may incorporate the effects of factors other than LSAPs; thus to ensure that the changes are caused by LSAPs and not by other factors, we also use a quantitative measure of LSAPs, which is calculated as the monthly change in SOMA holdings of agency MBS, federal agency securities, and US Treasury notes and bonds. This measure quantifies the liquidity injected by LSAPs. If LSAPs caused changes in corporate financing choices, these changes are expected to increase with the quantitative measure of LSAPs. Because it may take time for LSAPs to affect corporate financing decisions, the quantitative measure of LSAPs is lagged one month relative to the dependent variables.

In the specification, corporate financing during the period from January 2003 to July 2007 (before the crisis) is used as a proxy for the normal level of security issuance. To differentiate the crisis period prior to the implementation of LSAPs, a dummy variable, Crisis, is created,

which equals 1 if the issuance takes place between August 2007 and November 2008 and 0 otherwise. More important, the differences between the coefficient of Crisis and the respective coefficients of the LSAP variables provide a lower bound on the effects of LSAPs. LSAPs were introduced because macroeconomic conditions were deteriorating rapidly and traditional monetary policy tools were ineffective, which implies that without LSAPs, macroeconomic conditions should be at least as unfavorable as they were before LSAPs, if not worse. If corporate financing changed dramatically after the implementation of LSAPs, these changes should represent the effects of LSAPs provided that macroeconomic conditions were unchanged. The actual effects may be even higher because macroeconomic conditions might have been substantially worse.

As in Erel et al. (2012), the control variables in this paper include other factors that have been reported to affect corporate financing choices. Firm age is the number of years since a firm first appeared in the Compustat North America Fundamentals Annual database. Firm size is the natural logarithm of quarterly total assets in constant 2003 dollars, adjusted for inflation using the CPI. Market leverage is the ratio of the sum of long-term debt and debt in current liabilities to the market value of assets, which is calculated as total liabilities plus the market value of common equity plus the redemption value of preferred stock minus deferred taxes and investment tax credits. The M/B ratio is computed as the market value of total assets divided by the book value of total assets. Tangibility is the ratio of net property, plant and equipment to total assets. Cash flow is income before extraordinary items plus depreciation and amortization scaled by total assets. Cash is the sum of cash and short-term investments scaled by total assets. Z-score is the modified Altman's Z-score, as in MacKie-Mason (1990).[5] R&D/Sales is research and development expenses scaled by sales, with missing or negative values replaced by zero. An R&D dummy is created to denote observations that do not report research and development expenses. Firm rating is included to denote firms with Standard & Poor's (S&P) domestic long-term issuer credit ratings. Later in the analysis, we also classify firms into investment-grade and noninvestment-grade groups based on S&P ratings. A firm is defined as investment-grade[6] if it has been assigned a rating

[5] Z score=[3.3*(ibq+xintq+txtq)+saleq+1.4*req+1.2*(actq-lctq)]/atq.

[6] The definition of investment-grade firms in this paper is broader than that in Erel et al. (2012). Whereas their definition

of BBB- or above for at least one month during the sample period. Otherwise, it is classified as noninvestment-grade. Sales growth rate is the growth rate of inflation-adjusted real sales. Past three-month stock return is the cumulative stock return during the three months prior to the issuance. Term spread[7], which is defined as the difference between the ten-year Treasury constant maturity rate and the one-year Treasury constant maturity rate with a one-month lag, is included to control for the term premium. Industry fixed effects at the 2-digit SIC level are also controlled for in the regressions. As Petersen (2009) suggests, the t-statistic is corrected by double clustering at the firm and quarter levels for the logit regression and by clustering at the firm level for the multinomial logit regression.

After analyzing corporate financing choices, we examine how firms used the capital they raised. The regression model is depicted in Equation (3). Quarterly investment is regressed on the issuance amount of different securities in the previous quarter scaled by total assets, controlling for firm fixed effects, Tobin's Q and cash flow (the latter two items both lagged for one quarter), as in Duchin, Ozbas and Sensoy (2010). Several measures of corporate investment are used: capital expenditure, acquisition expenditure, research and development expense, and net working capital. As in Duchin, Ozbas and Sensoy (2010), Tobin's Q is computed as the market value of total assets divided by the sum of 90 percent of the book value of total assets and 10 percent of the market value of total assets. Cash flow is the ratio of operating income before depreciation to the book value of total assets. The t-statistic is corrected by double clustering at the firm and quarter levels, as suggested by Petersen (2009).

$$Investment_{i,q} = \alpha_i + \beta_0 + \beta_1 IssueAmount_{i,q-1} + \beta_2 Tobin'sQ_{i,q-1} + \beta_3 CashFlow_{i,q-1} + \varepsilon_{i,t}. \quad (3)$$

In all regressions, continuous variables (except for the quantitative measure of LSAPs) are winsorized at both the 1st and 99th percentiles to mitigate the effect of outliers.

3.3 Descriptive statistics

Figure 1 plots bank credit, GDP and the pace of purchases under LSAPs. Panel A indicates that the purchases concentrated on agency MBS under LSAP1 and on Treasury securities

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focuses on the ratings of public bonds issued by firms and thus first requires that a firm have access to the public bond market, the definition here focuses on the overall creditworthiness of the firm. Therefore, in this paper, a firm can have an investment-grade rating even if it only has access to the syndicated loan market after 1995(Sufi, 2009).

[7] Term spread data are downloaded from the webpage of the Economic Research Division, Federal Reserve Bank of St. Louis at http://research.stlouisfed.org/pdl/183.

under LSAP2, whereas MEP did not affect securities holdings to a significant degree. Panels B and C indicate that bank credit, particularly bank loans and leases, continued to decrease until the third quarter of 2011[8]. Notably, real GDP began to grow in the third quarter of 2009, soon after the implementation of LSAPs but long before the recovery of bank lending. This indicates that LSAPs stimulated the economy through mechanisms other than the restoration of bank lending.

Table 1 provides summary statistics for security issues and firm characteristics by security type. Panel A indicates that between January 2003 and August 2012, 1,835 firm-months issued SEOs, 7,174 firm-months borrowed syndicated loans, and 3,974 firm-months issued public bonds. These data are comparable to the sample in Erel et al. (2012). Specifically, before the subprime crisis of 2007, the number of SEO issues was steady, the number of syndicated loan issues decreased slightly, and there was a relatively large decline in the number of public bond issues. When the subprime crisis began in 2007, both SEO and syndicated loan issues declined slightly whereas public bond issues increased. When the subprime crisis expanded to the real economy in 2008, the frequency of all security issues declined significantly. However, after LSAPs commenced in 2009, the number of SEO issues nearly quadrupled relative to the prior year and the number of public bond issues increased by two-thirds over the prior year; however, the number of syndicated loan issues decreased by approximately one-third. After 2009, the number of SEO issues decreased slightly but remained significantly higher than the pre-crisis level. The number of syndicated loan issues slowly recovered, and the number of public bond issues remained relatively stable. In terms of the median issue amount, the size of SEO issues increased significantly in both 2007 and 2008 and then declined significantly after 2008. The size of syndicated loan issues increased annually until 2007, decreased significantly in both 2008 and 2009, and recovered thereafter. Public bond issues continued to increase until 2008 and then fluctuated thereafter. Thus, syndicated loans accounted for the largest share of capital raised during the sample period. Public bonds represented approximately one-half of the amount of capital raised by syndicated loans, and SEOs accounted for the smallest amount of capital raised during the

[8] Benmelech and Bergman (2012) propose a general equilibrium model with endogenous collateral values and use the "credit trap" equilibrium to explain this continued decline.

sample period. Nonetheless, we will demonstrate that SEOs are the most important source of financing for lower-quality firms.

Firm characteristics by security issue type are reported in Panel B and are consistent with the prior literature. Compared with non-issuers, security issuers tend to be older, larger, and more likely to have an S&P creditor rating; they also tend to have higher leverage, more tangible assets, and fewer growth opportunities. SEO issuers tend to be the youngest and smallest firms among the issuers and to have the highest growth opportunities in terms of the M/B ratio, R&D investment and the sales growth rate; however, SEO issuers are less likely to have an S&P creditor rating. Conversely, public bond issuers tend to be the oldest and largest issuers and are most likely to have an investment-grade rating, but they have fewer growth opportunities. Syndicated loan borrowers tend to lie between SEO issuers and public bond issuers.

4. Empirical results

4.1 LSAPs and corporate financing

Table 2 reports the estimation results of equations (1) and (2) for the entire sample. Panel A reports the results of the estimate that includes LSAP dummies, and Panel B reports the results of the estimate that includes the quantitative measure of LSAPs. These data show that the probability of external financing decreased significantly during the pre-LSAP crisis period, decreased slightly more during LSAP1, recovered during LSAP2, and then decreased slightly during MEP. The recovery of external financing during LSAP2 and MEP indicates that LSAPs are effective in increasing corporate external financing. The continued decline in external financing during LSAP1 was primarily caused by the decline in demand manifested by the negative GDP growth rate during the fourth quarter of 2008 and the first quarter of 2009 (as shown in Figure 1). Thus, the first prediction is substantiated.

In terms of external financing choices, the multinomial logit estimate reveals a dramatic change in the corporate financing pattern after the implementation of LSAPs. During the pre-LSAP crisis period, the coefficients for SEOs, syndicated loans and public bond issues are all significantly negative. However, after the implementation of LSAPs, the coefficients of the LSAP dummies for SEO issues are all significantly positive, which implies that firms issued more SEOs after the implementation of LSAPs than they did during normal periods. In

addition, Panel B shows that the probability of SEO issues increased with the monthly purchase amount of LSAPs. The probability of syndicated loan issues decreased further during LSAP1, greatly increased during LSAP2, but decreased again during MEP. Finally, the probability of bond issuance increased gradually, and was not significantly different from the pre-crisis level during MEP. Therefore, LSAPs increased the probability of SEO and public bond issuance but failed to increase bank loan issuance, which is consistent with the predictions in Section 2.

The results for the control variables are essentially consistent with the prior literature. Older firms issue less equity and more syndicated loans. Larger firms issue less equity and more debt. Firms with higher leverage borrow less through syndicated loans but issue more public securities. Firms with higher M/B ratios tend to seek external financing. Firms with larger tangible assets tend to issue more public securities. Firms with larger cash holdings issue fewer syndicated loans but more public bonds. Firms with higher Z-scores tend to borrow more syndicated loans and issue fewer public securities. Firms with higher R&D investment issue more public securities, whereas firms with no R&D investment borrow more syndicated loans. Firms with S&P domestic long-term issuer credit ratings tend to issue more bonds. Firms with higher sales growth rates issue more equity. A higher stock return in the past three months is associated with an increased level of public security issuance. A higher term premium is associated with the increased use of debt. The coefficients of the control variables are similar and thus are omitted from Panel B and from the same estimates afterwards.

It may be argued that because both LSAPs and corporate financing are correlated with aggregate demand, the regressions may suffer from omitted variable bias. The regressions already control for firm characteristics that are correlated with aggregate demand, such as the M/B ratio and sales growth rate. However, to alleviate the omitted variable concern, we explicitly include the measure of aggregate demand and find that the results become stronger. Specifically, we measure aggregate demand using two widely followed consumer confidence indices, the Consumer Confidence Index (CCI) issued monthly by the Confidence Board and the University of Michigan Consumer Sentiment Index (CSI). The results are reported in Table 3. After controlling for CCI or CSI, the probability of external financing is higher

during all three phases of the LSAP program than it is during the pre-LSAP crisis period. Moreover, the probability of external financing is no longer lower than the pre-crisis level during LSAP2 and MEP. With respect to corporate financing choices, the coefficients for SEO issues are larger but the probability of public bond issues does not differ significantly from the pre-crisis level. Therefore, the results are not driven by aggregate demand.

In addition, the results are robust to several alternative specifications. First, the results are not affected by the use of the Fama-French 48 industry classifications in place of the first two digits of firms' SIC codes. Second, the results remain unchanged after the exclusion of firms that did not issue any type of security during the sample period. In addition, the results do not change after the exclusion of firms with inflation-adjusted total assets valued at less than $50 million, which demonstrates that the results are not driven by small firms.

Because the impact of macroeconomic conditions on corporate financing depends on corporate credit quality (Erel et al., 2012), we next classify the sample into investment- and noninvestment-grade firms based on whether a firm has been rated as investment-grade for at least one month during the sample period[9], and estimate separate regressions for the two groups. The results are presented in Table 4. Panels A and B report the results for investment-grade firms and indicate that the probability of investment-grade firms obtaining external financing decreased during the pre-LSAP crisis period, primarily as a result of the decline in syndicated loan issues. The probability of investment-grade firms obtaining external financing decreased further during LSAP1, which provides additional confirmation that the demand effect of the crisis dominated during this period, but recovered to the pre-crisis level during LSAP2 and MEP. Regarding the type of security issued, the issuance of public equity did not change significantly after the crisis, which is consistent with the finding of Erel et al. (2012) that public equity issuance by investment-grade firms is not affected by economic downturns. However, syndicated loan issues by investment-grade firms decreased significantly after the crisis, which is inconsistent with the finding of Erel et al. (2012) that loan issuance increases during economic downturns and manifests the severe impact of the financial crisis on banks. Public bond issues by investment-grade firms did not

[9] The results remain unchanged if we classify firms based on firm creditor rating for the most recent fiscal quarter-end. However, because this criterion may place a given firm into different groups over time, we do not report those results here.

change during the pre-LSAP crisis period but increased significantly after LSAPs commenced. Overall, LSAPs increased the issuance of public bonds by investment-grade firms, which is consistent with the predictions in Section 2.

The results presented in panels C and D demonstrate that the increase in public equity issues following LSAPs is exclusively observed among noninvestment-grade firms. During the pre-LSAP crisis period, noninvestment-grade firms significantly decreased the issuance of each type of security. After LSAPs were implemented, the coefficient of LSAP dummies becomes significantly positive for SEO issues and the probability of noninvestment-grade firms issuing SEOs increased with the monthly purchase volume of LSAPs. The probability of noninvestment-grade firms borrowing syndicated loans remained significantly lower than the pre-crisis level, whereas the probability of noninvestment-grade firms issuing public bonds became less negative but remained lower than the pre-crisis level.

Taken together, these results demonstrate that firms issued more public equity to raise external funds after the implementation of LSAPs. In terms of firm credit quality, investment-grade firms use more public bonds for financing, whereas noninvestment-grade firms use more public equity.

We also examine whether there is any change in the amount that can be raised by firms seeking external finance. Table 5 reports the estimation results when the monthly issuance amount scaled by total assets is used as the dependent variable. During the pre-LSAP crisis period, there was a marginal decrease in the issuance amount of SEOs. After LSAPs were implemented, the issuance amount of SEOs was significantly lower, whereas the issuance amounts of syndicated loans and public bonds increased over time.

However, the decrease in the SEO issuance amount does not mean that the issuance of SEOs is trivial. After collapsing firm-month observations into firm observations, we find that since 2009, 11.5 percent of the 5,073 unique firms in the sample have issued SEOs at least once, whereas the corresponding figures are 8.6 percent during the pre-crisis period and 2.6 percent during the pre-LSAP crisis period. SEO issuers are overwhelmingly noninvestment-grade firms, and the majority of them (7.7 percent) rely exclusively on SEOs for financing.

To explain why investment-grade firms can issue more public bonds during recessions, Erel et al. (2012) suggest the credit crunch as discussed by Holmstrom and Tirole (1997) and the flight to quality as modeled by Caballero and Krishnaurthy (2008) and Vayanos (2004). LSAPs also decreased corporate bond yields, which may be another reason that higher-quality firms issued more bonds. In contrast, the increased public equity issuance following LSAPs is novel and contradicts the finding of Erel et al. (2012) that recessions reduce the probability of SEO issuance. Therefore, in the next part, we will explore how LSAPs increased public equity issuance.

4.2 How LSAPs increased public equity issuance

Before discussing how LSAPs allowed firms to issue more public equity, we first must demonstrate that LSAPs affected the stock market. Discussing the issue in terms of traditional monetary policy tools, Bernanke and Kuttner (2005) find that the stock market reacts strongly to surprise federal funds rate changes. For an unexpected 25-basis-point cut in federal funds rate, the stock market index will increase by approximately 1 percent. Because LSAPs also reduced longer-term interest rates, it is reasonable to expect that the stock market responded to LSAPs.

We begin with a univariate analysis. Figure 2 plots the monthly levels and trading volumes of the four main US stock market indices, namely, the S&P 500 index, the Dow Jones Industrial Average, the NASDAQ composite index, and Russell 2000. All four indices reached their lowest levels in January 2009, one month after the implementation of LSAPs, and rebounded strongly thereafter. Moreover, although the trading volumes of these indices increased substantially during the financial crisis due to increased uncertainty, trading volumes declined continuously after 2009, which suggests that the market is unanimously bullish. All of this evidence suggests a strong relationship between LSAPs and the stock market.

Next, in a similar spirit of establishing the causal effects of LSAPs on term structure as in Gagnon et al. (2011), we employ the event-study method to show that LSAPs affected the stock market. Specifically, we show that the stock market reacted to major LSAP

announcements. We use five event dates for LSAP1[10], as in Krishnamurthy and Vissing-Jorgensen (2011) and Gilchrist and Zakrajsek (2013) (November 25, 2008; December 1, 2008; December 16, 2008; January 28, 2009; and March 18, 2009); three event dates for LSAP2 (August 10, 2010; September 21, 2010; and November 3, 2010); and one event date for MEP (September 21, 2011). Because the stock market differs from the debt market in terms of its forward-looking ability, the stock market tends to anticipate and react before announcements. Thus, we enlarge the event window from two days (as used in Krishnamurthy and Vissing-Jorgensen (2011)) to seven days, encompassing three days before to three days after the event dates. As a result, the post-event window for the November 25, 2008 event date overlaps the pre-event window for the December 1, 2008 event date. Therefore, we calculate the average market stock return for each day in the event window both with and without the event date of December 1, 2008. Furthermore, to examine whether firms with different credit qualities respond differently to LSAPs, we perform the analysis separately for investment- and noninvestment-grade firms. The results are plotted in Figure 3[11].

Figure 3 indicates that the stock market began to react strongly two days prior to the announcements, which suggests that the stock market can to some extent anticipate LSAP information. The average stock market return reached its highest level (1.5 percent) on the day immediately preceding the announcements. If the December 1, 2008 event date is included, the market return is not significantly different from zero on day 0, whereas the return is approximately 1 percent if this event date is excluded. This difference may be due to the large reversal (approximately 8.5 percent) following the much larger increase (over 18 percent) around the initial announcement on November 25, 2008. The return on the equal-weighted CRSP index is slightly higher than that on the value-weighted index, which suggests that small firms tend to react more positively. Regarding the subsamples, the stock reaction of investment-grade firms around the announcements is slightly larger than that of

[10] Gagnon et al. (2011) identify eight event dates for LSAP1but three events are dropped in Krishnamurthy and Vissing-Jorgensen (2011) due to the small yield changes. The stock return patterns remain consistent if the three omitted events are included, although the return on day -1 decreases from 1.5 percent to 1 percent, because two of the three omitted events announced a gradual slowing in security purchases.

[11] Figure 3 does not exclude financial firms. The stock return patterns remain unchanged if financial firms are excluded, except that the highest stock return on day -1 is approximately 1.2 percent.

noninvestment-grade firms, but there is also a larger reversal for investment-grade firms after the announcement. Thus, the total return of investment-grade firms is slightly less than that of noninvestment-grade firms. In addition to the evidence on daily stock returns, Rosa (2012) uses intraday data and finds that the surprise component of LSAPs has a significant effect on the S&P 500 index. Overall, LSAPs significantly affected the stock market.

Bernanke and Kuttner (2005) suggest that monetary policy can affect stock prices through its effects on expected future dividends, real interest rates and expected future excess returns, and find that the impact of federal funds rate surprises concentrates on expected future excess returns and expected future dividends. Similarly, LSAPs may affect the stock market through the same two mechanisms. The first is the required return channel. As the Federal Reserve purchases substantial amounts of longer-term securities from the private sector under the LSAP program, the aggregate risk in the private sector decreases. As investors regain confidence in the market, their risk aversion declines due to less aggregate risk, and they require a lower risk premium, which decreases the required return on stocks. The second mechanism is the cash flow channel. Because LSAPs reduce the corporate cost of borrowing, and enhance aggregate demand, firms' future cash flows increase. In this case, stock prices increase even if the required return remains fixed. Because both channels imply a positive relationship between stock market return and the amount of securities purchased under LSAPs, we next conduct a time-series analysis to test them. Here we assume that both channels are important, and we do not attempt to differentiate between them, given that Bernanke and Kuttner (2005) find that their relative importance varies by the sample period.

The results in Panel A[12] of Table 6 confirm the positive relationship between LSAP purchase volume and stock market return. The lagged LSAP monthly purchase volume is positively correlated with the real stock market return, which is computed as the difference between the monthly returns on three indices (the value- and equal-weighted CRSP indices and the S&P 500 index) minus the inflation rate calculated based on the CPI. The effect of LSAP purchase volume on the real stock market return is also economically significant. The standard deviation of LSAPs purchase volume is 0.57; thus, a standard-deviation increase in

[12] The results are robust to the inclusion of relevant monthly factors such as the dividend-price ratio, term spread, default premium, relative bill rate, and dividend-earnings ratio used in Hsu (2009). We do not include these factors due to the short sample period of the regressions.

LSAP purchase volume will increase the stock market indices by between 1.3 and 2.6 percent, which is higher than the average monthly return of the indices.

An alternative explanation is that LSAPs merely improve investor sentiment without affecting the required rate of return or corporate cash flow. Therefore, we examine the relationship between stock market return and monthly investor sentiment as used in Baker and Wurgler (2007) and report the estimation results in Panel B of Table 6[13]. Because the monthly investor sentiment has no significant relationship with the real stock return, the investor sentiment explanation is ruled out.

Next, to demonstrate that increases in stock returns led to the issuance of new shares, we compare the pre- and post-issue stock returns of SEO issuers with a control group matched on industry, size, and M/B ratio. If the pre-issue stock return of issuers is lower than that of the matching firms, it is possible that issuers were forced to issue equity to survive. However, if the pre-issue stock return of issuers is significantly higher than that of matching firms but the post-issue return is not, it is very likely that SEO issuers exploited the increase in their stock prices to issue new shares.

To compare stock returns, we first find a matching firm for each SEO issuer. There are 952 firm-month observations that have issued SEOs since January 2009, among which 51 observations are missing annual stock return data either before or after the issuance. For each of the remaining 901 observations, we retain firms with the same first two-digit SIC code and the same fiscal quarter-end and then rank the firms based on firm size and the M/B ratio. Next, we choose the firm with the smallest ranking sum. Because we focus on annual stock return both before and after the issuance, we ensure that the matching firms have at least one monthly return both before and after the issuance. Otherwise, the firm with the second smallest ranking sum will be used. Following this procedure, we are able to match 899 firm-month observations with control firms. Table 7 compares the observations with the matching firms.

Panel A compares pre-issue firm characteristics using the most recent quarterly financial statement data. Because quarterly data are less stable due to the seasonality of certain

[13] Because the investor sentiment index is only available for periods before 2011, the regression is primarily descriptive.

industries, SEO issuers differ somewhat from the control group. Although firm size is similar, SEO issuers tend to have more growth opportunities based on their higher M/B ratio, R&D/Sales ratio and sales growth rate, all of which may contribute to increased public equity issuance. However, SEO issuers also have more tangible assets and are more likely to have a firm rating, both of which may contribute to greater debt issuance. Overall, the effect of the differences in firm characteristics on the probability of SEO issuance is undetermined. Nevertheless, Panel B reveals a significant difference between the stock return pattern of SEO issuers and that of the matching firms. During the year before the SEO issuance, the average stock return of SEO issuers was 18 percent higher than that of the control group, and most of this difference (approximately 13.4 percent) occurred during the last four months before the issuance. In contrast, the average stock return of SEO issuers was not significantly different from that of the control group after issuance. Although the stock return of SEO issuers increased during the two months after the issuance, this increase is likely a reversal of the decline that occurred in the issuance month. Therefore, there is little evidence that firms were forced to issue SEOs as a means of survival. Instead, it seems very likely that SEO issuers timed the stock issuance to exploit a spike in their stock price.

In sum, by purchasing large-scale longer-term securities from the private sector, LSAPs decreased the required rate of return on stocks by reducing investors' risk aversion and increased corporate future cash flows by lowering the cost of capital, which greatly increased firms' stock prices and made it advantageous for firms to issue stocks.

4.3 Firms' use of the capital raised

After demonstrating that LSAPs increased corporate financing, we next examine how firms use the funds raised, which is a crucial component of the analysis of whether LSAPs ultimately stimulate the real economy. We regress different measures of corporate investment on the issuance amount of SEOs, syndicated loans, and public bonds during the previous quarter scaled by issuers' total assets. The results are reported in Table 8.

Panel A shows that SEO issuers, which are dominated by noninvestment-grade firms, used the proceeds to increase net working capital. Because the loan spread increased but loan size decreased during the crisis (Santos, 2011), it became more difficult and expensive for lower-quality firms to meet operating liquidity requirements by borrowing syndicated loans.

As previously discussed, the surge in stock prices made public equity a less expensive source of financing for SEO issuers; thus, they opted to issue SEOs to maintain normal operations. To demonstrate that the equity issuance is crucial to issuers' survival, Panel B further decomposes net working capital into its main items. It shows that SEO issuers used the proceeds to repay short-term debt and increase cash holdings, which can greatly reduce the likelihood of bankruptcy.

Panel C shows that although it was difficult to secure syndicated loans during the crisis, once syndicated loans had been borrowed, firms that did issue syndicated loans used the proceeds to make acquisitions. Panel D shows that bond issuers, primarily investment-grade firms, did not shrink their businesses but instead exploited the crisis to increase capital expenditures and acquisition activities. Bond issuers' net working capital increased due to their increased acquisition activity, whereas R&D expenditures decreased, suggesting that firms may have innovated through acquisitions.

Overall, LSAPs enabled noninvestment-grade firms to issue more equity, and these firms used the proceeds to increase working capital and thereby to avoid bankruptcy. By contrast, LSAPs allowed investment-grade firms to issue more public bonds, and these firms used the proceeds to exploit the financial crisis by increasing investment and acquisition activity. Therefore, LSAPs can stimulate the real economy even though they do not restore bank lending. However, because equity issuers did not increase investment, and debt issuers primarily used the raised funds to acquire existing capital, LSAPs might not have created a substantial amount of new capital, which to some extent explains the slow recovery of the real economy after the introduction of LSAPs.

5. Conclusion

During the recent financial crisis, after the federal funds rate was reduced to effectively zero, the Federal Reserve conducted large-scale asset purchases to stimulate the economy. Although it has been found that LSAPs reduced longer-term interest rates, whether they improved corporate financial conditions is unexplored. The aim of this paper is to address this issue by examining how LSAPs affected corporate financing and investment.

To analyze how LSAPs affected corporate financing, we focus on corporate incremental financing choices because these choices indicate whether firms can raise capital when

necessary. We use a logit regression to study the probability of external financing and a multinomial logit regression to study firms' external financing choices among SEOs, syndicated loans and public bonds. We find that LSAPs increased the probability of external financing and dramatically altered the pattern of corporate financing choices. Firms issued significantly more public equity and relatively more public bonds but fewer loans. The effect of LSAPs on corporate financing choices also depends on corporate credit quality. LSAPs increased the probability that investment-grade firms would issue public bonds, which can be explained by the finding that LSAPs lowered corporate bond yields and by the credit crunch and the flight to quality. In contrast, LSAPs enabled noninvestment-grade firms to issue more public equity, which has not occurred in previous economic downturns.

To explain how LSAPs increased firms' public equity issuance, we first use event-study and time-series analyses to demonstrate that LSAPs affected the stock market. Next, we investigate whether firms issued public equity to time the stock market and find that issuers enjoyed significantly higher stock returns before the issuance but not after the issuance, which suggests a high probability that public equity was issued to time the market.

To determine whether LSAPs stimulate the real economy, an analysis of firms' use of the capital raised is also critical. Thus, we compare corporate investment by security issuers with corporate investment by other firms. We find that public equity issuers used the proceeds to increase net working capital, specifically to repay short-term debt and increase cash holdings, loan issuers used the borrowings to increase acquisitions, and bond issuers used the capital raised to increase both capital expenditures and acquisitions.

To summarize, by spurring the stock and bond markets, LSAPs enabled lower-quality firms to issue more public equity to avoid bankruptcy, and allowed investment-grade firms to issue more public bonds to exploit the crisis by expanding their businesses. For these reasons, LSAPs can stimulate the real economy although they do not restore bank lending.

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Table 1

Summary statistics

This table reports summary statistics for security issues by year and firm characteristics by security issue types. The sample period for security issues is from January 2003 to August 2012. Firm characteristic data are from firms' latest quarterly financial statements. Firm age is the number of years since a firm first appeared in Compustat. Firm size is the natural logarithm of total assets. Market leverage is long-term debt plus debt in current liabilities scaled by the market value of total assets. M/B ratio is the ratio of market value to book value of total assets. Tangibility is the ratio of net property, plant and equipment to total assets. Cash flow is income before extraordinary items plus depreciation and amortization scaled by total assets. Cash is cash plus short-term investments scaled by total assets. R&D/Sales is R&D expenses scaled by sales. The R&D dummy denotes firms that do not report their R&D expenses. Firm rating and Investment-grade rating denote firms with S&P issuer ratings and firms with a rating of BBB- or above for at least one month during the sample period, respectively.

Panel A Security issues by year

	SEO issues			Syndicated loan issues			Public bond issues		
	No. of firms	Median size	Total amount	No. of firms	Median size	Total amount	No. of firms	Median size	Total amount
2003	167	82.8	20.79	1,051	125	338.21	585	200	208.36
2004	185	78.3	28.43	1,058	175	499.71	571	201.25	195.36
2005	148	79.5	22.05	955	233.5	558.47	362	250	159
2006	162	82.3	24.00	851	250	635.25	326	300	212.13
2007	142	103.5	25.77	801	300	684.94	407	350	265.61
2008	79	122.6	30.34	533	175	322.34	229	475	208.03
2009	311	50	36.64	383	155	236.70	384	400	283.29
2010	283	28.85	23.50	502	300	382.83	435	400	307.5
2011	204	54.3	23.13	758	500	702.24	373	450	315.59
2012	154	50.6	15.07	282	375	274.17	302	500	224.27
Total	1835	67.5	249.71	7174	250	4634.86	3974	300	2379.14

Panel B Firm characteristics by type of security issued

	Non-issuers	Issuers	SEO issuers	Loan borrowers	Bond issuers
Firm age	15.41	19.87	10.89	20.67	22.64
Firm size	4.90	6.98	5.22	6.96	7.82
Market leverage	0.15	0.21	0.16	0.19	0.25
M/B ratio	3.27	2.02	3.49	1.77	1.77
Tangibility	0.23	0.31	0.30	0.31	0.33
Cash flow	-0.05	0.01	-0.06	0.02	0.02
Cash	0.22	0.13	0.29	0.10	0.13
Z-score	-4.74	-0.28	-4.39	0.43	0.25
R&D/Sale	0.52	0.37	1.94	0.06	0.20
R&D dummy	0.47	0.56	0.40	0.61	0.56
Firm rating	0.21	0.55	0.23	0.50	0.77
Investment-grade dummy	0.11	0.31	0.08	0.31	0.41
Sale growth rate	0.09	0.06	0.17	0.04	0.04
Past three-month stock return	0.04	0.08	0.19	0.05	0.07

Table 2

Corporate incremental financing choice

This table presents the estimation results for the logit and multinomial logit regressions for the entire sample from January 2003 to August 2012. Panel A presents the results of the estimation that includes LSAP dummies, and Panel B presents the results of the estimation that includes the quantitative measure of LSAPs. The dependent variable External equals 1 if a firm issues any type of security (SEO, syndicated loan or public bond) and equals 0 otherwise. The last three columns report the multinomial logit regression results. The dependent variable represents the three different types of security issues (SEO, syndicated loan and public bond). The base outcome is firms with no security issues. Robust t-statistics are corrected by double clustering at the firm and quarter levels for the logit regression and by clustering at the firm level for the multinomial logit regression. The symbols ***, ** and * denote statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Panel A LSAP dummies

	Logit	Multinomial logit		
VARIABLES	External	SEO	Loan	Bond
Crisis	-0.403***	-0.280***	-0.442***	-0.455***
	(-3.497)	(-2.581)	(-10.372)	(-6.423)
LSAP1	-0.417***	0.619***	-0.843***	-0.314***
	(-6.059)	(6.732)	(-18.343)	(-4.820)
LSAP2	-0.131	0.683***	-0.259***	-0.226***
	(-1.274)	(6.329)	(-5.502)	(-2.792)
MEP	-0.181**	0.619***	-0.468***	-0.086
	(-2.455)	(6.128)	(-9.956)	(-1.232)
Firm age	0.000	-0.037***	0.003**	0.000
	(0.008)	(-9.487)	(2.287)	(0.125)
Firm size	0.283***	-0.056**	0.287***	0.450***
	(19.980)	(-2.262)	(22.214)	(20.017)
Market leverage	0.618***	0.599***	-0.269**	2.212***
	(4.477)	(2.673)	(-2.053)	(11.860)
M/B ratio	0.074***	0.070***	0.044***	0.089***
	(9.316)	(8.312)	(3.802)	(8.274)
Tangibility	0.200*	0.947***	-0.063	0.415**
	(1.704)	(3.160)	(-0.500)	(2.211)
Cash flow	-0.178	0.117	0.192	0.636
	(-0.971)	(0.536)	(0.458)	(1.421)
Cash	-0.984***	0.242	-2.711***	0.479**
	(-7.321)	(1.337)	(-17.939)	(2.303)
Z-score	-0.009**	-0.007*	0.025**	-0.011**
	(-2.399)	(-1.951)	(2.138)	(-2.258)
R&D	0.052***	0.036***	-0.017	0.036***
	(9.185)	(4.398)	(-0.612)	(3.016)
R&D dummy	0.013	-0.337***	0.128***	-0.139**
	(0.306)	(-3.428)	(3.180)	(-2.122)
Firm rating	0.332***	0.079	0.071	0.927***

	(6.818)	(0.739)	(1.448)	(10.170)
Sales growth rate	0.090**	0.153***	-0.083	0.024
	(2.499)	(3.331)	(-1.469)	(0.435)
Past three-month stock return	0.544***	1.321***	0.074	0.575***
	(9.481)	(16.696)	(1.200)	(8.123)
Term spread	0.059**	-0.005	0.068***	0.068***
	(2.259)	(-0.154)	(5.852)	(3.155)
Constant	-5.551***	-5.507***	-5.440***	-8.928***
	(-20.738)	(-8.265)	(-19.276)	(-31.082)
Industry fixed effects	Yes		Yes	
N	322,143		322,363	
Pseudo R-squared	0.0733		0.1028	

Panel B Quantitative measure of LSAPs

	Logit	Multinomial logit		
VARIABLES	External	SEO	Loan	Bond
Crisis	-0.336***	-0.439***	-0.305***	-0.404***
	(-3.267)	(-4.138)	(-7.425)	(-6.221)
LSAPs	-0.002***	0.004***	-0.005***	-0.002***
	(-3.128)	(6.486)	(-10.576)	(-3.795)
Control variables	Yes		Yes	
Industry fixed effects	Yes		Yes	
N	322,143		322,363	
Pseudo R-squared	0.072		0.1	

Table 3

The effect of LSAPs on corporate financing after controlling for consumer confidence

This table presents the same regression results as Table 2 except that the consumer confidence index or the University of Michigan consumer sentiment index has been added. Robust t-statistics are corrected by double clustering at the firm and quarter levels for the logit regression and by clustering at the firm level for the multinomial logit regression. The symbols ***, ** and * denote statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Panel A Estimates using LSAP dummies after controlling for the consumer confidence index

	Logit	Multinomial logit		
VARIABLES	External	SEO	Loan	Bond
Crisis	-0.300***	-0.104	-0.362***	-0.301***
	(-2.754)	(-0.885)	(-6.970)	(-3.725)
LSAP1	-0.238**	0.955***	-0.708***	-0.046
	(-2.132)	(7.090)	(-10.636)	(-0.498)
LSAP2	-0.017	0.902***	-0.173***	-0.054
	(-0.147)	(7.026)	(-2.998)	(-0.600)
MEP	-0.023	0.906***	-0.348***	0.149*
	(-0.234)	(6.871)	(-5.353)	(1.700)
Consumer confidence index	0.005*	0.009***	0.004***	0.007***
	(1.946)	(3.365)	(2.696)	(3.842)
Control variables	Yes		Yes	
Industry fixed effects	Yes		Yes	
N	322,143		322,363	
Pseudo R-squared	0.0736		0.1031	

Panel B Estimates using the quantitative measure of LSAPs after controlling for the consumer confidence index

	Logit	Multinomial logit		
VARIABLES	External	SEO	Loan	Bond
Crisis	-0.251***	-0.508***	-0.170***	-0.336***
	(-3.105)	(-4.583)	(-4.027)	(-5.167)
LSAPs	-0.001	0.003***	-0.003***	-0.001*
	(-1.159)	(4.453)	(-5.623)	(-1.907)
Consumer confidence index	0.007***	-0.005***	0.012***	0.006***
	(3.824)	(-2.643)	(13.192)	(4.356)
Control variables	Yes		Yes	
Industry fixed effects	Yes		Yes	
N	322,143		322,363	
Pseudo R-squared	0.0732		0.1018	

Panel C Estimates using LSAP dummies after controlling for the consumer sentiment index

	Logit	Multinomial logit		
VARIABLES	External	SEO	Loan	Bond
Crisis	-0.299**	0.003	-0.442***	-0.173*
	(-2.225)	(0.021)	(-7.392)	(-1.956)
LSAP1	-0.289**	0.988***	-0.844***	0.038
	(-2.364)	(7.182)	(-12.928)	(0.423)
LSAP2	-0.020	1.003***	-0.259***	0.080
	(-0.142)	(6.899)	(-4.069)	(0.822)
MEP	-0.069	0.932***	-0.469***	0.220**
	(-0.629)	(6.954)	(-7.557)	(2.551)
Consumer sentiment index	0.006	0.016***	-0.000	0.016***
	(1.323)	(3.689)	(-0.020)	(5.231)
Control variables	Yes		Yes	
Industry fixed effects	Yes		Yes	
N	322,143		322,363	
Pseudo R-squared	0.0735		0.1032	

Panel D Estimates using the quantitative measure of LSAPs after controlling for the consumer sentiment index

	Logit	Multinomial logit		
VARIABLES	External	SEO	Loan	Bond
Crisis	-0.215**	-0.556***	-0.132***	-0.266***
	(-2.361)	(-4.814)	(-2.982)	(-3.952)
LSAPs	-0.001	0.003***	-0.003***	-0.001
	(-1.403)	(4.399)	(-6.370)	(-1.423)
Consumer sentiment index	0.010***	-0.008***	0.014***	0.011***
	(3.228)	(-2.841)	(10.594)	(5.066)
Control variables	Yes		Yes	
Industry fixed effects	Yes		Yes	
N	322,143		322,363	
Pseudo R-squared	0.0729		0.1014	

Table 4

Corporate incremental financing choices by investment- and noninvestment-grade firms

This table reports the empirical results of the regressions in Table 2 separately for investment-grade firms and noninvestment-grade firms. Investment-grade firms are firms that have been rated as investment grade for at least one month during the sample period; the remaining firms are defined as noninvestment-grade. The control variables in Table 2 are also included in all regressions, except that firm rating is not included in the regressions for investment-grade firms and the industry fixed effects are not included in the multinomial logit regressions. Robust t-statistics are corrected by double clustering at the firm and quarter levels for the logit regression and by clustering at the firm level for the multinomial logit regression. The symbols ***, ** and * denote statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Panel A Estimates using LSAP dummies for investment-grade firms

	Logit	Multinomial logit		
VARIABLES	External	SEO	Loan	Bond
Crisis	-0.331**	-1.220*	-0.529***	-0.044
	(-2.520)	(-1.704)	(-6.965)	(-0.431)
LSAP1	-0.366***	-0.411	-1.040***	0.285***
	(-3.730)	(-1.177)	(-11.614)	(2.851)
LSAP2	0.001	-1.424*	-0.161**	0.260**
	(0.006)	(-1.911)	(-2.101)	(1.994)
MEP	-0.026	-1.835*	-0.363***	0.426***
	(-0.178)	(-1.768)	(-5.054)	(4.274)
Control variables	Yes		Yes	
Industry fixed effects	Yes		No	
N	44,743		44,743	
Pseudo R-squared	0.0259		0.0318	

Panel B Estimates using the quantitative measure of LSAPs for investment-grade firms

	Logit	Multinomial logit		
VARIABLES	External	SEO	Loan	Bond
Crisis	-0.297**	-0.980	-0.393***	-0.167*
	(-2.432)	(-1.388)	(-5.303)	(-1.921)
LSAPs	-0.002**	-0.0004	-0.006***	0.0005
	(-2.401)	(-0.127)	(-7.192)	(0.623)
Control variables	Yes		Yes	
Industry fixed effects	Yes		No	
N	44,743		44,743	
Pseudo R-squared	0.0247		0.0269	

Panel C Estimates using LSAP dummies for noninvestment-grade firms

	Logit	Multinomial logit		
VARIABLES	External	SEO	Loan	Bond
Crisis	-0.458***	-0.204*	-0.398***	-0.775***
	(-4.082)	(-1.844)	(-7.692)	(-8.057)
LSAP1	-0.448***	0.712***	-0.756***	-0.670***
	(-5.318)	(7.546)	(-14.095)	(-7.876)
LSAP2	-0.198*	0.808***	-0.322***	-0.479***
	(-1.891)	(7.346)	(-5.398)	(-4.550)
MEP	-0.276***	0.724***	-0.533***	-0.373***
	(-4.269)	(7.055)	(-8.615)	(-3.724)
Control variables	Yes		Yes	
Industry fixed effects	Yes		No	
N	277,400		277,620	
Pseudo R-squared	0.0646		0.0889	

Panel D Estimates using the quantitative measure of LSAPs for noninvestment-grade firms

	Logit	Multinomial logit		
VARIABLES	External	SEO	Loan	Bond
Crisis	-0.370***	-0.392***	-0.258***	-0.641***
	(-3.749)	(-3.623)	(-5.172)	(-6.936)
LSAPs	-0.002***	0.004***	-0.004***	-0.003***
	(-2.830)	(7.155)	(-7.760)	(-4.841)
Control variables	Yes		Yes	
Industry fixed effects	Yes		No	
N	277,400		277620	
Pseudo R-squared	0.0628		0.0852	

Table 5

Monthly issuance amount before and after the implementation of LSAPs

This table presents the OLS regression results when the monthly issuance amount of each security scaled by total assets is used as the dependent variable. Robust t-statistics double clustered at the firm and quarter levels are reported in parentheses. The symbols ***, ** and * denote statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Panel A LSAP dummies

VARIABLES	SEO issue	Loan issue	Bond issue	Total
Crisis	-0.063*	0.004	0.004	-0.011
	(-1.901)	(0.498)	(0.601)	(-1.551)
LSAP1	-0.177***	0.031	0.019**	-0.011
	(-5.676)	(1.560)	(2.271)	(-0.682)
LSAP2	-0.123***	0.091***	0.032***	0.046***
	(-2.639)	(8.311)	(3.428)	(2.849)
MEP	-0.140***	0.065***	0.014**	0.014*
	(-4.327)	(7.287)	(2.097)	(1.665)
Firm age	-0.001	-0.001***	-0.000	-0.001**
	(-0.969)	(-3.518)	(-0.353)	(-2.505)
Firm size	-0.084***	-0.068***	-0.074***	-0.070***
	(-6.760)	(-17.945)	(-20.305)	(-21.135)
Market leverage	-0.055	0.037	0.071***	0.096***
	(-0.975)	(1.011)	(2.864)	(4.186)
M/B ratio	0.079***	0.040***	0.050***	0.061***
	(10.406)	(6.263)	(10.601)	(12.281)
Tangibility	-0.044	-0.086***	-0.048**	-0.084***
	(-0.557)	(-3.032)	(-2.436)	(-3.984)
Cash flow	0.139	0.009	0.064	0.041
	(0.905)	(0.071)	(0.704)	(0.452)
Cash	0.202**	-0.262***	0.083***	0.045
	(2.568)	(-5.717)	(2.780)	(1.494)
Z-score	0.006**	0.002	-0.003	0.005***
	(2.420)	(0.697)	(-0.940)	(4.548)
R&D	0.001	-0.001	0.002	0.004*
	(0.461)	(-0.329)	(0.790)	(1.681)
R&D dummy	-0.002	0.028***	-0.003	0.023***
	(-0.093)	(3.117)	(-0.419)	(3.604)
Firm rating	0.049**	0.033***	-0.006	0.020**
	(2.462)	(2.839)	(-0.723)	(2.349)
Sales growth rate	0.028	-0.026**	-0.009	-0.001
	(1.030)	(-2.157)	(-0.845)	(-0.133)
Past three-month stock return	0.142***	0.011	0.009	0.042***
	(4.093)	(0.704)	(0.702)	(3.070)
Term spread	-0.008	-0.029***	-0.004	-0.020***
	(-0.812)	(-6.030)	(-1.226)	(-5.564)

Constant	0.595***	0.749***	0.613***	0.620***
	(4.694)	(14.406)	(18.088)	(18.244)
Industry fixed effects	Yes	Yes	Yes	Yes
N	1,548	5,697	3,422	10,262
R-squared	0.589	0.250	0.640	0.407

Panel B Quantitative measure of LSAPs

VARIABLES	SEO issue	Loan issue	Bond issue	Total
Crisis	-0.025	-0.009	-0.002	-0.016**
	(-0.833)	(-1.039)	(-0.365)	(-2.131)
LSAPs	-0.001*	0.0001	-0.00002	-0.0002
	(-1.706)	(0.638)	(-0.318)	(-1.196)
Control variables	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
N	1,548	5,697	3,422	10,262
R-squared	0.579	0.240	0.638	0.405

Table 6

Stock market return, LSAPs and investor sentiment

This table reports the results of regressing real stock market return on lagged real market return and lagged LSAP monthly purchase volume or contemporaneous investor sentiment. Real stock market return is the index return minus the inflation rate based on the CPI. Unlike the data in the other tables, the LSAP monthly purchase volume is divided by 100 in this table due to the small magnitude of the coefficients. The sample period is from January 2009 to August 2012 for stock market return. T-statistics based on the Newey-West (1987) standard errors are reported in parentheses. The symbols ***, ** and * denote statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Panel A Stock market return and the quantitative measure of LSAPs

	Real market return		
	Value-weighted CRSP	Equal-weighted CRSP	
VARIABLES	index	index	S&P 500 index
LSAPs	0.029**	0.046**	0.024**
	(2.211)	(2.340)	(2.093)
Lagged return/premium	-0.076	-0.055	-0.044
	(-0.686)	(-0.468)	(-0.387)
Constant	-0.001	-0.004	-0.002
	(-0.095)	(-0.348)	(-0.161)
N	44	44	44
Adjusted R-squared	0.040	0.123	0.021

Panel B Stock market return and investor sentiment

	Real market return		
	Value-weighted CRSP	Equal-weighted CRSP	
VARIABLES	index	index	S&P 500 index
Investor sentiment	-0.098	-0.169	-0.090
	(-1.279)	(-1.567)	(-1.224)
Lagged return/premium	-0.003	0.015	0.027
	(-0.016)	(0.132)	(0.155)
Constant	0.001	0.001	-0.002
	(0.052)	(0.043)	(-0.102)
N	24	24	24
Adjusted R-squared	0.046	0.107	0.041

Table 7

Comparison of SEO issuers and matching firms

This table compares the firm characteristics and stock returns of SEO issuers with those of a control group matched on industry, firm size and M/B ratio. The sample period is from January 2009 to August 2012. Panel A compares the pre-issue firm characteristics with the latest quarterly financial statement data. Panel B compares the monthly stock returns from four months before to two months after the issuance and the annual stock returns of one year before and one year after the issuance. The symbols ***, ** and * denote statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Panel A Firm characteristics

	SEO issuers	Matching firms
Firm age	11.26	14.66
Firm size	4.99	4.96
Market leverage	0.16	0.12
M/B ratio	3.33	2.74
Tangibility	0.29	0.25
Cash flow	-0.08	-0.03
Cash	0.31	0.34
Z-score	-5.68	-2.68
R&D	2.37	1.45
R&D dummy	0.35	0.40
Firm rating dummy	0.19	0.16
Sales growth rate	0.18	0.11

Panel B Return difference

Time	Return difference	T statistic
Month -4	0.027*	1.81
Month -3	0.026**	2.44
Month -2	0.041***	4.08
Month -1	0.040***	3.58
Month 0	-0.03***	(2.78)
Month 1	0.016**	2.23
Month 2	0.026***	2.96
Year -1	0.18***	4.97
Year 1	0.01	0.25

Table 8

Corporate investment after the implementation of LSAPs

This table reports the regression results of Equation (3) and its alternative specifications. The dependent variables are the different measures of quarterly investment. SEO/Bond/Loan issue amount is the amount of each security issued in the previous quarter scaled by total assets. All explanatory variables are lagged by one quarter. Firm fixed effects are included in the regressions. Robust t-statistics clustered at the firm level are reported in parentheses. The symbols ***, ** and * denote statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Panel A SEO issue amount and corporate investment

VARIABLES	Capital expenditure	Acquisition	R&D	NWC
SEO issue amount	0.738	0.584	-2.435	40.491***
	(1.391)	(0.979)	(-1.410)	(3.172)
Tobin's Q	0.149***	0.124***	0.402***	-13.323***
	(6.728)	(7.787)	(4.211)	(-6.447)
Cash flow	0.003**	0.003***	-0.058***	1.337***
	(2.447)	(5.632)	(-6.812)	(7.573)
Constant	0.873***	0.136***	2.578***	33.147***
	(21.766)	(4.723)	(13.043)	(8.566)
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	47,350	46,499	24,950	46,855
R-squared	0.620	0.159	0.838	0.845

Panel B SEO issue amount and working capital items

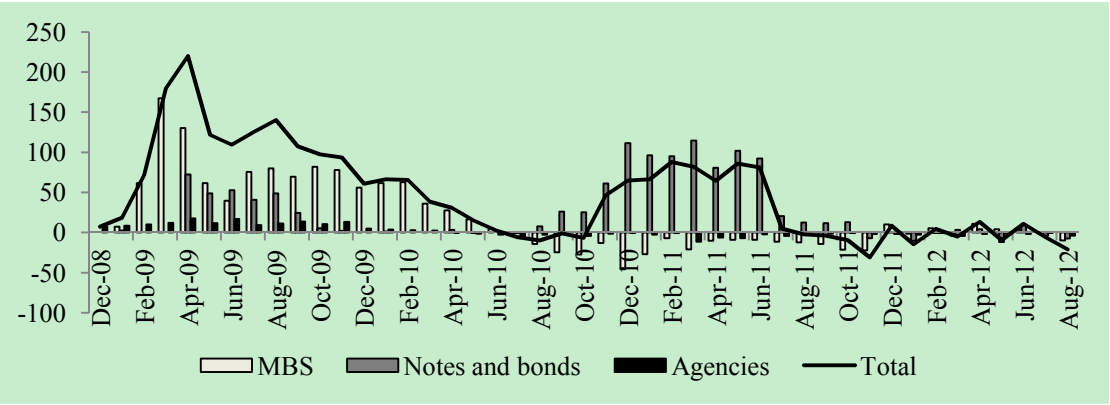
VARIABLES	Current assets	Current liabilities	Debt in current liabilities	Account payable	Account receivable	Inventory	Cash holdings
SEO issue amount	0.111***	-0.298**	-0.144***	-0.047	-0.070***	-3.599***	0.237***
	(3.412)	(-2.565)	(-2.893)	(-1.281)	(-4.725)	(-3.686)	(5.879)
Tobin's Q	0.025***	0.155***	0.052***	0.028***	0.008***	0.196**	0.012***
	(10.666)	(7.562)	(6.392)	(6.494)	(7.707)	(2.110)	(5.228)
Cash flow	0.000	-0.013***	-0.004***	-0.003***	0.000***	-0.017***	0.001***
	(1.141)	(-7.367)	(-5.253)	(-6.926)	(3.332)	(-3.241)	(3.936)
Constant	0.469***	0.141***	0.011	0.067***	0.123***	11.178***	0.191***
	(110.050)	(3.661)	(0.710)	(8.362)	(62.336)	(64.961)	(46.766)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	46,855	46,868	46,213	47,573	45,571	46,614	47,604
R-squared	0.923	0.849	0.788	0.858	0.884	0.942	0.882

Panel C Loan issue amount and corporate investment

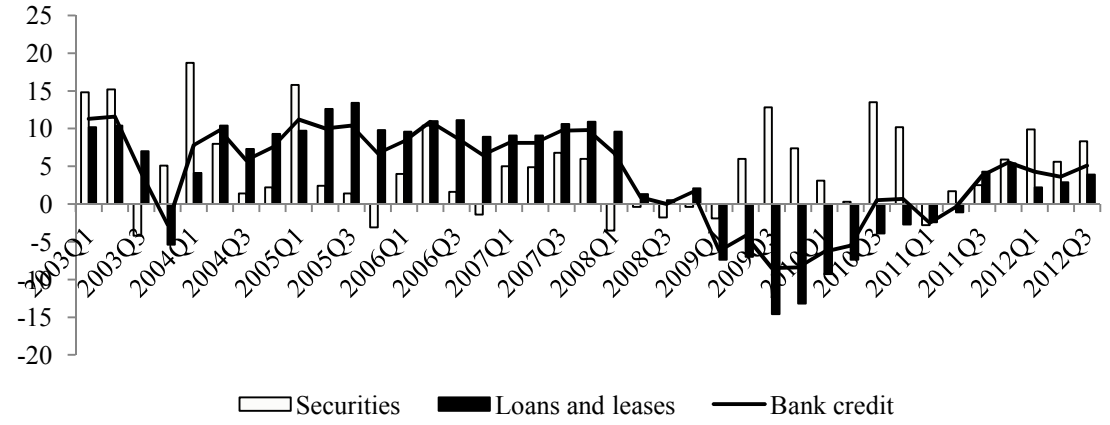
VARIABLES	Capital expenditure	Acquisition	R&D	NWC
Loan issue amount	0.185	0.893***	-0.118	-0.238
	(1.216)	(2.636)	(-1.239)	(-0.184)
Tobin's Q	0.149***	0.124***	0.401***	-13.307***
	(6.733)	(7.781)	(4.205)	(-6.440)
Cash flow	0.004**	0.003***	-0.058***	1.338***
	(2.468)	(5.670)	(-6.839)	(7.589)
Constant	0.873***	0.132***	2.573***	33.198***
	(21.751)	(4.549)	(13.028)	(8.576)
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	47,350	46,499	24,950	46,855
R-squared	0.620	0.159	0.838	0.845

Panel D Bond issue amount and corporate investment

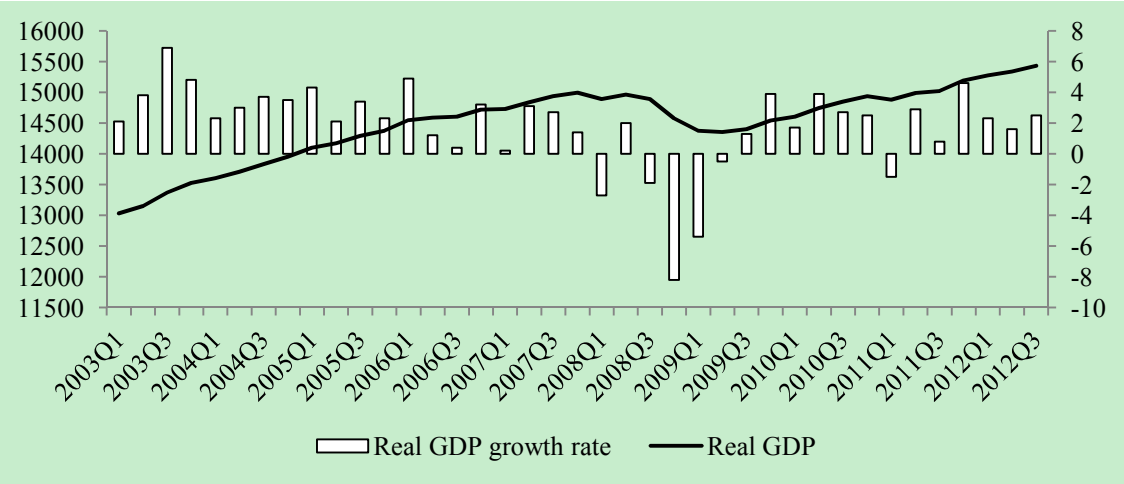
VARIABLES	Capital expenditure	Acquisition	R&D	NWC
Bond issue amount	0.770**	1.973**	-1.974***	7.021**
	(2.236)	(2.439)	(-3.602)	(2.068)
Tobin's Q	0.149***	0.124***	0.401***	-13.308***
	(6.735)	(7.807)	(4.204)	(-6.440)
Cash flow	0.004**	0.003***	-0.058***	1.338***
	(2.467)	(5.679)	(-6.840)	(7.588)
Constant	0.873***	0.133***	2.576***	33.183***
	(21.734)	(4.598)	(13.043)	(8.571)
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	47,350	46,499	24,950	46,855
R-squared	0.620	0.159	0.838	0.845



Panel A Monthly changes in SOMA holdings by asset class

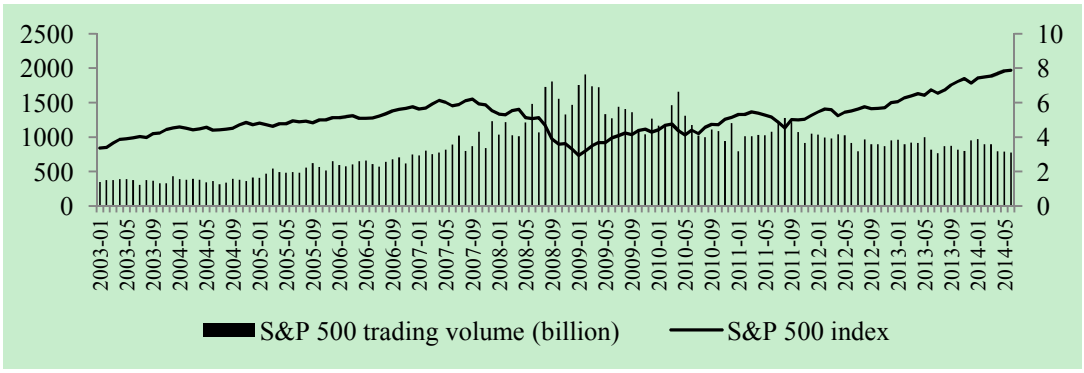


Panel B Annualized growth rate of the combined bank credit of all commercial banks

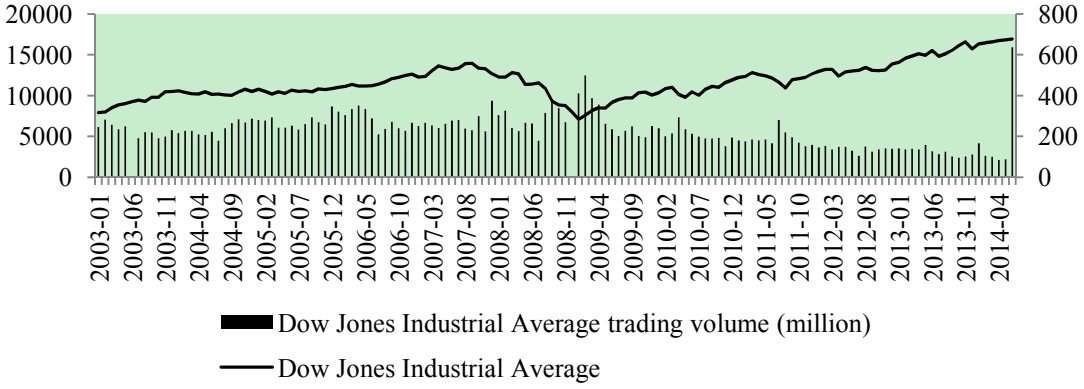


Panel C Real GDP level and annualized growth rate

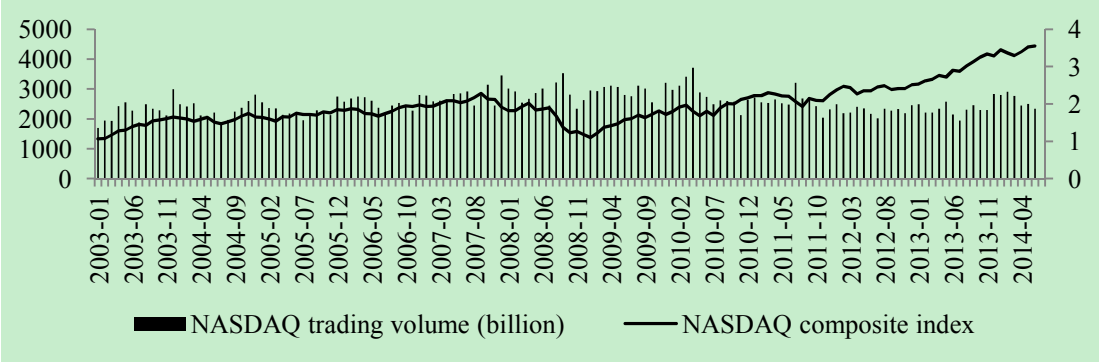
Figure 1. Pace of purchases under LSAPs, bank credit and real GDP. Panel A plots the monthly changes in System Open Market Account (SOMA) holdings in agency MBS, agency debt, and Treasury notes and bonds, all of which are driven by LSAPs. Panel B plots the seasonally adjusted annualized growth rate of the combined bank credit of all commercial banks and the two components of bank credit, securities and loans and leases. Panel C plots the real GDP level in billions of 2009 dollars and the annualized growth rate. The SOMA holdings data are from the Federal Reserve Bank of New York, the bank credit data are from the Federal Reserve's H8 report, and the GDP data are from the Bureau of Economic Analysis, US Department of Commerce.



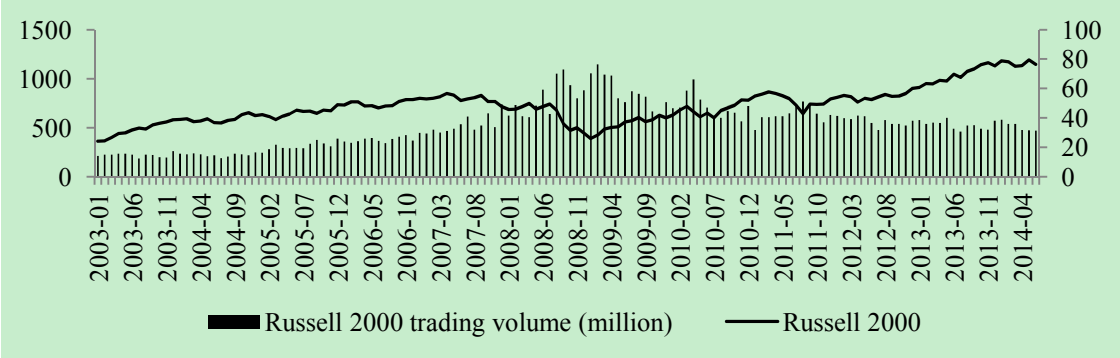
Panel A S&P 500 index



Panel B Dow Jones Industrial Average index

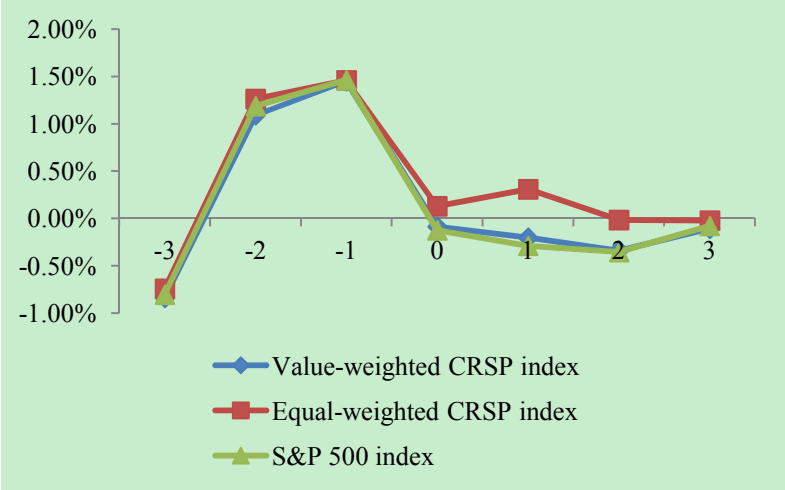


Panel C NASDAQ composite index

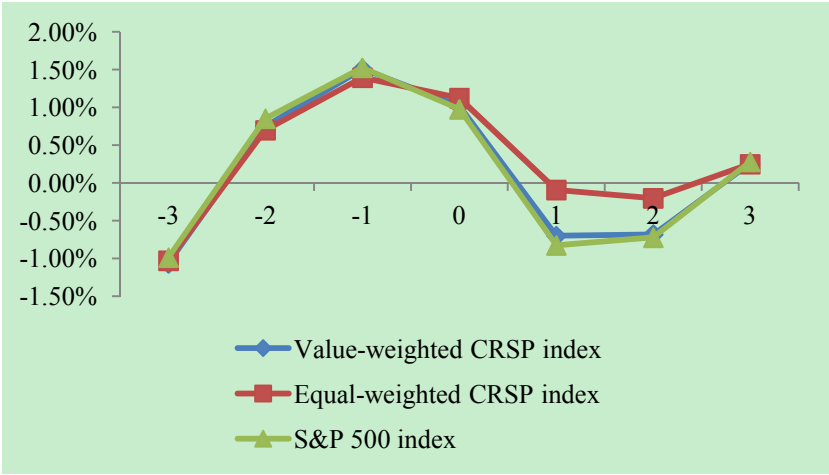


Panel D Russell 2000 index

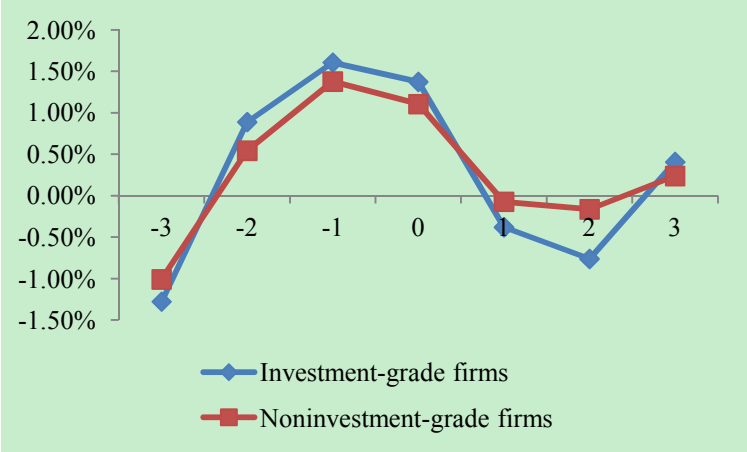
Figure 2. Main stock market indices. This figure plots the monthly levels and trading volumes of the four main US stock market indices from January 2003 to June 2014.



Panel A Including the event date of December 1, 2008



Panel B Excluding the event date of December 1, 2008



Panel C Subsample reactions

Figure 3. Daily stock returns around the event window of LSAPs. This figure plots the average stock return from three days before to three days after important LSAP announcements. The event dates include at least four announcements (November 25, 2008, December 16, 2008, January 28, 2009, and March 18, 2009) for LSAP1, three announcements (August 10, 2010, September 21, 2010, and November 3, 2010) for LSAP2, and one announcement (September 21, 2011) for MEP.