

Did ECB Liquidity Injections Help The Real Economy?*

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Abstract

In an effort to boost the Eurozone economy, the European Central Bank (ECB) launched a plethora of monetary interventions, of which the series of Longer-Term Refinancing Operations (LTROs) was among the most significant. The efficacy of these LTRO programs, such as their impact on the corporate policies of non-financial corporations, is an important but unanswered issue. Analyzing a large panel of individual corporations across countries, we find that non-financial corporations in the Eurozone issued more long-term debt and hoarded more cash following the ECB liquidity injections. However, this increase in corporate liquidity was not employed in a productive manner, as corporations did not subsequently increase their investments or employment. The decrease in investment, post-LTRO, is evident regardless of the corporations' banking connections, their industry structure, or taxation environment and is confirmed in counter-factual analysis. However, the LTRO effect on investment is most pronounced for corporations located in countries with less exports, lower corruption, and more modest government debt. Therefore, the LTROs affected corporations' financial policies (e.g., their cash holdings) but not their non-financial policies (e.g., their investment decisions) in the direction intended by the ECB. Overall, our findings suggest that the unconventional LTROs had an impact on the financial economy, but have not necessarily helped the real economy in the Eurozone.

Keywords: Unconventional monetary policies; liquidity injection; ECB; cash holdings; real economy.

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1 Introduction

Since the summer of 2009, the European Central Bank (ECB) has been engaged in a series of both conventional and, latterly, unconventional monetary policy actions such as injecting liquidity into the banking system via the Longer-Term Refinancing Operations (LTROs) of significant size and scope. However, the key question is whether these ECB liquidity injections helped the real economy, as intended. Despite the overwhelming press coverage on this topic, the existing literature has mainly focused on the impact of unconventional monetary policy by the ECB on the Eurozone banking sector and their financial ramifications. However, there is still a lack of evidence on the changes in corporate financial and operating policies in the Eurozone around the time of the ECB liquidity injections, which have implications for the transmission of the real effects of monetary policy. In this paper, we fill this gap in the literature by examining a series of important, exogenous policy shocks in the Eurozone. Specifically, we study unconventional liquidity interventions and their impact on corporate policies in a unified framework, including cash holdings, financing, investment and employment. Understanding the real effects of such liquidity injections is important as many central banks around the world are actively and regularly employing this approach in an effort to stimulate their economies.

The Eurozone, and Europe at large, has faced serious fiscal challenges in recent years, at least since Greece requested emergency funds from the European Union (EU), the International Monetary Fund (IMF) and the ECB in April 2010. These fiscal problems caused substantial stress in the financial markets and spread to other periphery countries in the Eurozone, e.g., Ireland, Italy, Portugal and Spain, and even threatened its very core. As a reaction to heightened sovereign bond yields and the looming European Sovereign Debt Crisis, the EU, the IMF, and the ECB engineered a series of interventions to improve market liquidity, real output and employment. However, the efficacy of these measures remains hotly debated.

A prominent example of these interventions is the liquidity injected by the ECB into the commercial banks of Eurozone countries via two unconventional programs: LTROs with a three-year maturity in December 2011 and February 2012, respectively. In addition, the ECB announced in June 2014 that it would conduct a series of targeted LTROs (TLTRO), through which the permitted additional borrowing amounts were also linked to the banks' lending to the non-financial

sector, such that the operations became even more directed towards their final goal, i.e., to overcome the financing difficulties at the corporate and household levels.¹ Another example of an ECB liquidity intervention in the Euro-area debt markets is the so-called Securities Markets Program (SMP), which was initiated in May 2010. The SMP focused on liquidity provision in the secondary sovereign bond markets in particular countries, and had an aim similar to that of the LTRO, i.e., to explicitly safeguard the monetary policy transmission to the corporate sector. More recently, in March 2015, the ECB received legal approval for implementing its Outright Monetary Transactions (OMT) program, after clearing a number of legislative and legal hurdles, following its announcement several months earlier.² However, no purchases were made under OMT, but rather under an asset purchase program (APP) under which Eurozone sovereign bonds, asset-backed securities, and caveat bonds were purchased by the ECB.

The extant discussion on the effect of market liquidity interventions, both in policy-making circles and in the academic literature, has focused mainly on the overall market reactions (e.g., bond yields or market liquidity) or how the interventions affected financial institutions. Correspondingly, the final goal of boosting *corporate* liquidity and the real economy has not been analyzed in any depth. As noted in the previous literature, macro-liquidity injections do not necessarily translate into corporate liquidity and investment.³ Further, unconventional liquidity interventions can affect the real economy not only through bank lending to corporations, but also through the corporations' own liquidity, financing and investment policies. Unconventional monetary policies may boost bank liquidity, making it less necessary for corporations to hold more precautionary cash. However, banks may use the lender-of-last-resort (LOLR) funding to take on more sovereign risk, rather than lend to corporations. Risk taking by banks through their lending may further increase corporate precautionary motives for cash holdings. As a result, corporations may save more cash from their operating cash flows, or even borrow more and save the proceeds as cash holdings. Firms may even decrease their risky investments and switch to *safer* cash-equivalent holdings, such as sovereign bonds. In addition, even while macro-liquidity injections can relax corporate financing constraints in a particular region, corporate investment may decrease due to a sharp decline in demand from

¹https://www.ecb.europa.eu/press/pr/date/2016/html/pr160310_1.en.html

²Figure 1 provides a detailed time-line for the recent unconventional monetary policies launched by the ECB.

³Theoretical discussions can be found in Christiano (1994). He shows that a liquidity injection cannot be effective in standard real business cycle models and has ambiguous effects in a sluggish capital model.

other regions. Consequently, and especially since the LTROs were implemented at a time of low demand, it is less likely that we would observe the positive effect of liquidity injections on the real economy.⁴

In this paper, we explicitly address this lacuna in the literature and investigate whether ECB liquidity injections helped the real economy. Specifically, we examine the impact of the macro-liquidity injections on corporate policies in the context of ECB's LTRO I and II, as exogenous liquidity shocks in Eurozone countries. ECB liquidity injections provide an ideal setting to conduct a cross-country study of corporations' response to macro-liquidity interventions, and comparisons of the real effects of various policies, in view of the heterogeneity of economic conditions across the Eurozone. We comprehensively examine corporate cash holdings, their debt financing, and investment and employment policies, which are all integrated components of corporate liquidity management policies.

We use a comprehensive data sample that combines monetary policy data from the ECB Statistical Warehouse, loan information on Euro-area lenders from SDC Dealscan, corporate fundamental data from Compustat and S&P Capital IQ, credit rating data on non-financial corporations from CreditPro[®] by S&P Capital IQ, credit default swap data from Markit, as well as relevant data from other sources.⁵ We find that corporations increase their cash holdings following the ECB liquidity injections, both at the time of their announcement and during the implementations of the programs. The increase in cash holdings is statistically significant for Eurozone corporations.⁶ Our evidence suggests that corporations seem to raise debt from Eurozone banks (and probably, also the public bond market) and hoard the resultant cash receipts. The cash holdings analysis in the sample of Eurozone corporations demonstrates the liquidity injection effects, since we use the actual LTRO uptake in each country. Our results show that the cash increase is related to the actual uptake of the banks under the LTRO program in the same country. However, we further find that such an increase in corporate liquidity was not necessarily employed in a productive manner.

⁴There is a substantial amount of disagreement among business economists on the real effects of those liquidity injections. For example, the Spanish bank BBVA expresses a more optimistic view and argues that ECB liquidity injections could boost Eurozone GDP by 0.3% to 0.5%.

⁵The advantage of using data from Compustat is that we have quarterly rather than annual data, that for instance is obtained when using data from Amadeus and highly used in related European corporate studies. However, for robustness tests, we supplement our quarterly panel data with annual data from Amadeus.

⁶For non-Eurozone corporations in other EU countries, we do not find such an effect, which is consistent with our prediction, since Eurozone countries were more directly affected by the ECB liquidity injections than non-Eurozone countries (see, for instance, Appendix Table B4).

Corporations subsequently decreased their investments, while there is no significant change in the corporate payments to employees.

Corporations' response to the liquidity injections may depend on the uncertainty they face regarding credit supply ("credit supply shock") and the demand for, and the cost of, their products and services (economic uncertainty). A negative credit supply shock or greater uncertainty about future credit supply may increase the corporate precautionary demand of cash holdings. Corporations with greater uncertainty in their future product demand may increase their cash holdings, decrease their investment, and even decrease employee payments by reducing either the number of employees or their wages. Hence, the impact of liquidity injections on the real economy really depends on the resolution of these economic uncertainties and the corporations' perceptions of the policy response. If the liquidity injections indeed helped resolve these uncertainties, we would expect to see that corporations would respond by decreasing their cash hoardings, increase their investment and their hiring of employees or wages (increase their wage payments).

Considering the recent crisis in Europe, the demand uncertainty is generally higher for Eurozone corporations with greater industry competition, when corporations rely more on domestic demand, and for corporations situated in the periphery countries, which face higher economic uncertainty, in general. We find that firms reduce investment regardless of their industry structure and taxation environment. However, the reduction in investment is more pronounced for firms in countries with less exports, lower corruption, and more modest government debt. Overall, our findings do not suggest that the ECB's unconventional monetary policies helped the real economy in the Eurozone through a change in investment or employment around the liquidity injections.

Understanding the determinants of corporate policies is important for evaluating the effectiveness of the ECB's unconventional monetary policies and, in particular, its liquidity interventions. So far, however, the literature on the drivers of corporate cash holdings in the U.S. has focused mostly on micro-variables such as corporate characteristics, while the macro-variables including government and regulatory interventions are seldom examined in any depth. We add new insight into corporations' adjustment of their cash holdings and employment compensation, their use of investment assets, and the issue of public debt in response to such macro-liquidity injections. We do so in terms of the announcement and the actual excess inflow of liquidity to their lenders, and the potential increase in (cheaper) external funding from the ECB. This paper also provides some

new evidence about bank lending frictions and their impact on corporate liquidity. Overall, our study sheds new light on the impact of unconventional liquidity interventions.

Most existing studies on unconventional monetary policies are based on the U.S. experience (e.g., Berger and Roman (2016)). Among the few European studies is Acharya, Eisert, Eufinger, and Hirsch (2015a). On the one hand, our findings are consistent with theirs as both studies find that European corporations hold more cash after an exogenous liquidity shock. On the other hand, we focus on *corporations'* decisions and financing methods. Their research finds that corporations mostly save cash out of their free cash flows, while, in contrast, for our sample corporations, the sources of increased cash holdings are mainly bank loans. We also argue that the impact of ECB liquidity injection is ineffective, due to heightened economic uncertainty and a strong precautionary motive for corporations to hold cash. Overall, the increase in cash holdings can arise for both negative and positive exogenous liquidity shocks.

The rest of the paper proceeds as follows. We discuss the background and related literature in the next section. Section 3 provides descriptive statistics of our data and specifies the empirical setting for our analysis. In section 4, we investigate the impact of macro-liquidity injections on major corporate policies. In section 5, we conduct additional analyses to understand the reactions of corporate policies especially investment to these liquidity injections. Section 6 concludes.

2 Institutional Background and Related Literature

Central banks play active and prominent roles in financial markets and their actions may profoundly affect corporate policies. Understanding the impact of monetary policy is a fundamentally important issue. While there is substantial research on conventional monetary policies of the U.S. Federal Reserve System (see, e.g., Bernanke (2013), Gorton and Metrick (2013), Reinhart and Rogoff (2013), and Romer and Romer (2013)), there is little research on non-U.S. policies as well as unconventional monetary policies, and their impact on the real economy. Studies on European policies are especially important as Europe has a very different governance structure, particularly with regard to economic affairs, and the U.S. analysis may not apply in a straightforward way.

Since the global financial crisis and the great recession that ensued, monetary interventions were first initiated by the U.S. government and the Federal Reserve system and, hence, several studies

in the literature examine U.S. data. The first set of studies focuses on banks' response to the government programs. For example, Duchin and Sosyura (2015) analyze the Troubled Asset Relief Program (TARP) and find that banks that applied for TARP assistance made riskier loans, but maintained the same regulatory capital ratios as before. In other words, banks took advantage of the cheap government funding and engaged in risk-shifting and regulatory arbitrage. However, Berger and Roman (2016) argue that TARP helped "main street" in terms of mortgage financing and avoiding default. Foley-Fisher, Ramcharan, and Yu (2014) examine the impact of the U.S. Federal Reserve Maturity Extension Program (MEP) on the corporate financing constraint. They show that corporations more reliant on long-term debt experienced more positive stock price increases upon the announcement of the MEP, which aimed to lower the cost of long-term debt. These corporations also increased their long-term debt and investments. Overall, the evidence suggests that the MEP helped corporations to relax their financing constraints. There is a burgeoning literature on the impact on households, e.g., Agarwal, Chomsisengphet, Mahoney, and Stroebel (2015), who provide evidence that government interventions aiming to lower banks' funding costs are ineffective in terms of stimulating household borrowing and spending.⁷ Chakraborty, Goldstein, and MacKinlay (2016) find that the MBS purchases by Federal Reserve may crowd out banks' commercial lending and decrease corporate investment. However, they do not find the same effects for Treasury purchases.

The introduction of unconventional monetary policies in Europe by ECB also led to similar studies based on European data. Eser and Schwaab (2016) study the ECB's Securities Markets Program (SMP) through which ECB purchase bonds in the market. They find that the SMP helped lower the yield spreads and yield volatilities of European sovereign bonds. Moreover, they point out that it is the *actual* purchases, and not the signaling of the policy, that drove the lower bond yields.⁸ De Pooter, Martin, and Pruitt (2015) find consistent results that the SMP helped lower the sovereign bond liquidity premium. De Andoain, Heider, Hoerova, and Manganeli (2016) find that ECB liquidity injections helped stabilize the overnight unsecured interbank market. Drechsler, Drechsel, Marques-Ibanez, and Schnabl (2014) find that banks with weaker capitalizations borrow from the ECB and post riskier collateral to access the ECB funding. Acharya, Pierret, and Steffen

⁷We focus here mainly on studies of the impact of unconventional monetary policies on corporations other than on households.

⁸These findings are in contrast to Acharya, Imbierowicz, Steffen, and Teichmann (2015), who do find some announcement effects.

(2016) find different effects of the LTRO and OMT on bank risk. While the LTRO increased banks' holding of risky sovereign debt, the OMT reduced sovereign risk and benefited banks debt holdings. Cycon and Koetter (2015) examine one German bank and find that it did not reduce loan rates to corporate borrowers even though its funding costs were lowered by the ECB asset purchase programs. However, De Pooter, Rebecca DeSimone, and Pruitt (2015) find SMP announcement effects, but no actual purchase effect on bond yield spreads. Pelizzon, Subrahmanyam, Tomio, and Uno (2015) investigate the dynamic relationship between sovereign credit risk and sovereign bond market liquidity. They find that the change in sovereign credit risk leads the change in market liquidity. However, ECB intervention weakened the adverse relationship and improved market liquidity. Trebesch and Zettelmeyer (2014) investigate the determinants and effects of ECB interventions on the Greek government bond market in mid-2010. They find a much steeper drop in bond yields for those bought by the ECB.

Most studies focus on the impact of unconventional monetary policies on banks rather than the actual users of capital, i.e., corporations, which are our focus in this study.⁹ In this regard, Acharya, Eisert, Eufinger, and Hirsch (2015b) show that banks increase their lending to corporations, upon the implementation of the Outright Monetary Transactions (OMT). However, these corporations use the funds to build up their cash reserves rather than to increase their investment or employment. Acharya, Eisert, Eufinger, and Hirsch (2015a) show that the contraction in loan supply of Eurozone periphery banks that arose during the financial crisis in 2006-2012 depressed investment, job creation and sales of related European borrowers, and conclude that the borrowers saved more cash out of their free-cash-flows. Acharya, Imbierowicz, Steffen, and Teichmann (2015) investigate the transmission of liquidity interventions of central banks to bank deposit and loan spreads of European corporations. They find a differential transmission of central bank liquidity for low versus high risk banks, and an impaired transmission to corporate borrowers of high risk banks. Carpinelli and Crosignani (2015) also examine the LTRO, but only use data from Italian banks. They highlight the important role of collateral for the transmission of unconventional monetary policies. Garcia-Posada and Marchettin (2015) analyze the real effect of LTRO on Spanish corporations, and find that LTRO had a positive moderately-sized effect on the supply of bank credit

⁹Another related literature is on the determinants of corporate investment including corporate tax and other factors. For instance, Graham, Leary, and Roberts (2014) study U.S. data and find that government fiscal activities can affect corporate financial and investment policies.

to corporations, and provides evidence of a bank lending channel in the context of unconventional monetary policy. Andrade, Cahn, Fraise, and Mésonnier (2015) analyze the impact in France and find that LTROs enhanced loan supply for French corporations. In contrast to much of the prior literature, we provide a comprehensive examination of corporations in the EU as a whole, with a focus on the Eurozone, and examine the effects on corporate liquidity in a more detailed manner.

There is a large literature on corporate cash holdings that is too broad to be surveyed here, but we will restrict ourselves to a few prominent examples. In an early paper, Bates, Kahle, and Stulz (2009) show that corporations in the U.S. increased their cash holdings significantly from 1980 to 2006. Such increases in cash holdings have been shown to be a global phenomenon (Pinkowitz, Stulz, and Williamson (2016)) find that differences in cash holdings between U.S. and comparable international corporations are not related to country characteristics). Azar, Kagy, and Schmalz (2015) argue that the lower cost of carrying cash can potentially explain the higher cash holdings in recent times. Our study extends this literature by examining the impact of unconventional monetary interventions, during which the cost of holding cash is low, at least for certain corporations with access to cheaper bank credit.

Our paper relates to the above literature and provides new and more granular results to the literature on corporate liquidity management, in line with more recent studies in this area. As outlined by Bolton, Chen, and Wang (2014), corporations that face external financial frictions need to use liquidity reserves to service outstanding debt. Thus, corporations that face only costly lending opportunities will be forced to use their cash reserves. In times of generally illiquid lending markets, the expectation is that corporate cash holdings dries up. In another paper, Bolton, Chen, and Wang (2013) argue that when market conditions are good and/or corporations face significant uncertainties in their future financing conditions, they may raise external funds. In other words, corporations may issue new equity and/or debt and hoard the proceeds as cash, even if there is no immediate use of the funds. This implies that corporations that face low liquidity conditions or expect a decrease in the liquidity of their credit facilities, may be characterized by a more conservative liquidity policy, and hence maintain a high cash holdings ratio. Subrahmanyam, Tang, and Wang (2015) examine the relationship between credit default swaps (CDS), debt financing and corporate liquidity management, and find that the inception of CDS trading increases corporate cash holdings, and that this is partly financed by increases in debt financing. The increase in debt

financing is then motivated by the less vigilant monitoring of the creditors, which is tantamount to less stringent borrowing conditions for the borrower. All these papers outline the importance of cash holdings for corporate liquidity management, and that corporations do adjust their internal liquidity with respect to the availability of external funding. Through the investigation in this paper, we will be able to add insights into the corporations' adjustment of their cash holdings in response to macro-liquidity injections, both in terms of the announcement and the actual excess inflow of liquidity to their lenders and the potential increase in (cheaper) external funding from the central banks.

As distinguished from the previous literature, this paper investigates whether unconventional monetary policies helped the real economy in Europe by focusing on corporations' response to ECB liquidity injections. Unconventional monetary policies can affect the real economy not only through bank lending, but also through corporate liquidity management, financing and investment policies. Macro-liquidity injections do not necessarily translate into corporate liquidity. Unconventional liquidity interventions by the ECB may boost bank liquidity, making it less necessary for corporations to hold more precautionary cash. The three-year LTRO were implemented in order to ensure that monetary policy continued to be effectively transmitted to the real economy, thereby supporting the ability of banks to maintain and expand lending to Eurozone households and non-financial corporations. Thus, not only should the LTRO have improved bank liquidity, but, in particular, should also have lead to a boost in their lending to the corporate sector and, hence, provided a liquidity channel for credit. As such, the announcement by the ECB about its intent to implement medium-term lending facilities should, first of all, have been seen as a signal of a direct liquidity provision by the ECB. As outlined by Acharya, Eisert, Eufinger, and Hirsch (2015b), ECB announcements like the what-ever-it-take-speech in July 2012 by the ECB president, Mario Draghi, can themselves have a positive effect in terms of providing market confidence, even while there is no significant immediate impact on real economy.

However, banks' holding of government bonds may crowd out corporate lending. The decreased credit supply may increase corporations' precautionary cash holdings. Moreover, banks' increased holding of risky government bonds increases the risk of bank lenders, which further increases corporate precautionary cash holdings. Although an important motivation for providing LOLR funding is to stop bank panics, it may encourage banks' risk taking incentives (Drechsler,

Drechsel, Marques-Ibanez, and Schnabl (2014)). Acharya and Steffen (2015) also document the banks' carry trade behavior during the 2007-2013, because of the risk-shifting and regulatory arbitrage motives. Acharya, Pierret, and Steffen (2016) find that LTRO facilitated a reallocation of sovereign debt in bank portfolios (with a home bias). Therefore, the liquidity injection by the ECB may further encourage banks' risk taking, and strengthen the sovereign-bank linkage, which further increases corporate precautionary cash holdings. As a result, corporations may save more cash from their existing cash flows, borrow more and save the proceeds as cash holdings. Corporations may even decrease their risky investment and switch to "safer" cash equivalent holdings, such as sovereign bonds. In addition, even when macro-liquidity injections can relax the corporate financing constraints in a particular region, corporate investment may decrease due to the sharp decline in customer demand from other regions. Hence, it is less likely that we would observe the positive effect of liquidity injections on the real economy. In the following sections, we will examine the impact of the macro-liquidity injections on corporate policies in the context of ECB's LTRO liquidity injections.

3 Data and Methodology

3.1 Data

We collect data from several databases that contain European data to analyze the impact of liquidity interventions by the ECB. These data are for the period ranging from the adoption of the Euro in 2002 until 2014, and are thereby allow us to look at differences in corporate financial, investment and employment policies during normal and distressed periods, as well as periods characterized by interventions by the ECB.¹⁰

We use data on corporate fundamentals from the Compustat Global database. From this source, we identify a sample of European corporations and collect all yearly, as well as quarterly, corporate financial and stock price data for the period 2002-2014. As financial and utility corporations often have capital structures that are quite different from the average corporation, we follow the literature and exclude financial corporations (SIC-code numbers 6000 to 6999), utility corporations (SIC-code

¹⁰We restrict our sample to the period after 2002 in order to allow for an alignment with the establishment of the Eurozone. We set the end of our sample to the year 2014, as same corporate fundamental data for the year 2015 were unavailable at the time of the data collection for this research.

numbers 4900 to 4999), as well as corporations for which no SIC-code is available. Further, as we are only interested in active corporations, we also require corporations to have a non-negative asset value, and non-negative sales, to be included in a given year (quarter) (as in Bates, Kahle, and Stulz (2009)). We supplement the data from Compustat with corporate data from the Capital IQ database. In contrast to Compustat, Capital IQ compiles, among others, detailed information on the corporate debt structure using financial footnotes contained in the corporations’ financial reports. From this source, we obtain, in particular, data on drawn and undrawn portions of their credit lines. Finally, we use CreditPro[®] (S&P Capital IQ) rating data as a proxy for corporate credit risk, so that we are able to estimate the impact of the extraordinary liquidity injection by the ECB, after controlling for such risk.

To mitigate the effect of outliers, we follow the related literature (see, for instance, Chen, Dou, Rhee, Truong, and Veeraraghavan (2015)) and winsorize the observations for our variables at the 1st and 99th percentile. Further, we follow the conventional approach in related empirical research (as in Bates, Kahle, and Stulz (2009), Hirschey, Skiba, and Wintoke (2012) and Aghion, Askenazy, Berman, Cette, and Eymard (2012)) and assume that the corporation has no R&D expenditure, if it is reported as “missing” by Compustat, and set the missing values equal to zero. We use the same argument for observations of corporations’ mergers and acquisitions (M&A) activities (following for example, Ramondo, Rodriguez-Clare, and Tintelnot (2013)).

In addition to firm controls for corporate policies, we also use the 5-year sovereign CDS spreads from Markit as a proxy for country credit risk.¹¹ The 5-year tenor is by far the most liquid one for CDS contracts, and is the benchmark employed in the related literature. We use end-of-quarter observations of the daily 5-year CDS spread to match the quarterly corporate fundamental data. For additional country-specific measures, we use data from the World Bank. As a proxy for a country’s overall exposure to other countries’ economic condition, we use data on the country’s export of goods and services. In order to be able to measure the impact of the ECB liquidity intervention in each country, we also collect annual data about each country’s central government debt obligations. We also use these and other country- and industry-specific data, e.g., unemployment and corporate tax rates, as well as indicators for corruption and competition, to investigate the impact of differences in credit supply and demand differences on the sensitivity to the LTRO intervention

¹¹We restrict the sample of CDS to senior CDS with “complete” or “modified” restructuring as default triggers.

across corporations.

We restrict our main sample to corporations that are located in the Eurozone to analyze the impact of liquidity interventions by the ECB. This sample includes all corporations that are located in a country that is a part of the European monetary union (Eurozone) and is thereby directly affected by liquidity interventions by the ECB.¹² To exclude any potential biases or country-specific reasons for the later adoption of the Euro by some countries, we only include corporations from those countries that adopted the Euro as a common currency in 1999, and the European Monetary System from its inception in January 2001.¹³ However, we collect data for both Eurozone and non-Eurozone corporations (see Appendix Table B2) and use the latter as a control group for some of our subsequent analyses.

Our main objective in this research project is to investigate the impact of liquidity intervention on corporate policies. To address this issue, we use the ECB's implementation of its unconventional three-year LTROs, which, in particular, were set in place to not only increase the ECB's support to the Eurozone banking sector, but also to improve the real economy. The two LTROs were unconventional in the sense that the ECB, for the first time, offered LTROs with a maturity of three years.¹⁴ These operations were announced in early December 2011, and the two LTROs were then implemented on 21 December 2011 (LTRO I) and 29 February 2012 (LTRO II), respectively. The operations themselves were conducted via an auction mechanism. The amount of liquidity that was auctioned was determined by the ECB, and the banks bid against each other to access the available liquidity.¹⁵ In this sense, the final uptake of LTRO may also have been biased in favor of banks that had a particular need for liquidity, and hence, participated more aggressively in the auctions.

For detailed information about the LTRO liquidity interventions by the ECB and the banks

¹²The non-Eurozone sample includes all corporations located in a country that is a part of the European Union (EU), but outside the Eurozone, e.g., Denmark.

¹³Today, the Eurozone consists of 19 of the 28 European Union (EU) member states. Slovenia adopted the Euro in 2007 and was followed by Cyprus and Malta in 2008, Slovakia in 2009, and most recently, Estonia in 2011. By 2015, Latvia and Lithuania have also adopted the Euro, while Poland and the Czech Republic are current applicants. Further, due to the missing information of CDS data for Luxembourg, we exclude corporations that are located in Luxembourg (where there are 46 companies).

¹⁴The fundamental difference between the LTRO and other regular refinancing operations, therefore, lies basically in the maturity of the funding made available. This financing not only allowed banks to have more reliable liquidity management, but also eased credit conditions, more generally. Also, the interest rate was set lower than interest rates that would otherwise have been even for credit worthy banks.

¹⁵In Appendix A, we provide detailed background information about the LTROs, while the time-series of the overall amount of uptake is visually represented in Appendix, Figure B1.

uptake of the three-year LTRO, we use data from two sources. As we are particularly interested in whether and how much of the liquidity injection by the ECB flowed to individual banks, we use country-specific aggregate information on the Eurozone banks' uptake of LTRO I and LTRO II, respectively.¹⁶ Table 1 provides these LTRO uptake numbers in the Eurozone, by country.¹⁷ As shown in the table, banks from the periphery countries were highly active due to their actual capital needs as the LTRO provided them with their only option to access medium-term funding. However, for many banks, participating in the unconventional LTROs also provided an opportunity to replace their shorter-term borrowing with low cost three-year borrowing.¹⁸ Therefore, even high rated and safe Eurozone countries like Germany and France, participated in the three-year LTRO auctions. In addition, as Table 1 indicates, the participation and uptake from the two LTRO auctions were quite similar (both with the aggregate and country levels). The aggregate uptake was about 918 billion Euro, with Italian and Spanish banks being by far, the most active in the auctions, in terms of both the number of participating banks and the borrowed amounts.¹⁹ Together, banks in these two countries had an uptake of about 68% of the aggregate uptake. Figure 2 graphically presents the country-specific total LTRO uptake in the Eurozone. In terms of the significance of the ECB liquidity intervention, we see from the ratio of the total LTRO uptake to central government debt that the liquidity injection was most severe for countries in the Eurozone periphery, i.e., Greece, Ireland, Italy, Portugal and Spain (GIIPS). We supplement these intervention-specific data with other Eurozone-wide data provided by the ECB. The data were obtained from ECB Statistical Data Warehouse, where all published reports as well as historical data are stored on a monthly (or weekly) basis, dependent on the source.²⁰

¹⁶The data are hand-collected data from Bloomberg and contains bank-level uptake information related to LTRO I and II, respectively. We thank Matteo Crosignani for kindly sharing this data.

¹⁷While the ECB liquidity auction was only available for banks located in the Eurozone, a few non-Eurozone banks participated through their subsidiaries situated in a Eurozone country. However, the uptake by non-Eurozone headquartered banks was only minor (about 5% of the aggregate).

¹⁸See, for instance, the discussion in Fitch Ratings Special Report "European Banks Use of LTRO" http://inwestycje.pl/resources/Attachment/2012/02_28/file13936.pdf.

¹⁹The country-specific LTRO data that we use in this study are quite comprehensive and the total numbers are consistent with the data cited in the media such as <http://www.bloomberg.com/news/articles/2011-12-21/ecb-will-lend-banks-more-than-forecast-645-billion-to-keep-credit-flowing>, <http://www.marketwatch.com/story/ecb-allots-713-billion-to-banks-in-ltro-2012-02-29>.

²⁰See for instance <https://sdw.ecb.europa.eu/home.do>. For data about ECB liquidity provision, see for instance: <http://www.ecb.europa.eu/stats/monetary/res/html/index.en.html>. Note that the ECB itself does not provide country-specific data about banks' participation in its intervention programs.

3.2 Empirical Specification

In terms of methodology, our approach is twofold. In the first part of the paper, we provide an investigation of the impact of ECB’s unconventional LTROs, i.e., LTRO I and II, on corporate liquidity management. We also test the impact of the LTROs on the real economy, i.e., corporates investment and employment policies. Our main measure for corporate liquidity is the corporations’ cash holdings, *Cash*. Cash is the most liquid asset a corporation can hold and a change in cash holdings would clearly reflect a change in corporate liquidity. Following Bates, Kahle, and Stulz (2009) and Subrahmanyam, Tang, and Wang (2015), we measure corporate cash holdings by the ratio of cash and cash equivalents to total assets. As outlined in Table 2, the cross-country averages of corporate cash holdings are 8.29% for Eurozone companies. In line with Chen, Dou, Rhee, Truong, and Veeraraghavan (2015), we find a large cross-country variation, when comparing the cash holdings ratio across countries. Corporations in some countries, like Portugal, have cash holdings that are less than half (4.0%) of that of the Eurozone, while those in other countries, such as Germany, France and Ireland, have ratios of cash holdings above 10%.

We relate corporate cash holdings to a set of explanatory variables and other controls, including firm and time fixed effects. With respect to the determinants of corporate cash holdings, we follow the models of Chen, Dou, Rhee, Truong, and Veeraraghavan (2015), Bates, Kahle, and Stulz (2009) and Subrahmanyam, Tang, and Wang (2015). The choice of the determinants of cash holdings in our empirical specifications of cash holdings models is motivated by the transaction and precautionary explanations for cash holdings. *Market-to-Book* is the book value of assets minus the book value of equity plus the market value of equity, all divided by the book value of assets. The *Size* variable is the logarithm of total assets. *Leverage* is measured as the book value of the long-term debt plus debt in current liabilities, divided by total assets. The variable *Cash Flow/Assets* is the ratio of cash flow to total assets, where cash flow is defined as the earnings after interest and related expenses, income taxes, and dividends. The variable *Industry Sigma* is the industry cash flow risk, measured by the mean cash flow volatility across two digit SIC codes. *Net Working Capital* is measured as net working capital minus cash, divided by total assets. *R&D/Sales* is the ratio of R&D to sales. *Capital Expenditure* is the ratio of capital expenditure to total assets. The variable *Acquisition Activity* is the corporation’s costs related acquisitions scaled by total assets. Finally,

the variable *Rated* is a dummy variable that is equal to one 1, if the corporation is rated, and 0, otherwise.

In our investigation of the impact of the unconventional LTROs on the real economy, i.e., the investment and employment policies of the corporations, we follow the literature and use the ratio of capital expenditures to total assets as its proxy for investment. Following Table 2, the average corporation in our sample uses 3.12% of its total assets on capital expenditures. As a proxy for employment compensation, we use *Wages*, which represents the corporations' total salaries and wages, given in logarithms. Our main controls in the investment and employment compensation model specifications are *Cash Flow/Assets*, *Market-to-Book*, *Size*, *Leverage* and *Rated*. As investment and employment also may be determined by lagged ratios of alternative investment measures, e.g., R&D and acquisitions, as well as profitability and the degree of competition in the respective industry, we also use these controls in extended specifications.²¹ Further, we also use measures for corporate profitability and industry competition in our investment and employment compensation specifications. Our proxy for profitability, *Sales*, is the operating income (before depreciation) and is scaled by total assets. Our measure for industry competition is the Herfindahl-Hirschman Index (HHI), which is given as the sum of squared market shares of corporations within the same industry, for a given year.

As this paper is based upon Eurozone corporations and provides a cross-country study, we also include sovereign CDS spreads and countries ratio of exports to GDP in our model specifications to control for sovereign credit risk and diversification of the economy across markets. As outlined in Table 2, the median CDS spread over the sample period within the Eurozone is about 16.19 bps. The sovereign CDS spread variable shows a large cross-country variation, which implies an interesting setting for our study of unconventional monetary policies within the Eurozone. Likewise, we find a large variation in the countries' dependence on exports, which gives us the ability to study the impact of liquidity intervention for corporations that are (or are not) located in countries that rely heavily on local markets.²² In order to determine the driver of the changes in corporate policies as consequences of the intervention, we also investigate the impact of country specific

²¹For alternative specifications of investment and employment models, see, for instance, Almeida and Campello (2007), Campello and Graham (2013), Duchin, Ozbas, and Sensoy (2010) and Yagan (2015).

²²In Appendix Table B3, we provide summary statistics for the non-Eurozone sample. Except for the median sovereign CDS spread, which is significantly lower for Eurozone corporations, we find no general differences between Eurozone and non-Eurozone corporations.

unemployment and corporate tax rates, as well as indicators for perceptions of corruption. The data for unemployment and corporate tax rates are annual data provided by the World Bank.²³ For the Corruption Perception Index (CPI index) we use data from Transparency International, an independent research organization. The CPI index is a proxy for the threat of investor rights and indicates a country's relative to the other countries in the index in a given year. We follow the method proposed by Fan, Titman, and Twite (2012) and transpose the published CPI score into an index ranging from zero to ten with ten indicating a highly corrupt country.

To capture the liquidity injection impact of the three-year LTROs, we use *LTRO Uptake* as our main measure.²⁴ *LTRO Uptake* measures the differences between countries in terms of participation in the three-year LTRO auctions and, hence, reflects the country-specific uptake of liquidity. In particular, *LTRO Uptake* is equal to zero, until the first round of the unconventional LTRO, Q4-2011, and equals the amount of each countries' total uptake through LTRO I and II, scaled by the country's central government debt holdings in the year 2011, i.e.,

$$LTRO\ Uptake = \frac{\text{Total Uptake Amount}_{t,c}}{\text{Central Government Debt}_{2011,c}} \quad (1)$$

where t indicates the year-quarter and c refers to the country. The interpretation of the variable is the following: A high value of *LTRO Uptake* implies that the uptake through the LTROs compared to the existing government debt is significant and hence, all else equal, will affect the local banking sector more than another country's banking sector that had a low uptake. Thus, the variable measures the country-specific significance of the unconventional monetary policy by the ECB. The advantage of this specification is that the variable not only differentiates between countries that had a high or low uptake, respectively, but also takes into consideration whether the liquidity intervention was significant in relation to each country's local banking sector. Accordingly, we expect that corporations that are located in a country that received relative high liquidity injection would be affected more, and show a stronger reaction in terms of their liquidity management,

²³The corporate tax rates are measured by total tax rates from World Development Indicators and measure the amount of taxes and mandatory contributions payable by businesses after accounting for allowable deductions and exemptions as a share of commercial profits.

²⁴As an alternative and simplified measure, we use LTRO intervention, which is a dummy variable equal to 1 for year-quarter observations after the ECB had implemented the first three-year LTRO intervention (Q4-2011) (0 otherwise). Hence, LTRO intervention will be used to capture the overall impact of the three-year LTRO liquidity injection on corporate cash holdings.

financing and investment policies.²⁵

In section 4, we analyze the stand-alone impact of the *LTRO Uptake* measure on corporate cash holdings, investment and employment compensation. Furthermore, we also investigate the impact of the LTRO intervention on corporate debt financing, and the concatenate the relation to other changes in corporate policies. This helps us to determine the source of the changes in corporate policies and, hence, the actual transmission of liquidity provided by the ECB to the corporate sector.²⁶

In the second part of the paper, we identify and provide an overall understanding of the mechanisms for the impact on corporate policies in response to a macro-liquidity injection. Specifically, our aim is to understand the details of the corporations' response to liquidity injections and the resulting impact on the real economy. To this end, we study the corporate policies in the different subsamples and analyze the interaction of our main intervention measure, *LTRO Uptake*, with corporate, industry, as well as, country characteristics.

Overall, our investigation analyzes the two competing drivers of changes in corporate policies': the credit supply shock (credit supply uncertainty) versus uncertainty related to the demand for, and the cost of, their product (economic uncertainty). We first analyze corporations' reliance on bank debt. If corporations indeed interpreted the liquidity injection as a credit supply shock, their increased cash holdings may simply have been funded by increases in their bank debt holdings. However, if the uncertainty of the future demand and cost dominates, the real economy will not be rejuvenated by the liquidity injection since the corporate reaction would be tepid. We test the demand uncertainty argument by investigating the role of industry competition, and country-specific levels of export and credit risk.

4 LTRO and Corporate Policies

In this section, we investigate the impact of an unconventional liquidity intervention on corporate policies. We focus on the three-year LTRO interventions (macro-liquidity) by the ECB and

²⁵For robustness, we also use the ratio of country-specific LTRO uptakes to the countries' gross domestic product. In contrast to our main measure, this ratio also reflects the importance of the LTRO liquidity intervention relative to size of the country's economy. Our main results are robust to this alternative definition of the countries' LTRO uptake.

²⁶A full description of all our variables can be found in Appendix Table B1.

corporate liquidity management in terms of the precautionary demand for cash holdings (micro-liquidity). We also investigate the LTRO impact on corporate debt financing policies, as a channel for changes in their cash holdings, and the consequent effect on corporate investment and employment compensation.

4.1 Cash Holdings

Macro-liquidity injections, like the ECB's unconventional LTROs, do not necessarily translate (directly) into corporate liquidity. An analysis of both the supply-side, in this case provided by the banking sector, and the demand-side action, i.e., the corporate response, is necessary to understand such liquidity transmissions. On the one hand, unconventional liquidity interventions may boost bank liquidity, making it less necessary for corporations to hold precautionary cash. If this were the outcome of the liquidity injection, this would, from a corporate liquidity perspective, have achieved the ECB's goal with the intervention. However, on the other hand, banks may use the lender of last resort (LOLR) funding to take on additional sovereign risk, rather than lend to corporations. Further, the risk taking by banks may accentuate the corporations' precautionary motives for cash holdings. As a result, corporations may save more cash from their operating cash flows, or even borrow more and save the proceeds as additional cash holdings (cash hoarding). If the latter effect dominates, we expect that corporations in the Eurozone, and particularly those situated in countries with a high LTRO uptake, would have increased their precautionary cash holdings, following the LTRO intervention.

Whether the boost in bank liquidity, and hence, the transmission of liquidity to the corporate sector, will be effective or not, depends not only on the supply-side, but also on the demand for, and the cost of, the corporations' product and services. At the onset of the European sovereign debt crisis, aggregate demand was clearly down; indeed, when the unconventional LTROs were introduced in late 2011, demand across European countries and markets remained slack. Thus, in this framework of high demand uncertainty, corporations were likely to maintain their precautionary motives for significant cash holdings. Consequently, and independent of the supply side effect, it is very unlikely that a liquidity injection to the banking sector would have led to decreases in corporate cash holdings. Thus, if corporate demand uncertainty remained large and, thus, impaired the lending supply shock effect, we expect that corporations in the Eurozone, and particularly

those based in countries with high LTRO uptake, would have increased their precautionary cash holdings, following the LTRO intervention. While we, in a later section, analyze the effectiveness of the LTRO intervention in terms of supply and demand, we first investigate the impact on corporate cash holdings itself.

To investigate the corporate response to the LTRO intervention, we first of all follow the determinants of cash holdings in the model proposed by Opler, Pinkowitz, Stulz, and Williamson (1999) and Bates, Kahle, and Stulz (2009). In addition to the conventional determinants of corporate cash holdings, we then include the variable *LTRO Uptake* as our main variable of interest. We conduct the analysis in the sample of Eurozone corporations and the results are presented in Table 3, Model 1. As seen in Model 1, we find a positive and significant coefficient estimate for *LTRO Uptake* at a 1% level, suggesting that Eurozone corporate cash holdings increased, following the unconventional LTRO liquidity injection. In particular, we find that the effect increases with *LTRO Uptake*, i.e., corporations that are located in countries where the excess inflow of liquidity to their lenders was high, increased their cash holdings more. The coefficients for other control variables are generally consistent with prior findings. Corporations with high *Market to Book* and *R&D/Sales* ratios have greater precautionary cash holdings, since it is more costly for them to be financially constrained. Large corporations generally have less cash due to economies of scale of holding cash. *Capital Expenditure* and *Acquisition Activity*, which create assets that can be used as collateral for borrowing, lead to a decrease in precautionary cash holdings. With regard to our specified country controls *Sovereign CDS* and *Sovereign Export*, we find that countries with higher credit risk and lower export intensity, hold more cash, in general. This is in line with the precautionary motive for cash holdings.

The three-year LTRO intervention by the ECB implied a significant liquidity injection to banks in the Eurozone. Such a macro-liquidity injection may generate a positive *bank lending* shock and thus, not only create an immediate source for additional borrowings for corporations but, in particular, may mitigate the corporations' uncertainty in terms of future credit supply. With a positive bank lending shock, the corporate cash holdings and capital expenditures of corporations that are reliant on bank borrowing, will fall and rise, respectively. Hence, we expect corporations that before the intervention relied on bank debt and, thus, had access to bank debt as an external financing source, will be more affected by the macro-liquidity injection, all else equal. However, if

macro-liquidity injections cannot mitigate corporate uncertainty about the future (bank) lending supply, we expect to observe a greater increase in cash holdings, and an even a larger decrease in investment, for bank-reliant corporations.

Based upon the above argument, we use corporate reliance on bank debt to initially test the impact of the LTRO intervention on cash holdings. In particular, we separate corporations into sub-samples of those with *High Bank Debt* and *Low Bank Debt*. The separation is based upon the corporations' bank debt obligations (*Bank Debt*) one year before the first three-year LTRO intervention (Q4-2010). *Bank Debt* is the debt in the form of bank loans divided by total assets. Then, the sample of *High Bank Debt* (*Low Bank Debt*) includes corporations with a bank to asset ratio above (below) median. In Table 3, Model 2 and 3, we present our results for corporate cash holdings.

As shown in Table 3, Model 2, we find a positive and significant coefficient for corporations that use bank related loans and credits as their main source for debt financing. In contrast, the coefficient is positive, but insignificant, for low bank-reliant corporations. Hence, the results suggests that corporations, which used bank loans as their main source for debt financing prior to the LTRO interventions and accordingly, were more closely related to their bank, increased their cash holdings more than corporations with no, or only minor, use of bank debt. Thus, while all corporations may have had a heightened motive for precautionary cash holdings, only those that had a (significant) amount of bank borrowings, also increased their liquidity, i.e., their cash holdings. This may underscore the fact that at least one source for our finding of increased cash holdings, is the increase in existing bank borrowings that followed the LTRO intervention and the successive bank lending shock. In particular, corporations may have been able to refinance existing loans (debt renegotiation including improved borrowing conditions), or to take up new loans.²⁷ In both cases, corporations may have been able to hoard the additional proceeds from bank borrowing as cash.²⁸

In Appendix Table ??, we provide an analysis in the sample of *all* corporations in the Euro-

²⁷For more information, see, for instance, a special report provided by Fitch Ratings on European Banks' use of LTRO (http://inwestycje.pl/resources/Attachment/2012/02_28/file13936.pdf).

²⁸In line with this argument, large corporations in particular should have better access to lending and are less constrained and, therefore, should have exploited the bank lending supply shock more. We, therefore, expect that the increase in cash holdings after the LTRO intervention would be more pronounced for large corporations. When we classify our sample into large and small corporations in our robustness test, our results confirm this hypothesis.

pean Union (EU), i.e., the combined sample of Eurozone and non-Eurozone corporations. As the ECBs' monetary intervention programs were only available for banks in the Eurozone, the main variable of interest is the interaction term $LTRO\ Dummy \times EURO$. $LTRO\ Dummy$ is a dummy variable that is equal to 1 after the implementation of the first LTRO (Q4-2011) and captures the initiation of the unconventional three-year LTRO intervention (Q4-2011). The variable $EURO$ is a dummy variable equal to 1, if the corporation is located in a Eurozone country (0 otherwise). Compared to corporations outside the Eurozone, we find that Eurozone corporations are more affected by the LTRO intervention. In particular, we observe a positive and significant coefficient for $LTRO\ Dummy \times EURO$ (0.932%), indicating that corporations in the Eurozone increased their precautionary cash holdings even more.

Overall, the previous results suggest that corporations in the Eurozone increased their cash holdings, following the LTRO liquidity injection. However, the impact of a macro-liquidity injection on corporate liquidity policies may also depend on the corporate precautionary motive and the marginal value of cash. When the marginal value of cash is high, corporations have a greater precautionary demand for cash holdings. We, therefore, expect that these corporations are more likely to increase their cash holdings, following the announcement of an unconventional liquidity injection. In Appendix Table B5, we use the corporations' credit rating and leverage ratios as proxies for the precautionary demand for cash holdings, and show that the impact of the unconventional LTROs on cash holdings is amplified for more risky corporations, i.e., those with a higher precautionary motive for cash holdings.²⁹

4.2 Leverage Policies

To investigate whether the LTRO intervention may indeed have increased the corporations' cash holdings due to an increase in corporate borrowing, we next analyze the impact of the unconventional LTROs on corporate debt financing policies. For this investigation, we use several corporate debt financing measures, and the results for all alternative specifications are presented in Table 4.

²⁹Corporations with non-investment grade ratings not only have higher credit risk, but, compared to investment grade rated corporations, will also be more financially constrained, as they would have more limited access to debt markets and would borrow at higher cost. Similar to low rated corporations, highly leveraged corporations have greater default risk, and may, thus, face lower costs of carrying cash. Following the argument of Azar, Kagy, and Schmalz (2015), this may lead to greater cash holdings. In addition, concerns about debt-servicing cost may lead to a increased precautionary demand for cash holdings (Bolton, Chen, and Wang (2014)). This implies that the value of cash becomes strictly higher for corporations with high leverage and high cost of debt.

As before, the variable of interest is *LTRO Uptake*. As indicated in Table 4, we do find positive and significant coefficients for corporate leverage and net debt holdings, while short-term debt holdings are lower for corporations that are located in (high) LTRO uptake countries. As outlined in Model 1 and 2, we find that the increase in corporate leverage is even larger than the increase in cash holdings suggesting that cash is not equivalent to negative debt. In addition, we find a positive and significant coefficient for *LTRO Uptake* in the model of *Net Debt*, which is defined as the ratio of current plus non-current liabilities minus cash holdings to total assets. For short-term debt holdings which includes all current liabilities of the corporations, we find a negative impact. This suggests the potential replacement of shorter-term liabilities with longer-term liabilities by corporations. Recall that the LTRO intervention was an unconventional monetary policy that for the first time, included three year funding opportunities for Eurozone banks.³⁰ Not only would the participating banks' replacement of own short-term borrowing with longer-term borrowing have increased bank lending to the corporate sector in general, but also may have caused banks to offer loans to the corporate sector with longer maturities. A related discussion in the case of French corporations can be found in Andrade, Cahn, Fraise, and Mésonnier (2015). The results of decreased short-term holdings is, thus, in line with our expectations.

In line with the findings by Darracq-Paries and Santis (2013), we conclude from these findings that corporations increased their reliance on debt financing, following the macro-liquidity injection. In particular, they show that the three-year LTROs significantly lifted prospects for loan provision to non-financial corporations. This supports the view that the three-year LTROs can be interpreted as a favorable credit supply shock. Thus, the bank liquidity shock may indeed have been transferred into a bank lending shock, through which Eurozone corporations were able to increase their debt financing. Given the results of increased corporate cash holdings, in particular for high bank debt-reliant corporations, and increased leverage, our results suggest that increased borrowing may have provided an important source for the increase in cash holdings. We emphasize that, based only on this analysis, we cannot exclude other sources of funding for the increase in corporate cash holdings.

³⁰For details, please see Appendix A.

4.3 Investment and Employment Compensation

The implementation of the liquidity intervention by the ECB may not only have affected corporate liquidity management, but may also have had an impact on corporate investment and employment decisions. Corporate access to debt markets has an impact on investment (Harford and Uysal (2014)) and so do financing frictions do affect corporate investment decisions (Almeida and Campello (2007)). Thus, the availability of debt financing and hence, the credit supply shock, will have an impact on corporations' investment policies. Likewise, we expect that increased availability of debt financing may have increased employment compensation. In particular, the impact on employment compensation could either be due to an increase in the level of wages, or an increase in the number of employees. Both a positive effect on investment and increased employment compensation would suggest an ameliorating impact of LTRO on the real economy. However, as in the case of corporate cash holdings, corporate investment decisions and employment compensation also depend upon the economic uncertainty and, in particular, on the uncertainty of product demand (Guiso and Parigi (1999)). If product demand is low, then corporations would be more reluctant to invest (both in terms of property, plant, equipment and employees). In this framework, the LTRO intervention and the related increase in corporations debt financing may not necessarily have lead to increased investment. As demand uncertainty at the time of the LTRO implementation was clearly high, it would have been optimistic to expect a positive impact on either corporate investment or employee compensation: In other words, we would not expect that the intervention alone would be able to resolve the problem of demand uncertainty. In terms of the ECBs' intended objective with the introduction of LTRO, this would mean that the unconventional LTROs would not necessarily help the real economy, and hence, did not reach its goal, at least at the corporate level.

To investigate whether the LTRO intervention had an impact on corporate investment and employment decisions, we next present the results for our investigation on proxies for corporate investment and employment compensation. The analysis is conducted in the sample of all corporations in the Eurozone and the results are presented in Table 5. The variable of interest is *LTRO Uptake*. In Models 1 and 2, we use the ratio of capital expenditure to total assets as our proxy for corporate investment. In Model 1, we only add controls that affect the corporate capital expenditure decision. In Model 2, we add lagged-versions of alternative investment measures such

as dividend payment, R&D investment, and acquisition activities, as well as other controls, as a robustness check. As seen, while controlling for corporate fundamentals, we find a negative and significant coefficient for the country-specific LTRO uptake measure. This indicates that corporations located in countries with a high uptake of additional liquidity in the banking sector actually *decreased* investment, following the LTRO intervention. One explanation is that the LTRO implementation came along with additional baggage in terms of the use of the increased liquidity by banks for purposes other than corporate lending, such as investment in high yield sovereign bonds. This may have increased uncertainty about future product demand and, hence, corporations may have become more reluctant to invest. This argument is in line with our previous finding of increased precautionary cash holdings. Further, the effect of decreased investment may have been amplified by the fact that countries with high LTRO uptakes were countries with low investment, in general.

In Table 5, Models 3 and 4, we provide the same analysis for corporate employment compensation. As a proxy for employment compensation, we use corporations' total expenses related to wages (on a logarithmic scale). As seen, we do not find a significant effect for the LTRO uptake measure. Hence, similar to corporate investment, the corporate spending on employees was not affected positively by the introduction of the unconventional LTRO. Our tentative conclusion is thus, that while corporations may have had access to more debt financing, they did not use the proceeds from the additional borrowing to invest in their businesses, but instead hoarded it as cash.

5 Why Was LTRO Ineffective in Boosting Investment?

In the previous section, we investigated corporate policies following the three-year LTRO intervention, and presented evidence of increased corporate liquidity holdings. We also showed, that the liquidity injections did not necessarily help the real economy. In particular, corporations increased their debt obligations and hoarded the resulting cash proceeds, while their investment and employment compensation were unaffected (or even decreased) after the intervention. In this section, we conduct several additional analyses to understand why LTRO was ineffective in boosting investment and employment. Investment and hiring decisions may depend on various factors, such as the uncertainty about *future* credit supply (credit supply uncertainty), their own supply incentives

(affected by industry competition and tax policies), as well as the demand for their products (economic uncertainty). In addition, the institutional environment may also affect corporate policies, including financial policies. All of these factors may constraint or even impede the real effect of LTRO in boosting corporate investment.

Overall, we expect that a positive lending supply shock may reduce corporations' credit supply uncertainty and boost their investment. Considering that LTRO injections operated through the banking system, the investment boosting effect should be more prominent for firms with a greater dependency on bank debt. However, industry competition and tax policies may also affect corporate investment incentives, which may accentuate or impede the LTRO effect. Moreover, corporations facing greater economic uncertainty may decrease investment, even when there is increased bank credit supply following LTRO liquidity injections. The institutional environment also plays an important role in influencing corporate policies in the intended directions or otherwise. Thus, the impact of LTRO liquidity injection on corporate investment and employment really depends on corporations' simultaneous consideration of these various factors. In the following analysis, we construct proxies for factors that affect corporate investment policies to address this issue. If the liquidity injection was efficient in terms of resolving at least some of these considerations, we expect to see that corporations respond by increasing their investment and employment compensation.

5.1 Bank Debt Reliance

The three-year LTRO intervention by the ECB implied a significant liquidity injection to banks in the Eurozone. The stated intention of the program was that with a positive bank lending shock, corporate investment may increase as the lending shock may help corporations to overcome their financial constraints and, hence, provide a source of financing for new corporate investments. In particular, investment may increase for those corporations that rely more on bank financing and may not have access to alternative sources of funding. However, if macro-liquidity injections cannot mitigate corporate uncertainty about the future, we expect to observe no change or even a decrease in investment for all corporations. Therefore, an analysis of corporate investment, conditional on corporate bank debt dependency will provide additional evidence for investigating the LTRO impact on the real economy.

To this end, in Table 6, we separate corporations into subsamples of *High Bank Debt* and *Low*

Bank Debt based upon the corporations' bank debt obligations (*Bank Debt*), one year before the first three-year LTRO intervention (Q4-2010). Then, we run the same sub-sample analysis for corporate investment and employment compensation policies as for corporate cash holdings. For our measure of investment, *Capital Expenditure*, we find negative and significant coefficients for the LTRO uptake measure in all specifications. In terms of magnitude, the coefficients are quite similar for high and low bank-reliant corporations, suggesting no significant difference between the two samples. Model 3 and 4 in Table 6 present our results for our measure of employment compensation, *Wages*, conditional on bank debt dependency. In contrast to our investigation of cash holdings and investment, we do not find any significant effect, when we investigate the bank reliance impact and the effect on employment compensation, following the LTRO intervention. Thus, conditional on corporations' reliance on bank debt, we again do not find evidence of a positive impact of the liquidity interventions on corporate employment compensation. These results may partially be driven by the stickiness of corporate employment and compensation policies in general. It is possible that the real effects of monetary policy on employment take much longer to manifest themselves and are not observable in just a few years.

Overall, the investment results conditional on bank debt dependency presented in this section provide additional evidence that the LTRO intervention does not necessarily boost the real economy at least in the mean term. The negative coefficients for *LTRO Uptake* for both the *high and low bank debt* subsamples suggest that there might be other factors that explain the decrease in investment following LTRO liquidity injections. In the following sections, we construct proxies for some of these factors that affect corporate investment policies to develop a better understanding of the LTRO impact in their presence.

5.2 Corporate Supply Incentive

Industry competition and tax policies may affect the corporate supply incentive, which further plays a role in shaping corporate investment decisions. Accordingly, the finding of reduced investment following LTRO liquidity injections might be driven by corporate supply incentives. In this section, we construct proxies for corporate supply incentives, i.e., industry competition and tax policies, and investigate their potential impact on the LTRO effects on corporate investment.

5.2.1 Industry Competition

The environmental framework and structure of a corporations industry might be an important factor affecting corporate policies. Valta (2012) finds that corporations operating in competitive product markets generally face a higher cost of bank debt. Akdoğu and MacKay (2008) document that corporations in monopolistic industries are slower to invest than corporations in competitive industries for which investment opportunities are contestable. Hence, we expect in this framework, that corporations in highly competitive industries would be more aggressive in increasing investment, generally. Therefore, compared to corporations operating in less competitive industries, we are more likely to observe the positive effects of LTRO on investment for corporations operating in more competitive industries. However, on the other hand, deferring irreversible investment is valuable in the face of uncertainty. In a period of crisis, industry competition might not be the driving force for corporate investment decisions and the transmission of LTRO real effects, but rather the larger concerns of the macro-economic environment.

We test the impact of industry structure on LTRO effects by separating corporations into *High Industry Competition* and *Low Industry Competition* subsamples. We use the Herfindahl-Hirschmann-Index (HHI) as our proxy for industry competition with the separation being based upon the corporations' individual SIC-code classification. A company is classified into the group of *High Industry Competition* (*Low Industry Competition*) if it operates in an industry that has an above (below) median HHI, in a given year. The results are presented in Model 1 and 2 in Table 7. We find negative and significant coefficients for corporations in both *High Industry Competition* and *Low Industry Competition* samples. Further, the impact on investments also seems to be quite similar in terms of magnitude for the two subsamples, suggesting no significant difference between investment policies across different levels of industry competition. However, the results also indicate, that investment declined after the LTRO intervention. Thus, overall it seems that the industry competition does not drive the finding of a decrease in investment following liquidity injections.

5.2.2 Corporate Taxes

Tax policy is another factor that may affect corporate incentives of increasing investment. Based on survey data, Djankov, Ganser, McLiesh, Ramalho, and Shleifer (2010) document a large adverse impact of corporate tax rates on aggregate investments. Becker, Jacob, and Jacob (2013) also find evidence for the impact of dividend payout taxes on corporate investment. The consideration of current and/or future tax policies when making the investment decision may impede the transmission of the positive effects of LTRO to the real economy.

Accordingly, we study the LTRO impact conditional on corporate taxes to investigate the role of corporate tax rates on the real effect of the LTRO intervention. We separate firms into *High Corporate Tax* and *Low Corporate Tax* samples based upon the countries' corporate tax rates. A company is classified in the group of *High Corporate Tax* (*Low Corporate Tax*), if it operates in country that has an above (below) median corporate tax rate one year before the first three-year LTRO intervention (2010). The results are presented in Models 3 and 4 in Table 7. We find negative and significant coefficients for *LTRO Uptake* in both *High Industry Competition* and *Low Industry Competition* samples. Therefore, the results suggest that investment declined after the LTRO intervention, irrespective of the corporate tax rates. Together with the findings for industry competition, the results suggest that the finding of decrease in investment following the LTRO liquidity injections was not driven by corporate supply incentives (proxied by industry competition and tax policy).

5.3 Demand Uncertainty

In the previous sections, we found evidence that corporate bank relationship and supply incentives are not necessarily the drivers of the reduced investment following LTRO liquidity injections. In this section, we further investigate this effect by analyzing the impact of general economic uncertainty on the corporate response to the liquidity injections. For instance, demand uncertainty for corporations' products and services may affect its corporate policies. Considering the recent crisis in Europe, economic uncertainty is generally higher for Eurozone corporations that face greater industry competition, that rely more on domestic demand, and that are situated in periphery, i.e., high risk countries. Accordingly, the corporate response might be different for corporations fac-

ing different levels of economic uncertainties, e.g., product demand uncertainties (Kahle and Stulz (2013)). If the liquidity injections resolved at least some of the product demand/cost uncertainties by creating more solutions, corporations with greater uncertainty about macro economic before the intervention may have decreased their precautionary cash holdings, increased their investment and even paid higher wages to their employees or hired more of them. Otherwise, besides conditions confirming a positive bank lending shock, if the liquidity injection did not help to resolve the product demand/cost uncertainties, corporations with greater uncertainty before the intervention may have even greater precautionary demand for cash holdings.

Corporations with a greater reliance on the domestic market may, in general, face greater future product demand uncertainties. This is especially true for Eurozone corporations that are an integral part of the European Union, and during long-lasting economic downturns, such as the Eurozone sovereign debt crisis. One important measure of a country's external economic dependency in terms of markets is the level of their exports. Countries that are highly reliant on income from export markets, would be more exposed to changes in global demand. Thus, export-oriented countries may be the ones that suffer the most when there is a global downturn. However, when the downturn is local, rather than global, export-oriented countries may actually be better off than countries primarily reliant on domestic markets. Indeed, the unconventional monetary policy of LTRO was initiated in response to the severe economic downturn in the European economies. In this framework, being a highly export-oriented country may actually have been an advantage in terms of stable cash flows and profits, and in meeting adequate liquidity needs if the global economy rebounded. Thus, our expectation with respect to cross-country dependency is that corporations that are located in countries that rely on the domestic market were the ones that were exposed the most to the Eurozone sovereign debt crisis. Accordingly, we expect the liquidity injection through LTROs to have the largest impact on corporations in countries with high domestic demand reliance, i.e., low export countries.

To investigate this impact, we separate our sample of Eurozone corporations into *High Export* and *Low Export* corporations. A corporation is included in the *High Export* (*Low Export*) subsample if it is located in a country, that has an export ratio to GDP above (below) median, in a given year. Based upon the sample of corporations in the Eurozone, the analysis is then conducted in the two subsamples. The results are presented in Table 8, where we find that corporations,

situated in countries with greater reliance on domestic markets (*Low Export*), in contrast to those in high export-oriented economies (*High Export*), significantly decreased their investment, following the LTRO liquidity injections. Again, for neither high nor low export oriented corporations, do we find a significant change in employment compensation. Since the objective of the LTRO liquidity injections was to stimulate the real economy, the greater decrease in investment for corporations with high domestic market dependency and the lack of a significant impact on employment compensation, provide evidence that suggests that the interventions does not necessarily help the real economy in the Eurozone. Moreover, demand uncertainty may have been the driver of the key finding of decreased investment following LTRO, with little impact from the liquidity interventions.

5.4 Institutional Environment: Corruption and Government Debt

As argues earlier, the institutional environment may affect corporate policies. Uncertainty in the institutional setting in a corporation's home country is particularly relevant during periods of financial crisis. As discussed in Julio and Yook (2012), the uncertainty "itself may be hindering a recovery by inducing firms to delay investment until the uncertainty related to future financial regulation and macroeconomic policy is resolved." They document that corporations decrease their investment due to political uncertainty. Using aggregate data, Pindyck and Solimano (1993) and Mauro (1995) also find that political uncertainty lowers investment and economic growth. In addition, Graham, Leary, and Roberts (2014) find that government debt is strongly negatively correlated with corporate investment, but positively correlated with corporate liquidity.

Considering the importance of the institutional environment, we expect that corporate policies around macro-liquidity injections may change the institutional environment of the country that the corporation is situated in. On the one hand, corporations in countries with a relatively poor institutional environment (such as more corrupt or high sovereign debt countries) are likely to be more conservative, and experience a greater decrease in their investment following the LTRO intervention, i.e, a bank lending shock. On the other hand, countries with high sovereign debt and greater corruption, such as Greece, may already face be facing severe austerity, since the start of the European crisis and, hence, there might be little room for them to further decrease investment. Of course, in the face of future demand uncertainty in the European area, we may observe a decrease in investment in countries with a strong institutional environment. Therefore, the poor

institutional environment might not be the driver of the decreasing investment after the LTRO liquidity injections.

To investigate the impact of the institutional environment on corporate policies after liquidity injections, we proxy for the institutional environment using country level Corruption Perceptions Index (CPI) and the sovereign debt levels. The CPI is a proxy for the threat of investor rights and is published by Transparency International, an independent agency, as the country’s ordinal position relative to the other countries in the index. We follow the method proposed by Fan, Titman, and Twite (2012) and transpose the published CPI score into an index ranging from zero to ten with ten, indicating a highly corrupt country. Then, we classify firms into subsamples based on their home countries CPI index. High CPI countries represents countries with CPI greater than five in a given year. We then conduct our investment analysis in the subsamples of firms located in *High Corruption* and *Low Corruption* countries, respectively. We present our results in Models 1 and 2 in Table 9. We find that the decrease in investment following the liquidity injection is concentrated in countries with a low corruption index, i.e., less corrupt countries. In Models 3 and 4, we further classify firms into subsamples based on their government debt level. *High Gov. Debt* (*Low Gov. Debt*) are countries with government debt to GDP ratio above (below) the median in a given year. Then, we conduct the investment analysis in the subsamples of high and low government debt. The results indicate that the decrease in investment following LTRO liquidity injection is concentrated in countries with low government debt. These findings are intuitive, since corporations may already have very low investment levels in a more corrupt and high government debt country. Although corporations are more concerned about political uncertainty in these countries, there is little room for a further deduction of investment. As a result, the decrease in investment following LTRO liquidity injection is driven mainly by corporations in relatively “good” countries, i.e., those that have lower levels of corruption and government debt.

5.5 Counter-factual Analysis

The results from the previous sections suggest that the LTRO was ineffective in boosting corporate investment, since corporations have other concerns besides the availability of macro-liquidity when making their investment decisions. In particular, corporations’ concern about the uncertainty in demand for their products may impede the positive impact of LTRO on the real economy.

Moreover our results suggest that corporations tend to hold more cash reserves after the LTRO liquidity injection. We also find evidence that corporations in “good countries” are the drivers of the poor investment. These findings help us to develop a better understanding for the real effects of the LTRO intervention and may have implications for the design of future monetary policies. However, in order to emphasize that our results do *not* imply that LTRO is bad for corporate investment (or that LTRO induces corporate non-investment), we conduct several counter-factual analyses in this section to understand the proper benchmark effect for the evaluation of LTROs. Specifically, we want to identify what the corporate policies may have been in the absence of the LTRO intervention.

To estimate the counter-factual effect of the LTRO intervention, we investigate corporate policies after the LTRO intervention in a sample of corporations that are located in the European Union (EU), where non-Eurozone corporations are used as the control group for the LTRO effects. While banks in the Eurozone countries may have had access to LTRO liquidity injections during the two rounds of the unconventional LTROs, non-Eurozone countries did not have such access.³¹ In order to account for major differences in economic conditions between countries and the respective deferred impact, we match the EU sample countries based upon their sovereign risk when we investigate the impact of LTRO. In particular, we measure country risk using the country’s CDS spreads two years before the LTRO intervention. *High (Low) Sovereign Risk* is defined as a CDS spread above (below) the median in the pre-intervention and crisis period (2009 and 2010). In Figure 3, we first compare the market-to-book values of Eurozone and non-Eurozone corporations across years. The market-to-book ratio is a relative metric, that measures the valuation of the corporation, with a market-to-book value of above one indicating a highly valued corporation. We observe an increasing trend in the market-to-book ratios for both Eurozone and non-Eurozone corporations following the LTRO injections. Most interesting, we see that while the difference between high and low risk country corporations’ market-to-book ratio in the Eurozone widened following the financial crisis, the spread actually declined following the LTRO intervention period. The decrease in the spread is, in particular, driven by Eurozone corporations in countries with high sovereign credit risk, as these exhibit a greater increase in the spread. In the meantime,

³¹This is valid with the exception of non-Eurozone banks with bank subsidiaries located in Eurozone. Also, we do not account for other stimulus measures that may have been implemented in the non-Eurozone countries during the same period.

the market-to-book ratio gap between the high and low risk groups of corporations outside the Eurozone increased even more following the intervention.

Next, we conduct a regression analysis in a sample of corporations that are located in the EU and where we use non-Eurozone corporations as our control group. The results for cash holdings, investment, and employee payments are presented in Table 10 Panel A, B, and C, respectively. In Model 1 of all panels, we use the full sample of corporations. The variable *LTRO Dummy* is a time dummy variable equal to 1 for year-quarter observations, after the ECB had implemented the first three-year LTRO intervention (Q4-2011), and indicates the timing of the LTRO intervention. The variable *Non-Eurozone* is a dummy equal to 1, for corporations that are located in a country that is not a part of the Eurozone. The variable *Non-Eurozone* \times *LTRO Dummy* is the interaction term between the LTRO intervention and the non-Eurozone dummies, and accordingly equal to 1, for non-Eurozone corporations after the first LTRO intervention. The coefficient of interest is that of *Non-Eurozone* \times *LTRO Dummy*, which captures the effect of the liquidity intervention on corporate policies in non-LTRO countries (the counter-factual effect). In the sample with both Eurozone and non-Eurozone corporations, we find that Eurozone corporations generally have higher cash holdings, lower investment and less employment compensation, during the post LTRO intervention period. Compared to corporations in the Eurozone, non-Eurozone firms have even lower cash holdings during the post LTRO intervention period. Moreover, we find a negative and significant coefficient for the term *Non-Eurozone* \times *LTRO Dummy* for both the investment and wages analyses, suggesting that those non-Eurozone corporations may have experienced an even greater decrease in investment compared to corporations in the Eurozone.

In Models 2 and 3 in Table 10 Panel A, B, C, we further separate our sample of corporations in the EU into high and low sovereign risk subsamples based on the risk of the country in which the corporations are located. The separation is similar to the one used in Figure 3. We then compare corporate policies during the post-LTRO intervention period for high and low sovereign risk groups. In the sample of corporations in low risk countries, we find that Eurozone corporations have a greater increase in their cash holdings following LTRO compared to non-Eurozone corporations (the counter-factual). However, the difference is not significant for the high risk group. We further find that Eurozone corporations generally experienced a greater decrease in their investment and wages for both high and low risk groups following LTRO, compared with non-Eurozone corporations. In

Figure 4, we also plot the level of cash holdings and investment of Eurozone and non-Eurozone corporations matched by sovereign risk around the LTRO liquidity injections. Before LTRO, they generally have a similar trend in their cash holdings and investment, which validates the matching based on country risk. However, after LTRO, Eurozone corporations exhibit a greater increase in their cash holdings. We also observe a slightly decrease in investment for Eurozone corporations.

If non-Eurozone corporations (or sovereign risk matched non-Eurozone corporations) are the appropriate counter-factual (subject to the caveats in previous footnotes), the results in this section suggest that although LTRO was inefficient in boosting the corporate investment, the economy might have fared even worse (with lower corporate liquidity, lower investment and employee payment) without the LTRO intervention.

6 Conclusions

Since the 2008 global financial crisis, major central banks around the world have virtually exhausted their conventional monetary policy tools to boost the real economy; for instance, interest rates have reached the zero bound for many countries. Consequently, they have resorted to unconventional monetary policies such as asset purchases and liquidity injections, and seem willing to do “whatever it takes” including targeting zero or even negative policy interest rates. There have been many studies on how such unconventional monetary policies affected asset prices as well as the transmission of these monetary interventions to commercial banks, the most directly affected entities. Remarkably, there has been relatively little discussion on how corporations are affected, either positively or negatively, by these policies, and, particularly, with regard to actual liquidity injections. In this paper, we fill this void and investigate the policies of non-financial corporations in the Eurozone and the European Union, more generally, following the unconventional interventions by the ECB. To this end, we provide direct evidence on the effects of central bank liquidity injections on the real economy.

Examining the impact of ECB’s Longer-Term Refinancing Operations (LTRO) in 2011 and 2012, we find that non-financial corporations in the Eurozone held more cash after these massive LTRO liquidity injections. The cash increase is closely related to the *actual* uptake of the banks under the LTRO program in their country of domicile. In other words, when the commercial banks

in a country received more funds from the ECB via the LTRO programs, non-financial corporations in the same country ended up with more cash. Moreover, we find that the increase in cash holdings is significant only for corporations with existing bank relationships. We conjecture that for those corporations without an existing connection with banks, it is unlikely that there would be a pass-through effect of liquidity injection to the banking sector. Furthermore, even for those with a bank relationship, we find that such corporations increased both total debt and net debt, even while they reduce their short-term debt after LTRO, suggesting they are indeed raise additional debt. However, in terms of the real economy, we do not find evidence of a positive impact of the liquidity intervention on corporate investment or employment in any of our alternative model specifications. In fact, we find that corporations *decreased* their investment when the banks in their home countries receive more money from the LTRO programs. Such an investment reduction exists for corporations irrespective whether or not they have a bank relationship.

We also find little evidence from the supply side to explain these strong investment results. Corporations reduced their investment after LTRO regardless of their industry structure or taxation environment. However, the effect is even more pronounced for corporations located in countries with less exports, lower corruption or more modest government debt. These findings suggest that the efficacy of ECB's unconventional liquidity policies was not only determined by the positive credit supply shock accompanying the intervention, but also by the economic uncertainty about future demand and costs perceived by corporate decision makers, which was not alleviated by the policy intervention.

Our findings indicate that non-financial corporations in the Eurozone were indeed affected by the ECB liquidity injections in terms of cash holdings and leverage. However, at least part of the impact turned out to be different from what the ECB intended. If corporations simply hoarded the cash that they borrowed from banks instead of hiring or investing, then the real economy could not have benefited from the flood of liquidity circulating around the banking system and on corporate balance sheets. Overall, our study casts doubt on the effectiveness of certain unconventional monetary policies in improving real economic output. Other unconventional monetary policies, including ECB's Targeted LTROs (and negative interest rates by the Bank of Japan and the ECB itself) or the more aggressive Outright Monetary Transactions, may result in different outcomes, but they should also be carefully discussed and analyzed. We leave these issues for future study when

additional data become available.

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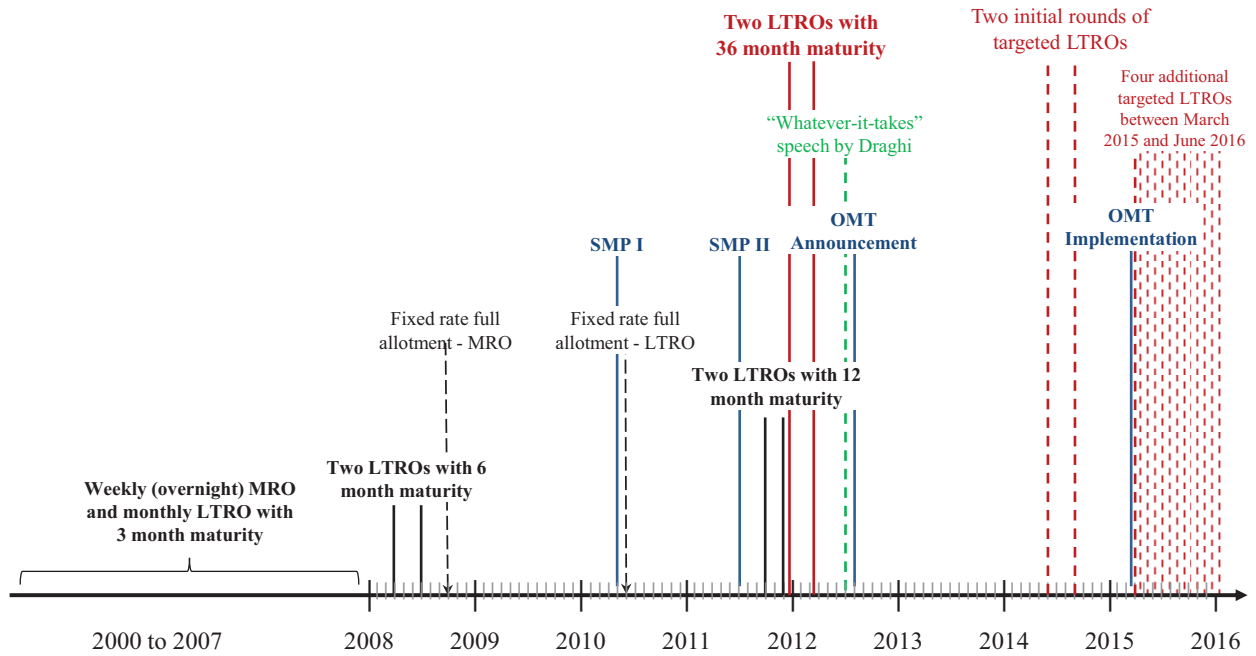


Figure 1: ECB's Unconventional Monetary Policies.

This figure outlines the time-line for recent unconventional monetary policies implemented by the European Central Bank (ECB). *MRO* labels the standard Marginal Refinancing Operations that are conducted on a weekly basis. *LTRO* refers to Longer-term Refinancing Operations, while *TLTRO* refers to the recently introduced Targeted Longer-Term Refinancing Operations. *SMP* the Security Market Program was recently replaced by the Outright Monetary Transaction (*OMT*) program. The "Whatever-it-takes"-event refers to a speech by Mario Draghi, the President of the ECB at the Global Investment Conference, London, July 26, 2012.

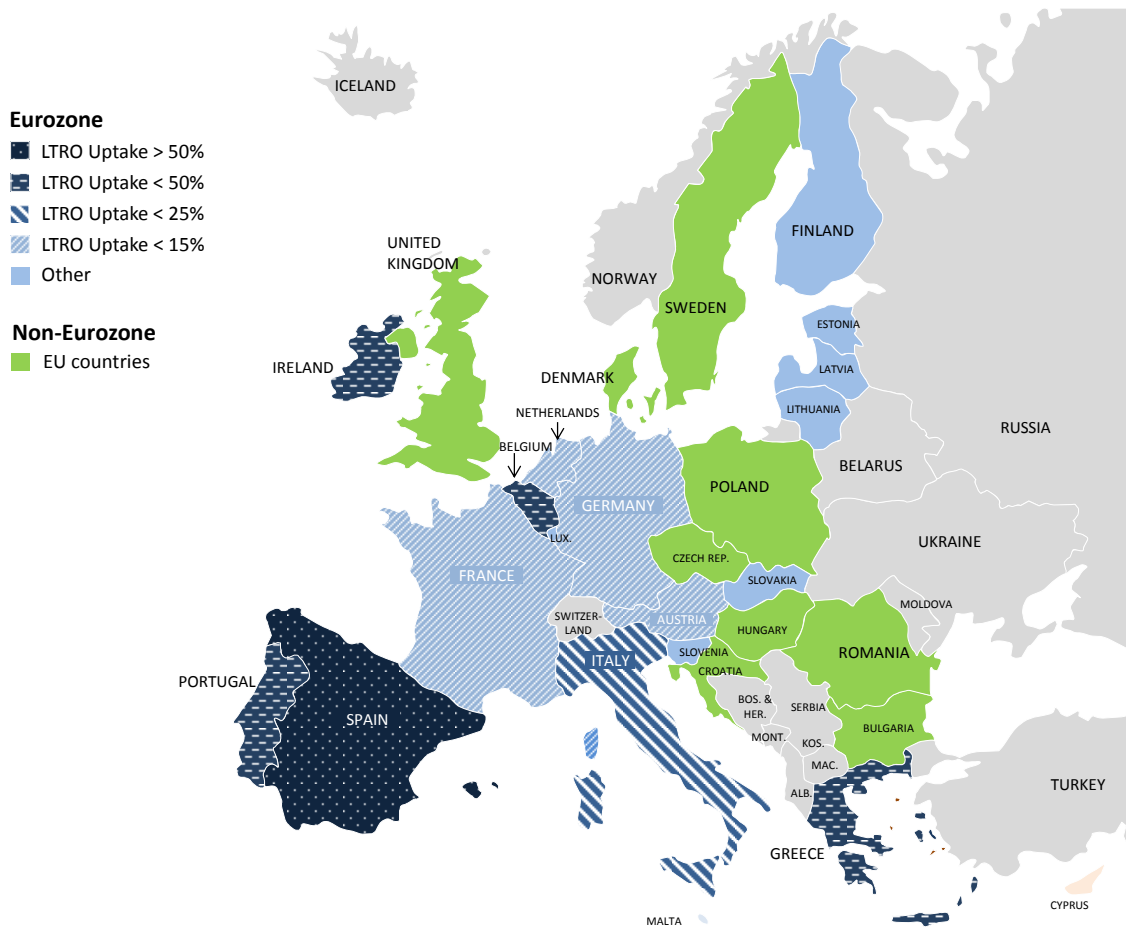


Figure 2: LTRO uptake in the Eurozone.

This figure outlines the total liquidity injection that countries within the Eurozone obtained from the three-year Longer-term Refinancing Operations (LTRO), which were initiated by the European Central Bank (ECB) in December 21, 2011 (LTRO I) and February 29, 2012 (LTRO II), respectively. The color scaling refers to the respective countries total LTRO uptake, scaled by the Central Government Debt. The information about the country-specific LTRO uptake is based upon hand-collected data from Bloomberg as well as central bank announcements and public commentaries. The information for central government debt by country, is obtained from the World Bank Database. In the case of Greece, we only have information about the total LTRO amount that, beside the three-year LTROs, also includes the standard 1-month and 3-month LTROs. As we cannot separate the latter out, the number is not directly comparable with the uptake numbers for other countries.

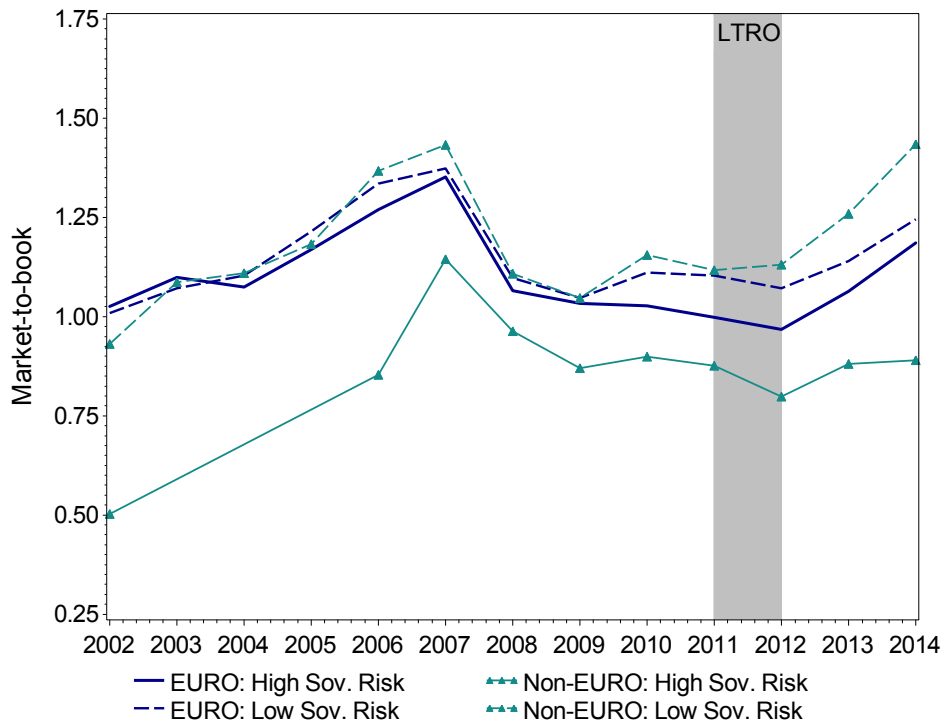
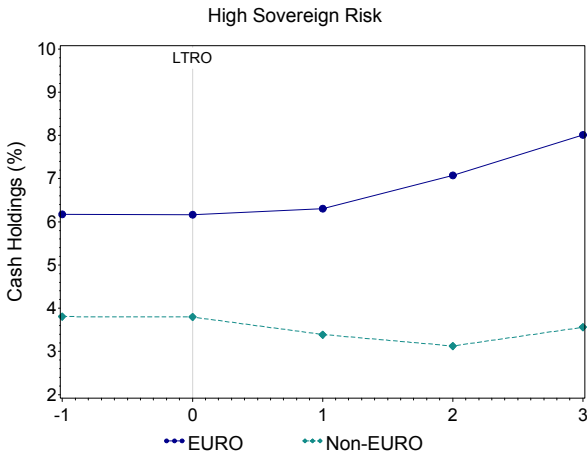
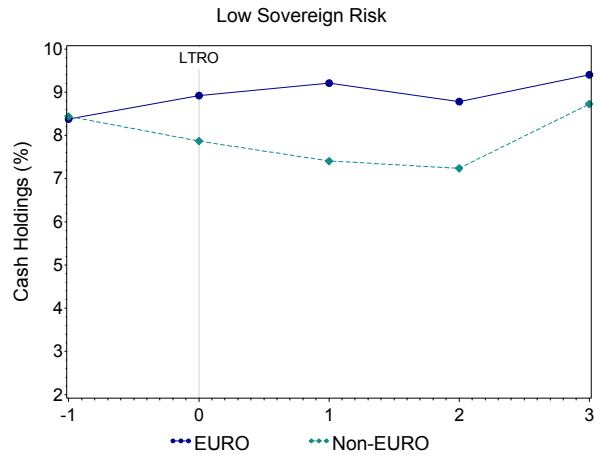


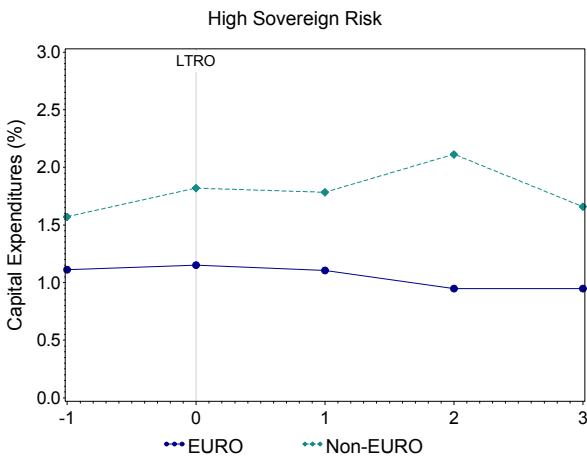
Figure 3: Time-series of the corporations' market-to-book ratio and the LTRO announcement and implementation. This figure outlines corporations' average (median) market-to-book ratio as a proxy for the stock market reaction to ECB interventions. Market-to-book is measured by the ratio of corporations' market value of equity to book value of equity and given on a yearly basis. The yearly measure is the median of quarterly observations. The time-series are conducted for low and high sovereign risk countries as well as Eurozone (EURO) and non-Eurozone (non-EURO) countries, respectively. The subsamples of high and low sovereign risk countries are based upon country's CDS spreads two years before the LTRO intervention.



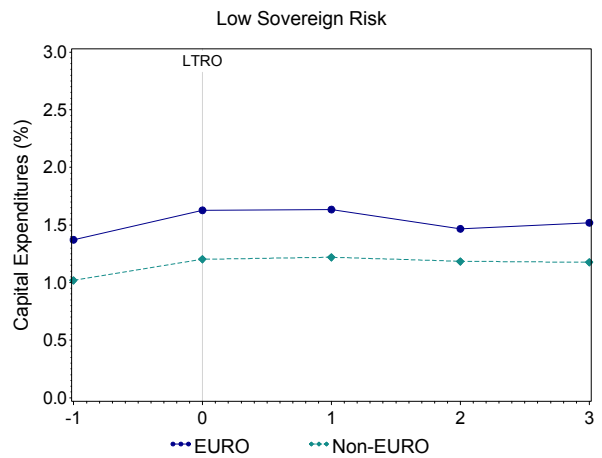
(a) Corporate cash holdings in high sovereign risk countries.



(b) Corporate cash holdings in low sovereign risk countries.



(c) Corporate investment in high sovereign risk countries.



(d) Corporate investment in low sovereign risk countries.

Figure 4: Time-series of corporate cash holdings and investment before and after the LTRO intervention.

The figures outline the development in corporations cash holdings (cash to assets ratio) and investment (capital expenditures to assets ratio) around the LTRO intervention in 2011/2012. Time 0 indicates the year of the first LTRO Intervention (2011) and the variable for cash (investment) is the average of the quarterly observations of the corporations cash to assets (capital expenditures to assets) ratio. Similarly, time -1 (“1”, “2” “3”) indicate the year 2010 (2012, 2013, 2014). We separate corporations into *EURO* and *Non-EURO* samples based upon whether they are located in a Eurozone, respectively non-Eurozone, country. Further, we provide the analyses separately for *High Sovereign Risk* and *Low Sovereign Risk* countries, where the separation is based upon countries CDS spread in the pre-intervention period (2009 and 2010).

Table 1: Liquidity injection from ECB's three-year Longer-term Refinancing Operations

This table presents the liquidity injections that Eurozone countries obtained from the three-year Longer-term Refinancing Operations (LTRO) that were initiated by the European Central Bank (ECB) in December 21, 2011 (LTRO I) and February 29, 2012 (LTRO II), respectively. The term *Uptake* refers to the amount that banks in the respective country obtained through LTRO I and II, with the numbers given in billion Euro. The *Total* refers to the total uptake through the two LTROs. In columns 4, we scale the *Total Uptake* for each country by the country's central government debt obligations, as of December 2011, respectively. The information about the country-specific LTRO uptake is based upon hand-collected data from Bloomberg as well as central bank announcements and public commentaries. The information for Government Debt by country is obtained from the World Bank Database.

Notes: ^a In the case of Greece, we only have information about the total LTRO amount that, beside the three-year LTROs, also includes the standard 1-month and 3-month LTROs. As we cannot separate the latter out, the number is not directly comparable with the uptake numbers for other countries.

Country	LTRO I: Dec. 2011	LTRO II: Feb. 2012	Total	LTRO Uptake
	EUR billion (1)	EUR billion (2)	EUR billion (3)	% of central government debt (4)
Austria	3.66	7.83	11.49	4.82
Belgium	45.28	43.71	88.99	25.02
France	5.59	6.52	12.12	0.61
Germany	12.25	13.13	25.38	1.67
Greece	60.94 ^a		60.94 ^a	25.54
Ireland	21.91	17.62	39.52	22.33
Italy	172.08	128.11	300.20	15.92
Netherlands	8.86	1.96	10.81	2.58
Portugal	24.54	24.76	49.30	29.37
Spain	153.21	165.53	318.74	51.44
Total	508.32	409.17	917.49	

Table 2: Summary statistics

This table provides sample averages (medians) of corporate characteristics for each country in our sample of Eurozone corporations. *Cash*, is the ratio of cash and short term investments to total assets. *Capital Expenditure* is the ratio of capital expenditure to total assets. *Wages* is the total salaries and wages, given in logarithms. *Leverage* is measured as the book value of the long-term debt plus debt in current liabilities, divided by total assets. *Net Debt* is defined as the ratio of current plus non-current liabilities minus cash holdings to total assets. *Short-term Debt* is defined as the ratio of current liabilities to total assets. *Bank Debt* is the amount of debt from bank loans, divided by total assets. *Size* is the logarithm of total assets. *Mrkt-to-Bk* is the book value of assets minus the book value of equity plus the market value of equity, all divided by the book value of assets. *Cash Flow/Assets* is the ratio of the cash flow to total assets, where cash flow is defined as the earnings after interest and related expenses, income taxes, and dividends. *Industry Sigma* is industry cash flow risk, measured by the mean cash flow volatility across two digit SIC codes. *Net Working Capital* is measured as the difference between current assets and current liabilities net of cash, divided by total assets. *R&D/Sales* is the ratio of R&D to sales. *Acquisition Activity* is the ratio of acquisitions to total assets. *Ind. Competition* is the Herfindahl-Hirschmann Index (HHI) industry competition measure. *Sovereign CDS* is the 5 year sovereign CDS spread for the country. *Sovereign Export* is the countries export to GDP ratio. *Government Debt* is the countries central government debt to GDP ratio given as a percentages. *Unemployment Rate* is the countries percentage of unemployed labor force. *Corruption* is the countries corruption perception index (CPI index) which ranges from 0 to 10, with 10 indicating the most corruptive country. *Corporate Tax* is the countries corporate tax rate given in percentage. The sample period for each country is 2002-2014, and the variables are based on quarterly corporate fundamental observations. If data are not available for a specific quarter, we replace the missing value with the yearly observation. Ratios are given in percentages.

Country	DEU	FRA	ITA	GRC	NLD	FIN	ESP	BEL	AUT	IRL	PRT	Total
Corporate Measures												
Cash	10.07	10.23	6.96	4.15	6.82	8.06	7.08	8.01	8.85	11.37	4.00	8.29
Investment	3.31	3.05	2.47	2.48	3.11	3.39	3.29	3.85	5.41	2.56	3.16	3.12
Wages	1.85	1.86	2.30	1.19	2.88	2.16	3.30	2.10	3.15	1.30	2.77	2.07
Leverage	16.40	19.06	27.63	33.97	22.80	23.86	28.33	22.42	22.35	21.28	40.2	22.07
Net Debt	55.58	59.01	64.26	60.54	58.65	57.39	63.95	56.70	55.96	55.04	73.59	59.01
Short-term Debt	0.05	0.06	0.11	0.16	0.05	0.07	0.08	0.05	0.08	0.03	0.14	0.07
Bank Debt	11.36	9.97	20.99	21.78	13.38	15.49	22.47	11.43	14.23	12.56	22.58	14.54
Size	4.53	4.59	5.70	4.84	6.32	4.99	6.42	5.15	5.44	5.69	5.92	5.02
Market to Book	120.0	121.6	114.4	95.2	128.9	125.9	123.4	114.7	114.7	128.9	106.9	117.9
Cash Flow /As.	4.84	3.57	3.07	1.62	5.80	7.21	5.89	4.81	5.36	2.90	2.96	4.10
Industry Sigma	7.61	5.69	3.20	3.07	5.53	4.43	2.59	4.48	3.30	4.55	2.97	4.85
Net Working Cap.	6.17	1.90	0.85	5.11	2.13	3.75	-2.08	-0.58	3.38	0.55	-7.76	2.75
R&D/Sales	0	0	0	0	0	0.47	0	0	0	0	0	0
Acquisition Act.	0	0	0	0	0	0	0	0	0	0	0	0
Ind. Competition	13.75	13.74	13.19	10.48	14.74	13.62	14.02	14.52	14.46	14.34	13.48	13.73
Country Measures												
Sovereign CDS	10.55	11.71	52.00	56.40	29.95	13.09	50.74	24.96	10.35	27.89	36.86	17.62
Sovereign Export	42.25	27.12	26.21	22.10	69.27	39.08	25.51	76.44	51.00	90.48	29.91	31.12
Government Debt	67.06	67.01	105.9	126.6	50.27	41.69	50.08	101.8	73.17	32.54	69.23	69.88
Corruption	2.1	3.1	5.7	6	1.099	0.8	3.5	2.6	2.1	2.5	3.7	2.9
Corporate Tax	30.17	35.42	31.4	29	25.5	26	30	33.99	25	12.5	29	34.43
# Observations	31333	30712	10825	9810	6594	6000	5443	4939	3376	2519	2392	113943
# Corporations	837	837	285	233	190	143	136	124	92	75	57	3,009

Table 3: LTRO uptake effect on cash holdings

This table presents estimates of the effect of the liquidity uptake through ECB's three-year Longer-term Refinancing Operations (LTRO) on corporate cash holdings in a sample of corporations that are located in the Eurozone. *Cash* is defined as cash and cash equivalents, scaled by total assets. Model 1 outlines our base cash model that in addition to base cash holding determinants includes the country specific controls *Sovereign CDS* and *Sovereign Export*. The variable *LTRO Uptake* is equal to zero until Q4-2011, and is equal to the country-specific total LTRO uptake amount, scaled by the central government debt of the country, thereafter. The coefficient of interest is that of *LTRO Uptake*, which captures the effect of the country-specific significance of the liquidity intervention on corporate leverage policies. The sample period is 2002-2014, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

	Cash		
	(1)	High Bank Debt (2)	Low Bank Debt (3)
LTRO Uptake	2.169*** (0.56)	2.609*** (0.61)	0.166 (0.98)
Industry Sigma	0.021 (0.01)	0.102*** (0.02)	-0.016 (0.02)
Cash Flow/Assets	0.001 (0.00)	0.000 (0.00)	0.004 (0.00)
Market to Book	0.014*** (0.00)	0.015*** (0.00)	0.015*** (0.00)
Size	-0.113 (0.07)	-0.714*** (0.10)	0.662*** (0.12)
Net Working Capital	-0.124*** (0.00)	-0.064*** (0.00)	-0.188*** (0.00)
Capital Expenditure	-0.121*** (0.00)	-0.037*** (0.01)	-0.190*** (0.01)
Leverage	-0.167*** (0.00)	-0.140*** (0.00)	-0.199*** (0.00)
Div. Dummy	0.665*** (0.08)	0.388*** (0.11)	0.752*** (0.12)
R&D/Sales	0.015*** (0.00)	0.029*** (0.00)	0.019*** (0.00)
Acquisition Activity	-0.023*** (0.00)	0.035*** (0.01)	-0.047*** (0.01)
Sovereign CDS	1.491*** (0.29)	0.295 (0.26)	0.785** (0.39)
Sovereign Export	0.552** (0.24)	-0.036** (0.01)	-0.053*** (0.01)
Rated	-0.048*** (0.01)	0.846 (0.52)	1.862*** (0.37)
Time fixed effect	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes
R-square	0.767	0.589	0.778
N	82053	30126	43777

Table 4: LTRO uptake effect on leverage policies

This table presents estimates of the effect of the liquidity uptake through ECB's three-year Longer-term Refinancing Operations (LTRO) on leverage in a sample of corporations that are located in the Eurozone. *Leverage* is measured as the book value of the long-term debt plus debt in current liabilities, divided by total assets. *Net Debt* is defined as the ratio of current plus non-current liabilities minus cash holdings to total assets. *Short-term Debt* is defined as the ratio of current liabilities to total assets. The variable *LTRO Uptake* is equal to zero until Q4-2011, and is equal to the country-specific total LTRO uptake amount, scaled by the central government debt of the country, thereafter. The coefficient of interest is that of *LTRO Uptake*, which captures the effect of the country-specific significance of the liquidity intervention on corporate leverage policies. The sample period is 2002-2014, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

	Leverage	Net Debt	Short-term Debt
	(1)	(2)	(3)
LTRO Uptake	4.420*** (0.65)	3.554*** (1.15)	-0.012*** (0.00)
Industry Sigma	0.112*** (0.01)	0.106*** (0.03)	0.001*** (0.00)
Cash Flow/Assets	-0.059*** (0.00)	-0.123*** (0.00)	-0.000** (0.00)
Market to Book	0.008*** (0.00)	0.051*** (0.00)	0.000 (0.00)
Size	2.640*** (0.09)	-3.271*** (0.18)	0.001 (0.00)
Net Working Capital	-0.302*** (0.00)	-0.633*** (0.00)	-0.005*** (0.00)
Capital Expenditure	-0.173*** (0.01)	-0.239*** (0.01)	-0.001*** (0.00)
Cash	-0.228*** (0.00)	-0.549*** (0.00)	-0.002*** (0.00)
Div. Dummy	-1.271*** (0.09)	-1.196*** (0.18)	-0.005*** (0.00)
R&D/Sales	-0.013*** (0.00)	0.013* (0.00)	-0.000*** (0.00)
Acquisition Activity	0.064*** (0.01)	0.007 (0.01)	-0.000 (0.00)
Rated	0.020 (0.34)	-1.234* (0.65)	-0.002 (0.00)
Sovereign CDS	2.763*** (0.28)	0.559 (0.45)	0.010*** (0.00)
Sovereign Export	-0.106*** (0.01)	-0.021 (0.02)	-0.000 (0.00)
Time fixed effect	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes
R-square	0.795	0.778	0.801
N	82053	64040	57166

Table 5: LTRO uptake effect on investment and employment

This table presents estimates of the effect of the liquidity uptake through ECB's three-year Longer-term Refinancing Operations (LTRO) on corporate investment and employment compensation in a sample of corporations that are located in the Eurozone. Our measure for investment is *Investments*, which is the corporation's capital expenditure, scaled by total assets. Our measure for employment compensation is *Wages*, which is the corporations' total salaries and wages, given in logarithms. In Model 2 and 4 we include, in addition to base investment and employment compensation determinants, lagged values of alternative investment measures and other corporate and industry controls. The variable *LTRO Uptake* is equal to zero until Q4-2011, and is equal to the countries' total LTRO uptake amount, scaled by the country's central government debt, afterwards. The coefficient of interest is that of *LTRO Uptake*, which captures the country-specific significance of the liquidity intervention. The sample period is 2002-2014, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

	Investments		Wages	
	(1)	(2)	(3)	(4)
LTRO Uptake	-1.695*** (0.24)	-1.350*** (0.25)	-0.145 (0.08)	-0.101 (0.09)
Cash Flow/Assets	0.009*** (0.00)	0.005** (0.00)	-0.004*** (0.00)	-0.007*** (0.00)
Market to Book	0.004*** (0.00)	0.004*** (0.00)	0.000*** (0.00)	0.000** (0.00)
Size	0.127*** (0.03)	0.218*** (0.04)	0.675*** (0.01)	0.365*** (0.02)
Leverage	-0.016*** (0.00)	-0.020*** (0.00)	-0.001** (0.00)	-0.001 (0.00)
Rated	0.332*** (0.12)	0.340** (0.14)	0.100 (0.06)	0.135** (0.06)
Sovereign CDS	-0.771*** (0.10)	-0.670*** (0.10)	-0.102** (0.05)	-0.055 (0.05)
Sovereign Export	-0.014*** (0.00)	-0.017*** (0.00)	0.004* (0.00)	0.004* (0.00)
Lagged Div. Dummy		0.118*** (0.04)		-0.019 (0.01)
Lagged R&D/Sales		0.580*** (0.13)		0.028 (0.05)
Lagged Acquisition Act		-2.409*** (0.36)		-0.481*** (0.15)
Industry Sigma		-0.014** (0.00)		-0.001 (0.00)
Net Working Capital		-0.007*** (0.00)		-0.000 (0.00)
Log Sales		0.148*** (0.03)		0.356*** (0.01)
Competition		0.001 (0.00)		-0.005*** (0.00)
Time fixed effect	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes
R-square	0.568	0.597	0.787	0.790
N	86392	64635	51997	47910

Table 6: Bank debt reliance and LTRO uptake effect on corporate policies

This table presents estimates of the effect of corporate reliance on bank debt and the liquidity uptake through ECB's three-year Longer-term Refinancing Operations (LTRO) on corporate policies in a sample of corporations that are located in the Eurozone. Bank Debt is the debt from bank loans, divided by total assets (or total debt). In Models 1 and 2, and Models 3 and 4 corporations are separated into those with *High* and *Low Bank Debt* ratios based upon their bank debt ratio one year before the first three-year LTRO intervention (Q4-2010). In Model 1 and 2, we analyze the impact on corporate investments (capital expenditures scaled by total assets). Likewise, in Model 3 and 4 wages (salaries given in logarithmic scale), respectively. The variable *LTRO Uptake* is equal to zero until Q4-2011, and equal to the country-specific total LTRO uptake amount, scaled by the central government debt of the country, thereafter. The coefficient of interest is that of *LTRO Uptake*, which captures the effect of the country-specific significance of the liquidity intervention on corporate leverage policies. The sample period is 2002-2014, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

	Investments		Wages	
	High Bank Debt (1)	Low Bank Debt (2)	High Bank Debt (3)	Low Bank Debt (4)
LTRO Uptake	-1.286*** (0.37)	-1.123*** (0.33)	-0.023 (0.10)	-0.199 (0.15)
Cash Flow/Assets	0.015*** (0.00)	0.007*** (0.00)	-0.006*** (0.00)	-0.004*** (0.00)
Market to Book	0.007*** (0.00)	0.004*** (0.00)	0.000 (0.00)	0.000*** (0.00)
Size	0.184*** (0.06)	0.087** (0.04)	0.712*** (0.02)	0.668*** (0.02)
Leverage	-0.019*** (0.00)	-0.013*** (0.00)	-0.001 (0.00)	-0.000 (0.00)
Rated	0.615** (0.30)	0.152 (0.12)	0.171 (0.10)	0.071 (0.07)
Sovereign CDS	-0.689*** (0.16)	-0.620*** (0.13)	-0.145** (0.06)	-0.055 (0.07)
Sovereign Export	-0.012 (0.01)	-0.020*** (0.00)	-0.003 (0.00)	0.006* (0.00)
Time fixed effect	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes
R-square	0.524	0.563	0.779	0.789
N	31262	45556	20201	28804

Table 7: Product supply and LTRO uptake effect on investment policies

This table presents estimates of the effect of product supply and the liquidity uptake through ECB's three-year Longer-term Refinancing Operations (LTRO) on investment policies in a sample of corporates that are located in the Eurozone. Our measure for investment is *Investments*, which is the corporation's capital expenditure, scaled by total assets. In Models 1 and 2, corporations are separated into high and low industry competition based on the corporates' SIC-code classification and the related industry's Herfindahl-Hirschman index (HHI). The Herfindahl-Hirschman index (HHI) is given as the sum of squared market shares of corporates within the same industry and for a given year. *High (Low) Ind. Competition* is defined as a HHI below (above) the median in a given year. In Models 3 and 4, corporations are separated into high and low tax based on their location and the respective country's corporate tax rate. The corporate tax rate is given on a yearly basis. *High (Low) Corporate Tax* is defined as a corporate tax rate below (above) the median one year before the first three-year LTRO intervention (2010). The variable *LTRO Uptake* is equal to zero until Q4-2011, and equal to the country-specific total LTRO uptake amount, scaled by the central government debt of the country, thereafter. The coefficient of interest is that of *LTRO Uptake*, which captures the effect of the country-specific significance of the liquidity intervention on corporate policies. The sample period is 2002-2014, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

	Investments		Investments	
	High Ind. Competition (1)	Low Ind. Competition (2)	High Corporate Tax (3)	Low Corporate Tax (4)
LTRO Uptake	-1.575*** (0.27)	-1.324*** (0.43)	-1.188*** (0.29)	-2.644*** (0.76)
Cash Flow/Assets	0.010*** (0.00)	-0.000 (0.00)	0.005*** (0.00)	0.025*** (0.00)
Market to Book	0.003*** (0.00)	0.005*** (0.00)	0.004*** (0.00)	0.004*** (0.00)
Size	0.302*** (0.04)	0.472*** (0.06)	0.041 (0.03)	0.351*** (0.07)
Leverage	-0.013*** (0.00)	-0.022*** (0.00)	-0.016*** (0.00)	-0.014*** (0.00)
Rated	0.167 (0.14)	0.569*** (0.21)	0.344*** (0.12)	0.064 (0.35)
Sovereign CDS	-0.623*** (0.11)	-0.786*** (0.19)	-12.483*** (3.55)	-0.757*** (0.13)
Sovereign Export	-0.015** (0.00)	-0.009 (0.01)	-0.030*** (0.00)	0.002 (0.00)
Time fixed effect	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes
R-square	0.625	0.660	0.575	0.551
N	55646	30363	63693	22699

Table 8: Export dependence and LTRO uptake effect on investment

This table presents estimates of the effect of the liquidity uptake through ECB's three-year Longer-term Refinancing Operations (LTRO) on corporate investment in a sample of corporations that are located in the Eurozone. Our measure for corporates' investment is *Capital Expenditure* which is the corporate capital expenditure, scaled by total assets. The variable *LTRO Uptake* is equal to zero until Q4-2011, and equal to the country-specific total LTRO uptake amount, scaled by the central government debt of the country, thereafter. In Models 1 and 2, corporations are separated into low and high sovereign export based on the home countries' export to GDP ratio. The export data are given on a yearly basis. High (Low) Export is defined as an export to GDP ration above (below) the median in a given year. The coefficient of interest is that of LTRO Uptake, which captures the effect of the country-specific significance of the liquidity intervention on corporate cash holdings. The sample period is 2002-2014, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

	Investments	
	Low Export (1)	High Export (2)
LTRO Uptake	-1.504*** (0.26)	-0.411 (0.59)
Cash Flow/Assets	0.006*** (0.00)	0.009*** (0.00)
Market to Book	0.004*** (0.00)	0.004*** (0.00)
Size	-0.013 (0.04)	0.467*** (0.06)
Leverage	-0.013*** (0.00)	-0.015*** (0.00)
Rated	0.194 (0.14)	0.721*** (0.26)
Sovereign CDS	-0.680*** (0.10)	-1.740 (4.06)
Sovereign Export	-0.070*** (0.00)	0.011 (0.00)
Time fixed effect	Yes	Yes
Firm fixed effect	Yes	Yes
R-square	0.591	0.625
N	61206	25186

Table 9: Institutional Environment and LTRO uptake effect on investment policies

This table presents estimates of the effect of the institutional environment and the liquidity uptake through ECB's three-year Longer-term Refinancing Operations (LTRO) on corporate policies in a sample of corporates that are located in the Eurozone. Our measure for investment is *Investments*, which is the corporation's capital expenditure, scaled by total assets. In Models 1 and 2, corporations are separated into low and high corruption based on the home countries' CPI index, which ranges from 0 to 10, with 10 indicating a highly corrupt country. The CPI index is given on a yearly basis. *High (Low) Corruption* is defined as a corruption index higher than 5 in a given year. In Models 3 and 4, corporations are separated into high and low government debt based on this and the respective country's government debt scaled to total assets. The ratio is given on an annual basis. *High (Low) Gov. Debt* is defined as a government debt to GDP ratio above (below) the median in a given year. The variable *LTRO Uptake* is equal to zero until Q4-2011, and equal to the country-specific total LTRO uptake amount, scaled by the central government debt of the country, thereafter. The coefficient of interest is that of LTRO Uptake, which captures the effect of the country-specific significance of the liquidity intervention on corporate policies. The sample period is 2002-2014, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

	Investments		Investments	
	High Corruption (1)	Low Corruption (2)	High Gov. Debt (3)	Low Gov. Debt (4)
LTRO Uptake	2.515 (2.67)	-1.909*** (0.25)	2.113*** (0.78)	-1.346*** (0.31)
Cash Flow/Assets	0.034*** (0.00)	0.008*** (0.00)	0.017*** (0.00)	0.005** (0.00)
Market to Book	0.003*** (0.00)	0.004*** (0.00)	0.004*** (0.00)	0.003*** (0.00)
Size	0.320*** (0.10)	0.111*** (0.03)	0.146*** (0.05)	0.214*** (0.04)
Leverage	-0.007** (0.00)	-0.015*** (0.00)	-0.012*** (0.00)	-0.017*** (0.00)
Rated	-0.376 (0.40)	0.380*** (0.12)	0.239 (0.20)	0.413** (0.16)
Sovereign CDS	-0.240 (0.18)	-5.413*** (2.08)	-0.334** (0.13)	-17.803*** (4.82)
Sovereign Export	-0.137* (0.07)	-0.003 (0.00)	-0.056*** (0.01)	0.008 (0.00)
Time fixed effect	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes
R-square	0.525	0.586	0.612	0.605
N	13206	73186	36552	49840

Table 10: Counter-factual analysis of LTRO and corporate policies for high and low risk countries.

This table presents estimates of the counter-factual effect of the effect of the liquidity uptake through ECB's three-year Longer-term Refinancing Operations (LTRO) on corporate policies in a sample of corporations that are located in the European Union (EU) inside and outside the Eurozone. To estimate the counter-factual effect of the LTRO intervention we add some counter-factual controls to our base model for corporate cash holdings (investments and wages). The variable *LTRO Dummy* is a dummy variable equal to 1 for year-quarter observations after the ECB had implemented the first three-year LTRO intervention (Q4-2011) and indicates the timing of the LTRO intervention. The variable *Non-Eurozone* is a dummy equal to 1 for corporations that are located in a country that is not a part of the Eurozone (for details see Appendix B2). The variable *Non-Eurozone x LTRO Dummy* is the interaction variable between the LTRO intervention and non-Eurozone dummies, and, accordingly, equal to 1 for non-Eurozone corporations after the first LTRO intervention. In Model 1, we use the full sample of corporations. In Models 2 and 3, corporations are separated into high and low risk sovereigns based on their location and the respective country's CDS spreads two years before the LTRO intervention. *High (Low) Sovereign Risk* is defined as a CDS spread above (below) the median in the pre-intervention and crisis period (2009 and 2010). In Panel A we present the estimates when analyzing corporate cash holdings, in Panel B we present the estimates when analyzing corporate investment, and in Panel C we present the estimates when analyzing corporate wages. The coefficient of interest is that of *Non-Eurozone x LTRO Dummy*, which captures the effect of the liquidity intervention on corporate policies in non-LTRO countries (counter-factual effect). The sample period is 2002-2014, based on quarterly observations. In all specifications, we use controls as well as firm and time fixed effects. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

<i>Panel A: Cash Holdings</i>			
	Cash	Cash	
	Full sample	High Risk Sovereign	Low Risk Sovereign
	(1)	(2)	(3)
LTRO Dummy	0.396** (0.20)	-0.014 (0.33)	0.965*** (0.27)
Non-Eurozone	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)
LTRO Dummy x Non-Eurozone	-0.932*** (0.11)	0.061 (0.21)	-1.050*** (0.15)
R-square	0.751	0.677	0.762
N	144604	36258	103686
<i>Panel B: Investment</i>			
	Investment	Investments	
	Full sample	High Risk Sovereign	Low Risk Sovereign
	(1)	(2)	(3)
LTRO Dummy	-0.377*** (0.08)	-0.470** (0.18)	-0.627*** (0.10)
Non-Eurozone	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)
LTRO Dummy x Non-Eurozone	-0.516*** (0.05)	-0.927*** (0.11)	-0.408*** (0.06)
R-square	0.583	0.518	0.617
N	150671	37961	107834
<i>Panel C: Employment Compensation</i>			
	Wages	Wages	
	Full sample	High Risk Sovereign	Low Risk Sovereign
	(1)	(2)	(3)
LTRO Dummy	-0.086** (0.04)	-0.045 (0.05)	-0.176*** (0.05)
Non-Eurozone	-0.244 (0.26)	-0.247 (0.18)	0.000 (0.00)
LTRO Dummy x Non-Eurozone	-0.075*** (0.02)	-0.099*** (0.03)	-0.153*** (0.02)
R-square	0.774	0.842	0.769
N	91729	19902	69184
Controls	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes

Appendix A Background on ECB Liquidity Injections

This section provides some institutional background about ECB's LTRO, i.e., LTRO I and II and TLTRO.

Monetary Operations by the ECB in early 2000

In general, the ECB conducts repo auctions as weekly main refinancing operations (MRO) with a biweekly maturity, and as monthly longer term refinancing operations (LTRO) that mature after three months. Although MROs are the ECB's primary policy instrument, LTROs are far from negligible. In 2003, refinancing via LTROs amounted to 45 billion Euro, which, at that point in time, was about 20% of the overall liquidity provided by the ECB.

6 month Longer-Term Refinancing Operations³²

On 28 March 2008, the Governing Council of the ECB announced that it would conduct supplementary LTROs with a maturity of six months and, in addition, conduct further supplementary three month LTROs. The regular monthly LTROs remained unaffected. In particular, the three- and six month were carried out through a variable rate standard tender procedure. The six-month LTRO came in two rounds (allotted, respectively, on April 2 and July 9, 2008) and were both preset with an amount of 25 billion Euro. The two supplementary three-month LTROs were allotted on May 21 and June 11, 2008, and were both preset with an amount of 50 billion Euro to replace the outstanding three-month LTRO of 60 billion Euro each.

Fixed rate-full allotment

In October 2008, the European Central Bank (ECB) switched to a fixed rate-full allotment mode for its refinancing operations. This implied that the Eurozone banks, from this time on, were able to obtain unlimited short-term liquidity from the central bank at a fixed rate, provided that they pledged sufficient eligible collateral.

³²<https://www.ecb.europa.eu/press/pr/date/2008/html/pr080328.en.html>

Fixed rate tender procedure with full-allotment in three-month LTROs³³

On June 10, 2010, the Governing Council of the European Central Bank decided to adopt a fixed rate tender procedure with full allotment in the regular three-month LTROs to be allotted on 28 July, 25 August and 29 September 2010.

12 month Longer-Term Refinancing Operations³⁴

The Governing Council of the ECB decided on October 6, 2011 to conduct two LTROs; one to be conducted in October 2011, with a maturity of approximately 12 months, and the other to be conducted in December 2011, with a maturity of approximately 13 months. The operations were introduced as fixed rate tender procedures with full allotment and were in addition to the regular and special term refinancing operations.

Three-year Longer-Term Refinancing Operations (LTRO I and II)³⁵

On 8 December 2011, the Governing Council of the ECB announced its provision of two so-called longer-term refinancing operations (LTROs) with a maturity of three years, with the option of early repayment after one year. The operations were set in place in order to increase the ECB's support to the Eurozone banking sector, but also to improve real economy. Moreover, "there is no limit on what the banks can do with the money".³⁶ In particular, the two LTROs were allotted on 21 December 2011 (LTRO I) and 29 February 2012 (LTRO II) respectively.³⁷ In October 2008, as the ECB switched to the so called Fixed Rate Full Allotment (FRFA) policy, meaning that the ECB stands ready to offer all the liquidity banks ask at its Main Refinancing Rate (MRO), there was no "cap" on the total amount provided by the ECB. The only restriction banks faced was the amount of eligible collateral they could bring to the ECB for these repo operations. Also, there was a haircut according to the type and quality of the collateral, meaning that the loan pledged was somewhat smaller than the market value of the collateral. The haircut acted as a credit cushion to the ECB and central banks. The interest rate on the two long-term loans was an average of the

³³http://www.ecb.europa.eu/press/pr/date/2010/html/pr100610_1.en.html

³⁴https://www.ecb.europa.eu/press/pr/date/2011/html/pr111006_4.en.html

³⁵https://www.ecb.europa.eu/press/pr/date/2011/html/pr111208_1.en.html

³⁶http://www.nytimes.com/2011/12/22/business/a-central-bank-doing-what-central-banks-do.html?_r=0

³⁷Loans were settled one day after the allotment, on 22 December 2011 and 1 March 2012, respectively with maturity 29 January 2015 and 26 February 2015.

interest rate on the Marginal Refinancing Operation (MRO) rate, i.e. the overnight rate, in order to be neutral compared to shorter term loans.³⁸ The fundamental difference between the LTRO and other regular refinancing operations, therefore, lies basically in the maturity and the long-term horizon which allowed banks to relax their maturity mismatch between assets and liabilities, and a more reliable liquidity management. In this sense, the LTRO also eased credit conditions not only by allowing banks to borrow unlimited funds for three years (given the provision of eligible collateral), but also assisted banks in managing their "gap risk", i.e., it facilitated the ability of banks to match the tenor of their assets and liabilities. Prior to LTRO, many banks were only able to secure overnight funding. Banks used the two LTRO loans to both rollover previous central bank borrowing, and to obtain new borrowing. In total, 523 credit institutions participated in the first LTRO, and were provided by 489.2 billion Euro, which amounted to a net injection of 210 billion Euro³⁹. As outlined by Fitch Ratings the participants in the first LTRO round can roughly be divided in two groups.⁴⁰ On the one side, banks of the periphery countries were highly active due to their actual capital needs as the LTRO provide them their only option to access medium-term funding. However, for many banks/countries participating in the unconventional LTRO simply provided an opportunity to replace shorter-term funds with 1% three-year borrowing. As outlined by the ECB, 45.72 billion Euro of the total uptake was used to replace the 12-month allotment that took place in October 2011.⁴¹ In particular, a total of 123 counter parties chose this option, of which many were located in high rated, safe countries like France and Germany, which took up a significant share. In particular, the ECB outlines that banks that placed the highest bids, were the banks that 1) had a highest upcoming rollover need, and 2) had the lowest maturity structure (average tenor). On the other hand, it was also claimed that some certain banks also avoided LTRO due to alleviating concerns that banks that took part would be stigmatized as troubled institutions.⁴²

As outlined in Carpinelli and Crosignani (2015), a considerable portion of the banks' collateral

³⁸The interest rate on the two long-term loans was also calculated to be neutral compared to shorter term loans. Banks had the option to repay earlier, after one year, and the interest rate, paid at maturity, was very low (approximately one percent) and equal to the average rate of MROs over the life of the operation.

³⁹This amount is the injection net of other operations conducted the same weeks (like 3-month operations and regular weekly operations) and operations maturing at these dates.

⁴⁰Source: Fitch Ratings Special Report European Banks' Use of LTRO as of 28 February 2012

⁴¹Source: ECB Monthly Bulletin, January 2012

⁴²See for instance <http://www.zerohedge.com/contributed/ltro-users-manual>

was already pledged at ECB at the time of the first allotment; thus, in order to "push" the LTRO uptake in the second round, the central banks relaxed the collateral requirements at the time of the LTRO allotments. For instance, it reduced the rating threshold for certain asset-backed securities (ABS), and also allowed rated corporate loans as collateral, as long as these were processed through national central banks, and an appropriate hair-cut was taken. In general, the ECB always provided liquidity through MROs and LTROs on a collateral basis, but through the crisis, the range of securities allowed in the ECB's operations have been widened, and especially the use of non-marketable securities such as fixed term deposits and retail mortgage-backed debt instruments as collateral has increased.⁴³ The second round of LTRO provided a liquidity injection of 529.5 billion Euro (310 billion Euro in net terms) to 800 credit institutions. Table 1 provides the LTRO uptake numbers outlined by country.

Targeted LTRO

At the very outset of the debate regarding the effectiveness of the three-year LTROs, the ECB announced in June 2014 the conduct of the so-called targeted LTROs (TLTROs). The main change compared to the outstanding three-year LTROs was that counter-parties at the TLTRO were only allowed to borrow an amount that is capped in accordance to their lending to the corporate sector. Using this more targeted approach, the ECB aimed at improving bank lending to the Euro area non-financial private sector, excluding loans to households for house purchases. In September and December 2014, the ECB initially introduced two successive TLTROs, where counter-parties were able to borrow an amount in accordance with their initial allowance, at a rate equal to a 10 basis point spread over the MRO rate. In January 2015, the ECB eliminated this excess MRO spread which would be applied for the series of 4 rounds of TLTRO that were to be conducted between March 2015 and June 2016. The TLTROs all mature at September 26, 2018, while the dates for voluntary early repayment differ in accordance to the actual settlement dates.

⁴³Source: Nordea Market Analysis "The liquidity management of the ECB", March 2014

Appendix B Additional Figures and Tables

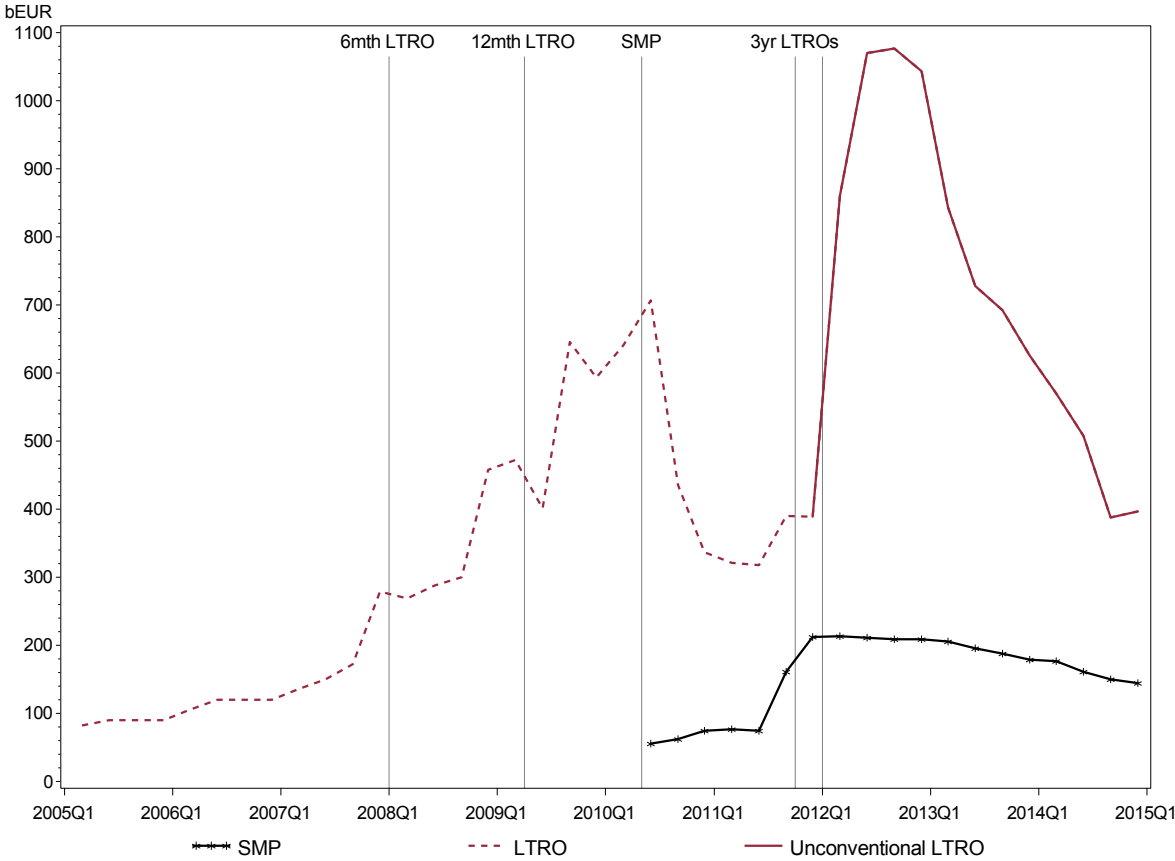


Figure B1: Time-series of Longer-term Refinancing Operation and Security Market Program. This figure plots the amount of ECB’s Longer-Term Refinancing Operations (LTRO) and the Security Market Program. The numbers are given in billion Euro. The unconventional LTRO refers to the two three-year Longer-Term refinancing operations. The data source is the ECB Statistic Warehouse which publishes monthly number for the outstanding amounts.

Table B1: Description of main variables.

The table provides descriptions of all variables used in the analyses. All financial variables are winsorized at the 1st and 99th percentile and in our empirical specifications we use ratios given in percentage.

<i>Dependent Variables</i>		<i>Description</i>
Cash	$\frac{\text{Cash}_t}{\text{Total Assets}_t}$	Cash is defined as cash including marketable securities. Source: Compustat.
Investment	$\frac{\text{Capital Expenditures}_t}{\text{Total Assets}_t}$	Corporate capital spending. Source: Compustat.
Wages	$\text{Log}(\text{Salaries and Wages})_t$	The natural logarithm of total expenses related to salaries and wages. Source: Compustat
Bank Debt	$\frac{\text{Bank Debt}_t}{\text{Total Assets}_t}$	Bank debt the amount of debt that is bank loans. Source: Capital IQ
Leverage	$\frac{\text{Debt}_t}{\text{Total Assets}_t}$	Debt is the book value of debt, i.e., the sum of current and long-term debt. Source: Compustat.
Net Debt	$\frac{\text{Total liabilities} - \text{Cash}_t}{\text{Total Assets}_t}$	Net debt is current plus non-current liabilities minus cash holdings. Source: Compustat.
Short-term Debt	$\frac{\text{Debt due in one year}_t}{\text{Total Assets}_t}$	Fraction of long-term debt that is due in one year
<i>ECB Intervention Controls</i>		<i>Description</i>
LTRO Dummy	Dummy	The variable is equal to 1 for the post-intervention period, i.e., Q1-2012 to Q4-2014, and 0 otherwise.
LTRO Uptake	$\frac{\text{Total Uptake}_{t,c}}{\text{CGD}_{2011,c}}$	The total uptake is the sum of the Euro amount of the two three-year LTROs (LTRO I and II) for each country. Accordingly, the variable is equal to 0 until the time Q4-2011 (first round of three-year LTRO) and afterwards equal to each countries total uptake. We scale the total uptake by the central government debt holdings in the year 2011. Source: Bloomberg and The World Bank.
Non-Eurozone	Dummy	The variable is equal to 1 if the company is located in a country outside the Eurozone as of 2014. 0 otherwise. See also appendix B2
<i>Corporate Controls</i>		<i>Description</i>
Size	$\text{Log}(\text{Total Assets})_t$	Book value of assets. Source: Compustat.
Market To Book	$\frac{\text{Assets} - \text{Book E.} + \text{Market E.}_t}{\text{Total Assets}_t}$	Book equity is total assets minus total liabilities. Market equity is the amount of shares outstanding times the share price as of end of the fiscal quarter/year. Source: Compustat.
Cash Flow /Assets	$\frac{\text{EBIT}_t}{\text{Assets}_t}$	EBIT is earnings after interest and taxes, but before depreciation. Source: Compustat.
Industry Sigma	cash-flow risk	Average standard deviation of corporates' cash flow within the same 2-digit SIC code (min. 3 obs.). Source: Compustat.
Net Working Capital	$\frac{(\text{Net working capital} - \text{cash})_t}{\text{Total Assets}_t}$	The amount of working capital net of corporate cash holdings. Source: Compustat
R&D/Sales	$\frac{\text{R\&D}_t}{\text{Total Sales}}$	Cost related to Research and Development. Source: Compustat
Capital Expenditure	$\frac{\text{Capital Expenditures}_t}{\text{Total Assets}_t}$	Corporate capital spending. Source: Compustat.
Acquisition Activity	$\frac{\text{Acquisition}_t}{\text{Assets}_t}$	The amount that is used for M&A activities. Source: Compustat
Dividends	Dummy	The variable is equal to 0 if the corporate in a given quarter/year has positive dividends. 0 otherwise. Source: Compustat.
Rated	Dummy	The variable is equal to 0 if the corporate has a rating. 0 otherwise. Source: S&P Capital IQ.
Sales		Operating income before interest and taxes (after depreciation). Source: Compustat.

<i>Industry and Country Controls</i>		<i>Description</i>
Industry Competition	Herfindahl-Hirschmann index, i.e., squared sum of market shares in within industries	The Herfindahl-Hirschmann index (HHI) measures the industry competition for industry j at time t . s_{ijt} represents the market share of corporate i in industry j and is measured by the corporates' sales. Source: Compustat
Sovereign CDS	5 year CDS spread	The variable is the end-of-quarter observation of the countries' 5 year CDS spread. Source: Markit
Sovereign Export	Exports of goods and services (% of GDP, by year)	Source: The World Bank
Government Debt	Government Debt (% of GDP, by year)	Source: ECB Statistical Data Warehouse
Corruption	Corruption Perception Index (Index ranging from 1 to 10 with 10 indicating the most corruptive, by year)	Source: Transparency International
Corporate Tax	Corporate Tax rate (% by year)	Source: The World Bank

Table B2: Sample Countries.

The table outlines the European countries that are included in our sample. Panel A outlines countries that defines our Eurozone sample, while Panel B accordingly outlines the countries in our non-Eurozone sample. The *Eurozone* sample only includes countries that agreed on the Euro as a common currency in 1999 and adopted the Euro right from its introduction in January 2001, and for which data is available. The sample, *Non-Eurozone*, includes countries that are outside the eurozone, but are part of the European Union (EU). Accordingly, our sample of EU corporates is then the combination of the Eurozone and Non-Eurozone samples. *EU Membership* outlines the year the respective country became a member of the European Union. Likewise *Euro Adoption* outlines the year a given country adopted the EURO as local currency.

Panel A: Eurozone						
Country	Country Code	EU Membership	Euro Adoption	Region	Credit Rating (end 2011)	
Austria	AUT	1995	1999	Core	AAA	
Belgium	BEL	1995	1999	Core	AA	
Finland	FIN	1995	1999	Core	AAA	
France	FRA	1995	1999	Core	A	
Germany	DEU	1995	1999	Core	AAA	
Greece	GRC	1995	2001	Periphery	CCC	
Ireland	IRL	1995	1999	Periphery	BB	
Italy	ITA	1995	1999	Periphery	BB	
Netherlands	NLD	1995	1999	Core	AAA	
Portugal	PRT	1995	1999	Periphery	B	
Spain	ESP	1995	1999	Periphery	BB	

Panel B: Non-Eurozone						
Country	Country Code	EU Membership	Euro Adoption	Region	Credit Rating (end 2011)	
Bulgaria	BGR	2007		Periphery	A	
Czech-Republic	CZE	2004		Periphery	AA	
Denmark	DNK	1995		Core	AAA	
Hungary	HUN	2004		Periphery	B	
Lithuania	LTU	2004	2015	Periphery	A	
Latvia	LVA	2004	2014	Periphery	A	
Poland	POL	2004		Periphery	AA	
Romania	ROU	2007		Periphery	BB	
Sweden	SWE	1995		Core	AAA	
United-Kingdom	GBR	1995		Core	AAA	

Table B3: Summary statistics for non-Eurozone corporates

This table provides sample averages (medians) of corporate characteristics for each country in our sample of non-Eurozone corporates. *Cash*, is the ratio of cash and short term investments to total assets. *Capital Expenditure* is the ratio of capital expenditure to total assets. *Wages* is the total salaries and wages, given in logarithms. *Leverage* is measured as the book value of the long-term debt plus debt in current liabilities, divided by total assets. *Net Debt* is defined as the ratio of current plus non-current liabilities minus cash holdings to total assets. *Short-term Debt* is defined as the ratio of current liabilities to total assets. *Bank Debt* is the amount of debt from bank loans, divided by total assets. *Size* is the logarithm of total assets. *Mrkt-to-Bk* is the book value of assets minus the book value of equity plus the market value of equity, all divided by the book value of assets. *Cash Flow/Assets* is the ratio of the cash flow to total assets, where cash flow is defined as the earnings after interest and related expenses, income taxes, and dividends. *Industry Sigma* is industry cash flow risk, measured by the mean cash flow volatility across two digit SIC codes. *Net Working Capital* is measured as the difference between current assets and current liabilities net of cash, divided by total assets. *R&D/Sales* is the ratio of R&D to sales. *Acquisition Activity* is the ratio of acquisitions to total assets. *Ind. Competition* is the Herfindahl-Hirschmann Index (HHI) industry competition measure. *Sovereign CDS* is the 5 year sovereign CDS spread for the country. *Sovereign Export* is the countries export to GDP ratio. The sample period for each country is 2002-2014, and the variables are based on quarterly corporate fundamental observations. If data are not available for a specific quarter, we replace the missing value with the yearly observation. Ratios are given in percentages.

Country	GBR	SWE	POL	DNK	ROU	BGR	LTU	LVA	HUN	CZE	Total
Corporate Measures											
Cash	9.38	8.94	5.23	6.05	1.64	4.07	2.36	2.72	7.74	3.33	7.94
Investment	2.55	1.90	4.04	3.36	4.37	4.66	4.66	4.07	6.77	4.32	2.74
Wages	0.09	2.65	2.17	3.76	1.68	1.44	1.96	0.46	7.75	5.36	1.12
Leverage	13.83	14.21	14.32	22.48	0.84	26.14	27.2	14.58	14.47	13.49	14.43
Net Debt	49.81	52.68	47.08	53.49	34.28	46.86	51.57	37.67	41.59	41.70	49.56
Short-term Debt	0.04	0.06	0.08	0.06	0.11	0.08	0.1	0.06	0.06	0.06	0.05
Bank Debt	11.86	12.91	12.92	17.38	15.22	19.63	23.4	17.41	23.09	7.89	12.99
Size	3.82	5.57	4.72	6.51	5.23	5.29	5.22	2.04	10.43	8.70	4.47
Market to Book	133.1	146.3	118.3	120.5	85.5	98.9	91.9	70.7	108.7	93.7	129.5
Cash Flow /As.	3.04	2.68	2.54	4.42	6.33	6.07	5.18	4.22	5.13	4.96	3.03
Industry Sigma	11.23	13.66	6.17	5.87	4.18	3.33	6.14	5.56	3.12	4.23	9.19
Net Working Cap.	-1.62	2.11	6.91	2.96	6.38	5.82	2.32	19.17	8.86	0.02	0.82
R&D/Sales	0	0	0	0	0	0	0	0	0	0	0
Acquisition Act.	0	0	0	0	0	0	0	0	0	0	0
Ind. Competition	14.46	13.48	10.09	14.00	14.46	14.26	14.53	17.23	15.26	18.08	14.00
Country Measures											
Sovereign CDS	42.11	13.66	79.50	20.08	213.09	180.56	110.20	125.86	45.50	32.00	34.14
Sovereign Export	0.27	0.46	0.39	0.51	0.33	0.52	0.56	0.43	0.75	0.63	0.30
# Observations	67801	20122	17319	5980	2576	1018	1317	1370	797	420	118720
# Corporations	2213	574	461	159	78	30	30	30	22	14	3611

Table B4: LTRO intervention effect on cash holdings

This table presents estimates of the effect of the LTRO intervention on corporate cash holdings in the European Union (EU). *Cash* is determined as cash and cash equivalents, scaled by total assets. The variable *LTRO Dummy* is a dummy variable equal to 1 for year-quarter observations after the ECB had implemented the first three-year LTRO intervention (Q4-2011) and indicates the timing of the LTRO intervention. The variable *Eurozone* is a dummy equal to 1 for corporations that are located in a country that is a part of the Eurozone (for details see appendix B2). The variable *Eurozone x LTRO Dummy* is interaction between the LTRO intervention and Eurozone dummies and accordingly equal to 1 for Eurozone corporations after the first LTRO intervention. Model 1 is based upon the full sample (EU), while in Model 2 and 3 the sample is restricted to countries that are located in the *Eurozone* and *non-Eurozone*, respectively. The coefficient of interest is that of LTRO Dummy, which capture the effect of the initiation of the three-year LTRO. The sample period is 2002-2014, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

	Cash	Cash	
	EU (1)	Eurozone (2)	Non-Eurozone (3)
LTRO Dummy	-0.536*** (0.20)	0.069 (0.24)	0.356 (0.31)
Eurozone	0.000 (0.00)		
LTRO Dummy * Eurozone	0.932*** (0.11)		
Industry Sigma	-0.030*** (0.00)	0.022 (0.01)	-0.066*** (0.01)
Cash Flow/Assets	-0.005** (0.00)	0.001 (0.00)	-0.009** (0.00)
Market to Book	0.008*** (0.00)	0.014*** (0.00)	0.005*** (0.00)
Size	-0.628*** (0.06)	-0.110 (0.08)	-0.955*** (0.09)
Net Working Capital	-0.123*** (0.00)	-0.123*** (0.00)	-0.121*** (0.00)
Capital Expenditure	-0.079*** (0.00)	-0.121*** (0.00)	-0.041*** (0.00)
Leverage	-0.192*** (0.00)	-0.167*** (0.00)	-0.225*** (0.00)
Div. Dummy	0.588*** (0.07)	0.626*** (0.08)	0.547*** (0.12)
R&D/Sales	0.026*** (0.00)	0.017*** (0.00)	0.031*** (0.00)
Acquisition Activity	-0.038*** (0.00)	-0.022*** (0.00)	-0.055*** (0.00)
Rated	1.557*** (0.26)	1.508*** (0.29)	1.709*** (0.51)
Sovereign CDS	0.755*** (0.25)	0.521** (0.24)	48.023*** (9.44)
Sovereign Export	0.029*** (0.00)	-0.040*** (0.01)	0.149*** (0.01)
Time fixed effect	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes
R-square	0.751	0.766	0.740
N	144604	80279	64325

Table B5: Corporate risk and LTRO uptake effect on cash holdings

This table presents estimates of the effect of corporate risk and the liquidity uptake through ECB's three-year Longer-term Refinancing Operations on corporate policies in a sample of corporates that are located in the Eurozone. *Cash* is determined as cash and cash equivalents, scaled by total assets. In Model 1 and 2, corporates are separated into investment and non-investment based on the companies rating. *Investment Rating (Non-Investment Rating)* refers to a S&P-rating of BBB- or higher (CCC+ or lower). In Model 3 and 4, corporates are separated high and low leverage companies, where *High Leverage (Low Leverage)* includes companies that one year before the first three-year LTRO intervention (Q4-2010) had a leverage ratio above (below) median. The variable *LTRO Uptake* is equal to zero until Q4-2011, and equal to the country-specific total LTRO uptake amount, scaled by the central government debt of the country, thereafter. The coefficient of interest is that of *LTRO Uptake*, which captures the effect of the country-specific significance of the liquidity intervention on corporate leverage policies. The sample period is 2002-2014, based on quarterly observations. (***) denotes significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level. The numbers in parentheses are standard errors.)

	Cash		Cash	
	Investment Rating (1)	Non-Investment Rating (2)	High Leverage (3)	Low Leverage (4)
LTRO Uptake	-4.223** (1.91)	2.435*** (0.57)	1.598*** (0.55)	0.657 (1.11)
Industry Sigma	-0.004 (0.04)	0.020 (0.01)	0.085*** (0.01)	-0.030 (0.02)
Cash Flow/Assets	-0.066** (0.02)	0.002 (0.00)	0.002 (0.00)	0.009 (0.00)
Market to Book	0.018*** (0.00)	0.013*** (0.00)	0.014*** (0.00)	0.014*** (0.00)
Size	0.517 (0.44)	-0.096 (0.08)	-0.167* (0.09)	0.292** (0.14)
Net Working Capital	-0.097*** (0.01)	-0.125*** (0.00)	-0.055*** (0.00)	-0.220*** (0.00)
Capital Expenditure	0.025 (0.05)	-0.123*** (0.00)	-0.021** (0.00)	-0.221*** (0.01)
Leverage	0.091*** (0.01)	-0.170*** (0.00)	-0.123*** (0.00)	-0.253*** (0.00)
Div. Dummy	0.697** (0.27)	0.662*** (0.08)	0.357*** (0.09)	0.881*** (0.14)
R&D/Sales	0.069*** (0.01)	0.015*** (0.00)	0.057*** (0.00)	0.002 (0.00)
Acquisition Activity	-0.019 (0.03)	-0.023*** (0.00)	0.014 (0.00)	-0.023 (0.01)
Rated	0.000 (0.00)	2.019*** (0.44)	0.365 (0.28)	3.549*** (0.62)
Sovereign CDS	2.491** (1.14)	0.568** (0.24)	0.045 (0.22)	1.600*** (0.56)
Sovereign Export	-0.155*** (0.03)	-0.047*** (0.01)	-0.071*** (0.01)	-0.032 (0.02)
Time fixed effect	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes
R-square	0.799	0.768	0.662	0.765
N	2037	80016	37525	36378