Collateral Policy Surprises*

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Abstract

Central bank collateral policy specifies which assets banks can pledge as collateral to obtain central bank funding. To study the systematic effects of central bank collateral policy on banks, financial markets, and asset prices, we propose a high-frequency approach to identify collateral policy surprises, using bank stock price changes around Eurosystem collateral policy announcements. Expansionary collateral policy surprises are associated with excess returns of bank stocks, a decline in several common volatility measures, and a decrease in bank CDS spreads. They also compress core-periphery government bond spreads, even for policy changes that are unrelated to the collateral treatment of government bonds. These findings indicate that collateral policy influences sovereign bond markets through an uneven transmission channel distinct from both asset purchases and conventional monetary policy.

Keywords: Central Bank Collateral Framework, Bank Stocks, Government Bond Market, High Frequency Identification, Intermediary Asset Pricing
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1 Introduction

Central banks implement monetary policy by lending to banks against collateral, which protects the central bank from losses after a bank failure. Central bank collateral policy specifies which assets banks can pledge as collateral and the valuation haircut applied to each asset. Since key policy rates refer to central bank funding, the availability of collateral is crucial for the transmission of monetary policy through banks to the real economy. In periods of financial stress, banks' demand for central bank lending can be constrained by limited eligible collateral, requiring collateral policy adjustments. For example, during the Great Financial Crisis in 2008, many central banks reduced the minimum rating requirements on government and corporate bonds to ensure all banks can access central bank funding. Hence, collateral policy solves a trade-off between facilitating the smooth implementation of monetary policy while limiting expected losses for the central bank. In doing so, collateral policy also affects banks' liquidity risk, their pricing of eligible assets, and asset prices more broadly. This paper sets out to quantify these effects and to uncover the transmission channels at play, using changes to the Eurosystem collateral framework as a laboratory.

Establishing causal effects of central bank collateral policy on asset prices is challenging for several reasons. First, the Eurosystem accepts a large amount of different assets as collateral, some of which are illiquid, and policy announcements often affect multiple asset classes simultaneously. This makes the choice of an appropriate asset class to study systematic effects of collateral policy nontrivial. Second, the stance of collateral policy varies over time and endogenously responds to the macro-financial environment, making it difficult to identify the part of an asset price change that is due to a collateral policy surprise, which is essential to establish causal effects.

To overcome these challenges, we propose a novel high-frequency identification approach. Guided by theories of collateral policy transmission to asset prices via banks, we exploit intraday changes in bank stock prices around Eurosystem collateral policy announcements. Focusing on the users of collateral rather than the eligible assets themselves allows us to include the broadest possible set of collateral policy events. Moreover, the high-frequency approach enables us to separate the surprise component of collateral policy from systematic responses to macro-financial conditions, similar to the identification of monetary policy shocks using high-frequency asset price data, see Kuttner (2001) for an early reference.

We compile a comprehensive list of ECB collateral policy announcements from the introduction of a harmonized Eurosystem collateral framework in January 2007 to December 2022, building on Bindseil et al. (2017). There are 98 events in total, 54 of which received sufficient public attention that they were reported by Thomson Reuters News. To measure the collateral policy surprise for each event, we compute the stock price change of large euro area banks over a short time window. The price reactions are often sizable, exceeding two percent within a 30-minute event window for some announcements. We extract the first principal component of individual asset price reactions and interpret events with positive (negative) bank stock price

reactions as expansionary (contractionary) collateral policy surprises. This classification generally aligns with narrative evidence for the most significant events. To further illustrate the validity of our empirical approach, we show that bank stock prices are much more volatile on days with a collateral policy event than on control days. The banks' stock price reaction is not predicted by indicators of financial market stress, such as the EURIBOR-OIS spread. Lastly, we document that illiquid and less capitalized banks respond more strongly to changes in collateral policy, which is in line with the literature on the bank lending channel of conventional monetary policy (Kashyap and Stein, 2000.

Using local projections (Jordà, 2005), we find that expansionary collateral policy surprises cause a generally positive financial market reaction. Bank stocks outperform the wider stock market. An expansionary one standard deviation CPS, corresponding to a bank stock increase by almost one percent induces reduce the most commonly traded stock volatility index (V2X) by around four percent. Similar effects can be observed for FX option-implied volatility at various maturities, suggesting a dampening effect on financial market uncertainty. Moreover, collateral policy lowers bank CDS spreads by 4 basis points on average. This effect is particularly for some banks located in the euro area periphery, where it exceeds 10 basis points.

We then examine how expansionary collateral policy affects the government bond market. The yields of all major euro area sovereigns decline significantly and persistently following an expansionary collateral policy surprise. The decline is around 10 basis points for periphery bonds (Italy, Ireland, Portugal, Spain) but only about 2 basis points for core bonds (Austria, Belgium, Finland, France, Netherlands, Germany). Accordingly, the periphery-core government bond spread narrows substantially. Collateral policy also affects the pricing of sovereign risk more generally. We also observe a decline in sovereign credit default swap (CDS) spreads, which is again much stronger for periphery borrowers.

We reconcile the positive effects of expansionary collateral policy on bank profitability, bank default risk, and the associated decline in sovereign bond yields and CDS spreads in a simple intermediary asset pricing framework (He and Krishnamurthy, 2013). Banks receive liquidity shocks that they have to settle by borrowing form the central bank against collateral. A relaxation of collateral policy reduces the probability that banks draw a liquidity shock that exceeds the collateral value of their assets. The associated reduction in bank default risk implies that banks receive the payoff from their investment with a larger probability. This increases their expected marginal utility of consumption (dividends) next period, which shifts their stochastic discount factor (SDF) upward. Hence, their willingness to pay for *all* assets rises, including their valuation of protection against sovereign default risk.

To further illustrate the transmission mechanism of collateral policy, we explore its effects in different sub-samples. We observe that the periphery-core spread also narrows significantly after collateral policy events which are unrelated to the treatment of government bonds. Within the simple intermediary asset pricing interpretation, such events affect all asset prices by changing banks' sdf. This again underscores the usefulness of focusing on banks, i.e. the users of collateral, who appear to be the key driver of an uneven transmission of collateral policy to

the government bond market. Furthermore, collateral policy has particularly pronounced effects during recessions, where the demand for central bank liquidity is arguably higher than in expansions. By contrast, during periods of excess liquidity, especially after the Eurosystem began large-scale asset purchases in 2015, the effects of collateral policy are less pronounced, but not zero.

As a last step, we benchmark the effects of collateral policy surprises, an "unconventional" central bank instrument after all, against conventional monetary policy surprises (Jarociński and Karadi, 2020). We find that monetary policy surprises affect equity markets, but there is no notable excess return for the banking sector. We observe no significant heterogeneous effects on government bond yields or on bank and sovereign CDS spreads. These findings suggest a markedly different transmission mechanism to banks and asset prices compared to conventional monetary policy.

Related Literature Our paper relates to two different strands of literature. From a methodological point of view, our paper is closely related to the large literature on high-frequency identification of monetary policy shocks. The idea here is that the unexpected (surprise) component of monetary policy announcements can be captured by examining asset price movements within a narrow time window surrounding these announcements (Kuttner, 2001, Gürkaynak et al., 2005, Altavilla et al., 2019, Swanson, 2021). Bianchi et al. (2023) examine the interactions between monetary and fiscal policies, while Känzig (2021) uses OPEC announcements to isolate oil supply news shocks and assesses their impact on prices, inflation, and broader economic conditions.

The high-frequency identification strategy has recently been applied to other dimensions of macroeconomic stabilization policy. Phillot (2025) identifies Treasury auction announcements as supply shocks in bond markets and analyzes how these supply changes impact yields, market liquidity, and broader fiscal policy dynamics. Boneva et al. (2023) study the effects of FOMC announcements related to lender-of-last-resort policy. Bluwstein and Patozi (2024) build a dataset of macroprudential policy announcements and measure their impact on systemic risk. Two studies obtain intraday bank stock data to calculate high frequency surprises, Drechsel and Miura (2024) using speeches related to bank regulation and Ottonello and Song (2022) using earnings announcements. To the best of our knowledge, this paper is the first to identify collateral policy surprises using high-frequency changes in bank stock prices around Eurosystem collateral announcements.

The empirical banking literature has also focused on central bank collateral policy, establishing that central bank collateral frameworks have an economically relevant impact on banks (the users of collateral) as well as non-financial firms and sovereigns (the issuers of collateral). Specifically, expansionary collateral policy reduces bank funding cost (Cassola and Koulischer, 2019; Fang et al., 2025), affects the price of eligible assets (Mésonnier et al., 2021; Chen et al., 2023) and increases bank credit supply (Bekkum et al., 2018) and has real effects on the non-financial sector (Delatte et al., 2025; Hüttl and Kaldorf, 2025). These papers use a single collateral policy

change as an identification strategy based on security or loan level data to analyze the effect on single asset classes. Exploiting the first inclusion of corporate bonds into the Eurosystem list of eligible collateral, Pelizzon et al. (2024) show that collateral eligibility reduces bond yields and improves their liquidity on secondary markets. Regarding sovereign bonds, Nissinen and Sihvonen (2024) show that government bond yields respond significantly when they switch from one maturity bucket to the next, since central bank haircuts depend on bond maturity in a discontinuous fashion. Similarly, Nguyen (2020) documents that investors demand higher yields for bonds with higher collateral haircuts. Our paper is the first to provide a systematic analysis of the macroeconomic effects of collateral policy using the full set of collateral policy *changes* over a longer time horizon.

Outline The remainder of the paper is structured as follows. Section 2 reviews the Eurosystem collateral framework and the transmission of collateral policy to banks, describes our empirical approach and shows the collateral policy surprise series. Section 3 provides a series of diagnostic tests on the identified surprise series. In Section 4, we discuss the effects of collateral policy surprises on financial variables and on the government bond market. Section 5 introduces a stylized intermediary asset pricing model to illustrate our findings. Section 6 concludes.

2 Identifying Collateral Policy Surprises

In this section, we outline our identification strategy, which is guided by theories regarding the transmission of collateral policy to the real sector via banks. First, we provide institutional background of the Eurosystem collateral framework on which our empirical results are based. Second, we review different transmission channels of collateral policy to the banking system and discuss their predictions concerning bank stock returns. We then describe the data, and how we implement the identification strategy based on bank stock returns and show the resulting collateral policy surprise series.

2.1 Institutional Background

Central banks implement monetary policy by lending to commercial banks against collateral. In contrast to the interbank market, there is no unsecured funding option. Therefore, a sufficiently large amount of eligible collateral is necessary to give all euro area banks access to central bank facilities. Operating a sufficiently wide collateral framework is essential to facilitate a smooth implementation of monetary policy. The Eurosystem collateral framework is exceptionally wide. While the Federal Reserve predominately lends against highly liquid US Treasury bonds, euro area banks can pledge a variety of asset classes with the Eurosystem, including non-marketable assets and BBB-rated bonds, see Bindseil et al., 2017 for an overview. The main reason for operating such a wide collateral framework is that the amount of euro denominated high quality liquid assets, such as AAA-rated government bonds, is quite small compared to the size of the euro area banking sector.

When accepting financial assets as collateral, the Eurosystem sets minimum quality requirements on assets and applies valuation haircuts to the market value of the pledged asset. This reduces the losses from exposure to low quality collateral in the case of a counterparty default. Accepting risky collateral can be costly either because setting up and operating a credit risk management facility is costly for the central bank (Bindseil and Papadia, 2006; Hall and Reis, 2015), or because central banks are loss adverse (Goncharov et al., 2023). The Eurosystem sets its collateral framework sufficiently wide to facilitate a smooth implementation of monetary policy, but tight enough to limit expected losses to an acceptable level. Importantly, collateral eligibility requirements and valuation haircuts in the Eurosystem only depend on the pledged collateral and not on the borrowing bank. This implies that it is not possible to directly discriminate between banks in the collateral framework.

The macro-financial environment shapes how this trade-off is resolved optimally. In times of high stress on financial markets, banks' demand for central bank funding increases temporarily. At the same time, the availability of high quality collateral usually declines due to rating downgrades of many issuers, both in the private and public sector. It is then typically optimal to broaden its lending operations and its collateral framework, both in terms of minimum eligibility requirements and valuation haircuts. De Fiore et al. (2024) give an excellent analysis in the context of the euro area debt crisis.

2.2 Collateral Policy and Banks Stock Prices

Based on the institutional features of the Eurosystem collateral framework, an empirical investigation at the macroeconomic level must simultaneously account for the wide range of accepted asset classes and the two main dimensions of collateral policy (eligibility requirements and valuation haircuts). Furthermore, it needs to take systematic responses of the collateral policy stance to the macro-financial environment into account, since financial market participants might expect a relaxation of collateral policy in response to stress in the banking system. To jointly address these issues, we use banks stock returns around collateral policy announcements to identify collateral policy surprises. Since we aim to shed light on the systematic effects of collateral policy on the macroeconomy, we extract the common factor of individual bank stock price responses.

Several advantages arise from such a set-up. First, by focusing on banks as the *users* of collateral, rather than the issuers of collateral, allows us to examine the largest possible set of collateral policy events. In particular, we can include events concerning non-marketable assets, such as asset-backed securities or credit claims, for which market prices are not available, at least not at a sufficiently high frequency. Second, we avoid many judgment calls on the choice of assets whenever multiple asset classes are affected. Third, by employing high-frequency bank stock price data within a narrow window around collateral policy announcements, we isolate the unexpected component of the policy change. In doing so, we exclude the systematic responses of the central bank to macro-financial conditions, which is essential for a causal interpretation of the

effect of collateral policy surprises on the macroeconomy. Fourth, extracting the common factor from individual responses does not require information on the exposure of individual banks to targeted assets, which are often very intransparent, even with detailed securities holdings data.

Theory suggests different transmission mechanisms of collateral policy surprises to banks, but they deliver the same prediction concerning bank stock prices. On one hand, banks are able to smooth out liquidity shocks more easily if the collateral eligibility of their assets improves (Bianchi and Bigio, 2022, De Fiore et al., 2024). On the other hand, expansionary collateral policy allows banks to switch their funding source to cheaper central bank facilities, rather than borrowing at less favorable market rates (Drechsler et al., 2016). This is particularly attractive to weaker banks. Switching to cheaper central bank funding, at least temporarily, increases the profitability of all banks and would hence also raise aggregate bank stock returns and lower aggregate bank CDS spreads. In addition to these aggregate effects, this might negatively affect the allocative efficiency on the interbank market, which clearly is an important consideration for the design of collateral frameworks. Due to our focus on aggregate implications, we restrict the attention to the common component in the following. Both mechanisms predict that expansionary collateral policy reduces bank default risk and increases banks' equity value. Regardless on the transmission mechanisms at play, our empirical strategy merely requires that expansionary collateral policy is associated with positive aggregate bank stock returns.

Lastly, there is one practical advantage from using bank stocks to identify collateral policy surprises. Bank CDS spreads would also be a suitable candidate to identify collateral policy surprises, since theory also delivers clear predictions about their response to collateral policy surprises. However, only bank stocks are traded at very high frequencies on centralized markets. However, we demonstrate that expansionary collateral policy surprises are indeed associated with lower bank CDS spreads at lower (daily) frequencies, which corroborates our identification strategy.

2.3 Data

To identify collateral policy surprises, we use high-frequency bank stock price changes in a short window around collateral policy changes. Our analysis relies on three data sources.

2.3.1 High-frequency bank stock data

We obtain high-frequency tick-by-tick data of stock prices of the largest euro area banks contained in the EURO STOXX Banks Index from Thomson Reuters. For our sample period from 1 January 2007 to 31 December 2022 we have full coverage for BBVA, Caixa Bank and Santander (Spain); Banco Comercial Portugues (Portugal); BNP Paribas and Societe Generale (France); Intensa Sanpaolo and Unicredit (Italy); and Deutsche Bank (Germany). For ING Group (Netherlands), Nordea Bank (Finland) and Bank of Ireland Group (Ireland) the high frequency data are only available for a more recent sub-sample, but adding them does not visible affect our results.

2.3.2 ECB Collateral Policy Announcements

We obtain a comprehensive list of collateral policy announcements by the ECB since the establishment of the Eurosystem-wide single list in January 2007 until December 2022, partially based on the list of framework changes contained in Bindseil et al. (2017). We do not include announcements concerning the so called "Additional Credit Claims" programs by different national central banks during the Great Financial Crisis. Over this period, we identify 98 distinct collateral-related announcements by the ECB, see Table A.1 for a detailed list. Hence, far from being an exceptionally rigid part of the plumbing of the financial system, collateral policy undergoes on average 6 changes a year.

Unlike monetary policy announcements, which are tied to regular meetings by the ECB governing council, collateral policy announcements are spread across the year and do not systematically coincide with the regular governing council meetings. In fact, collateral policy changes are often announced in a stand alone press release. As an illustration, consider the following excerpt from a press release concerning a collateral policy change on June 22^{nd}, 2012:

> **PRESS RELEASE, 22 June 2012** ECB takes further measures to increase collateral availability for counterparties
> *On 20 June 2012 the Governing Council of the European Central Bank (ECB) decided on additional measures to improve the access of the banking sector to Eurosystem operations in order to further support the provision of credit to households and non-financial corporations. The Governing Council has reduced the rating threshold and amended the eligibility requirements for certain asset-backed securities (ABSs). It has thus broadened the scope of the measures to increase collateral availability [...]*[1]

2.3.3 Historical News Archive

Based on the list of ECB collateral announcements, we make use of the LSEG Historical News Archive to uncover the precise time when news about ECB collateral policy announcements are disseminated. While ECB press releases provide the publication date, they do not include a precise timestamp, making the news archive essential for constructing accurate event windows in our high-frequency analysis.

In addition to timing, the archive provides valuable qualitative insights into market perceptions and commentary surrounding each announcement. For example, following up on the press release 22 June 2012 shown in the previous section, the market reaction for this announcement was the following: *"It just means that they are willing to take as collateral lower-quality credit, which is probably why the periphery is getting a bit of a bid against Germany"*, a trader said. This suggests that markets pay close attention and asset prices responded accordingly: the government bond and stock markets reacted positively.

[1]The full announcement is accessible under https://www.ecb.europa.eu/press/pr/date/2012/html/pr120622.en.html

We restrict our attention to those events that received press coverage in the LSEG Historical News Archive, i.e. events that were perceived as important by financial market participants and market observers. We exclude announcements for which we do not find any headline, as some of these were too technical to make the news and hence perhaps not salient enough for financial market participants. This gives us 54 events, a complete list of those events can be found in Appendix Appendix A.1. Finally, we exclude collateral policy announcements coinciding with ECB monetary policy announcements on the same day and an important EU summit decision on 28 June 2012. On these event days, it is not possible to cleanly attribute the variation in bank stock prices around the short event window to the collateral policy change. This results in a final sample of 44 collateral policy announcement events.

2.4 Collateral Policy Surprise Series

By using high-frequency asset price data around collateral policy announcements, we isolate the surprise component of each announcement. Akin to the large literature that identifies monetary policy surprises with high-frequency financial data (Kuttner, 2001; Gürkaynak et al., 2005), our identification strategy assumes that financial market participants have already priced in their expectations related to the macro-financial environment, specifically including systematic changes in collateral policy. Thus, any immediate price change in a narrow window around an announcement reflects new information.

We measure the surprise component of each announcement using the bank stock price changes of the largest banks in the Euro STOXX Banks Index in a 30 minute time window around the announcements. Since our focus is on aggregate effects of collateral policy, we extract the first principal component of individual bank stock price reactions, which essentially absorbs all bank-specific characteristics. We will revisit the role of bank heterogeneity in the next section. All events with a positive stock price reaction are interpreted as "expansionary", i.e. the collateral framework was relaxed more aggressively or tightened less aggressively than expected by market participants. The advantage of this classification is that it is purely driven by market data and comes at a low informational burden about the technical details of each announcement. It also renders events affecting very different asset classes, such as government bonds, covered bank bonds or non-marketable assets comparable to each other, which is crucial for a systematic analysis of the transmission to banks' liquidity risk and asset prices.

The time series of our collateral policy surprises (CPS) is shown in Figure 1. While there are more events during times of high financial stress, in particular during the European sovereign debt crisis, each year contains at least one event. Notably, the magnitude of the bank stock price reaction is quite evenly distributed across the sample, suggesting that collateral policy has relevant effects on banks outside of crisis times. There are several large positive and large negative events, the shock series has no visible skewness, there is no significant autocorrelation and we find no heteroskedasticity in the surprise series.

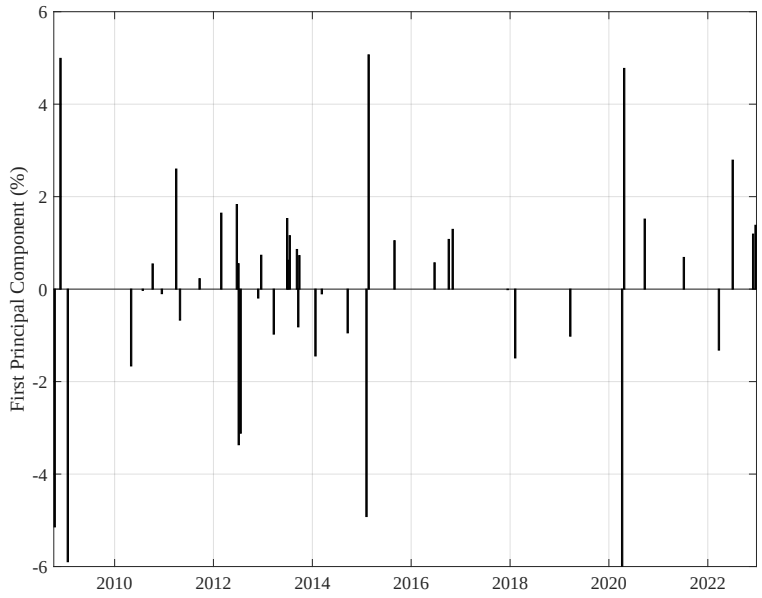

Figure 1: Collateral Policy Surprise Series: This figure plots the Collateral Policy Surprises, measured by the first principal component of all single bank stocks. Events coinciding with ECB governing council meetings and the 2012 euro summit are excluded, leaving a final sample of 44.

3 Diagnostics

In this section, we provide several plausibility checks and diagnostics for the CPS series. In addition, we complement our analysis with narrative evidence on selected events and micro-level analysis of the transmission mechanism, guided by the bank lending channel of monetary policy.

3.1 Plausibility Checks

Several additional points concerning the measurement of the surprise component need to be addressed. First, in the context of the euro area banking system, there might be structural differences between banks headquartered in different euro area countries that could affect the construction of our CPS measure. Second, not all bank stocks always move into the same direction or by the same magnitude for every event. In addition, periods of high financial stress might predict the collateral policy surprise even at the high-frequency that we use to measure the surprise component. This section addresses these concerns in detail.

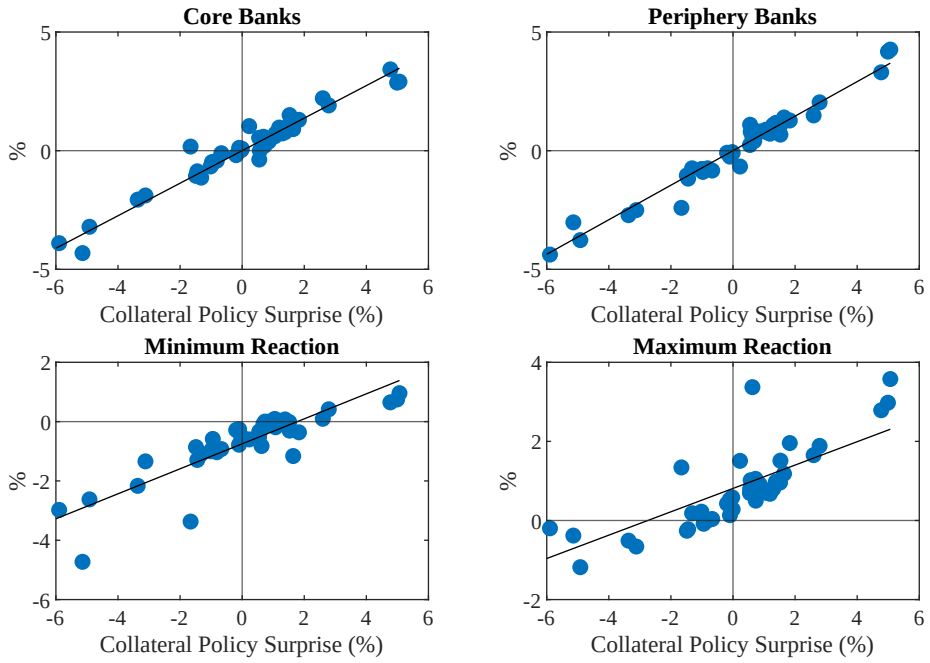

Figure 2: Collateral Policy Surprises and the Role of Bank Selection. The top row compares our baseline collateral policy surprise to the surprises estimated on the subsample of core and periphery banks, respectively. The bottom row compares our baseline collateral policy surprise to the maximum and minimum stock price reaction at each event. The solid line represents a simple linear fit.

Bank Selection To address bank heterogeneity in terms of their location, we re-estimate our collateral policy surprise measure on the sub-samples of core and periphery banks, respectively. In the top row of Figure 2, we show that the first principal component in either sub-sample is very highly correlated with the first principal component in the full sample of banks. As far as the robustness of our measure to outliers of individual banks at each event is concerned, we plot our CPS series against the minimum and maximum bank stock price reaction, respectively, in the bottom row of Figure 2. This shows that for most events with a positive (negative) first principal component, the maximum and minimum stock price reaction were also positive (negative). Furthermore, neither the minimum nor maximum show a systematically different pattern than the first principal component.

Macro-Financial Confounders The measured CPS series might be biased if the bank stock price reaction also captures the systematic reaction of collateral policy to the macro-financial environment and not only its surprise component. This could be the case if financial market participants do not pay attention to collateral policy and its systematic responses to the macro-financial environment. While the market commentary suggests that this is not the case, it is nevertheless instructive to contrast the CPS with a measure of interbank market stress. The first row of Figure 3 demonstrates graphically that the measured CPS does not correlate with the EURIBOR-OIS spread, which is a common measure of interbank market stress. The top left

panel plots the baseline CPS against the residual of regressing the CPS on the EURIBOR-OIS spread. The top right panel plots the fitted value from this regression against the CPS.

The second row uses the EUROSTOXX volatility index as common measure of uncertainty in wider financial markets. In both cases, the purged surprise series, i.e. the fitted residual, is highly correlated with the baseline CPS, while the residual exhibits no significant correlation. The picture does not change if one uses lagged EURIBOR-OIS spreads or lagged V2X instead.

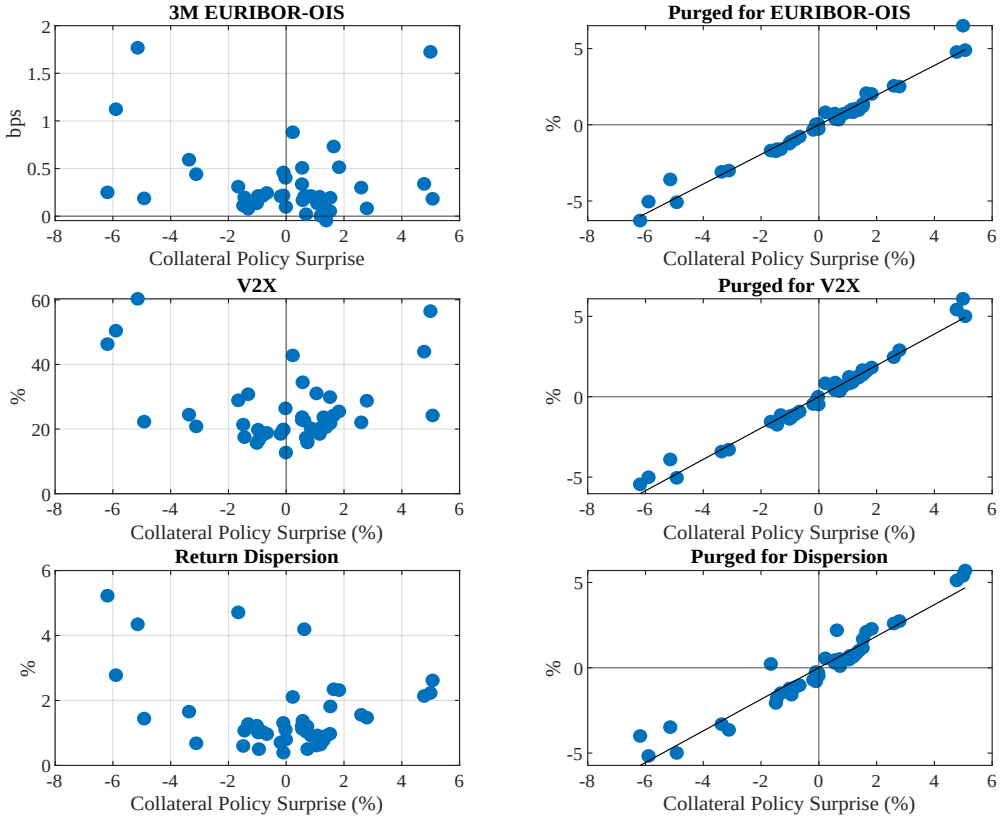

Figure 3: Purged Collateral Policy Surprises. The left column compares our collateral policy surprise, i.e. the first principal component of all bank stock price reactions (in %) to the residual ν_t from regressing cps_t on potential confounders: $cps_t = \beta_0 + \beta_1 y_t + \nu_t$. The right column plots the fitted value $\widehat{cps}_t$ against the original collateral policy surprise. The EURIBOR-OIS spread is expressed in basis points, the V2X is an implied volatility expressed in percentage points and the return dispersion is expressed in percent.

Return Dispersion The third row of Figure 3 plots the CPS series against the dispersion in bank stock price reaction, i.e. the maximum minus the minimum stock price reaction at each event. The left panel already suggests that there is no substantial correlation between the aggregate effect and the dispersion. More formally, we regress the CPS on the dispersion measure and plot the residual in the bottom right panel shows. Reassuringly, the residual is highly correlated with our shock measure. Nevertheless, we also consider the subset of all collateral policy surprises, where all bank stocks moved into the same direction as additional robustness in all our analyses. In these instances, we can clearly interpret the collateral policy

announcement as an positive shock to aggregate bank liquidity. By contrast, events that induce some bank stocks to increase and others to decline might contain a large distributive component within the banking sector, relative to their aggregate impact. Indeed, it turns out that all our empirical results are stronger when we restrict attention to unanimous events.

Confounding Events To ensure that our event window is not contaminated by other major economic news, we check for overlapping data releases using the Bloomberg economic calendar. We find no significant macroeconomic announcements or monetary policy decisions in the United States, the euro area, or the United Kingdom on those dates. Lastly, we test whether it can be predicted by monetary policy surprises. Specifically, we regress our surprise series on the monetary policy surprise factors identified by Altavilla et al. (2019) and find no statistically significant relationship.

Placebo Test A potential concern regarding the high-frequency approach can be that other news might affect the bank stock price during the event window, even if it is intraday. To test this, we conduct a "placebo" test by measuring intraday changes in bank stock prices using the same event window, but shifted to 7 days before each collateral policy announcement. These days serve as a proxy for comparable days without any actual collateral policy announcements. We do not find any significant changes in financial variables in response to these "placebo" surprise series. This can be illustrated graphically via probability density functions (pdf) similar to Känzig (2021). Figure 4 plots the kernel density estimate for our baseline surprise series against the kernel density estimate for the "placebo" surprise series. The pdf shows increased variance and fatter tails on announcement event windows as opposed to control event windows.

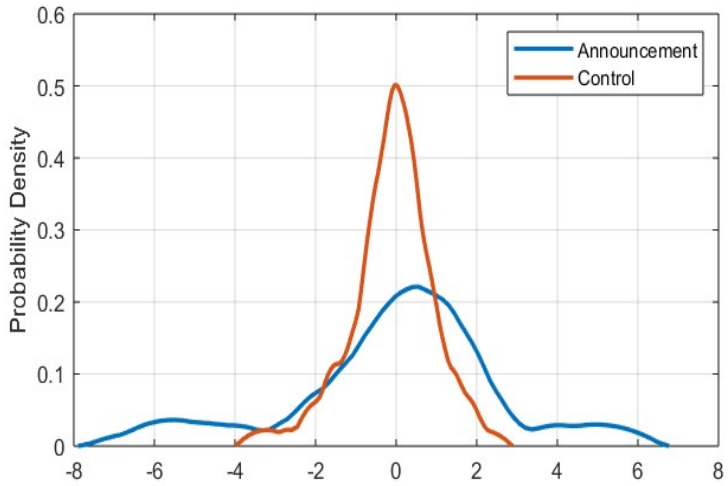

Figure 4: Announcement versus Control Event Window. The figure plots the Epanechnikov kernel density estimate for **"Announcement"**, our baseline surprise series (44 events that exclude ECB days and the EU summit decision) against the Epanechnikov kernel density estimate for the placebo surprise series **"Control"**. Again, we use the same intraday 45-minute event window, 7 days before each actual collateral announcement.

3.2 Narrative Evidence

To further corroborate the plausibility of our identified shock series — and to mitigate concerns about potential central bank "information effects", which have been suggested as a confounding factor in high-frequency monetary policy surprise measures based on asset price reactions to policy announcements (see Nakamura and Steinsson, 2018; Jarociński and Karadi, 2020; Miranda-Agrippino and Ricco, 2021) — we present narrative assessment of selected episodes in the spirit of Drechsel and Miura (2024).[2] Specifically, we examine a set of expansionary and contractionary events that are particularly relevant, as they are associated with average stock price reactions exceeding one percent in absolute value. These events correspond to the largest spikes observed in Figure 1.

- On January 20, 2009, the ECB says to require a rating of AAA/Aaa for ABS as collateral as of March 1st. Market commentary was mixed that day: *"From the banks' perspective, it's more restrictive, but it's not so drastic that it will shrink the mortgage market," said an analyst specialising in structured credit at a German bank. RBS economist Silvio Peruzzo said the announcement was minor compared to other changes announced to the ECB's collateral rules. "It provides an additional control on the quality of assets," he said. But Tullett Prebon economist Lena Komileva said the move sent the wrong signal at a time when the Bank of England and the U.S. Federal Reserve were stepping in to support illiquid markets. "Rather than responding to an underlying improvement in market liquidity conditions, the ECB's collateral tightening reflects quite the opposite – poor asset quality and insufficient market transparency – resulting in greater financial stresses," she said.* The bank stock reaction was unanimous and negative, and exceeded one percent in absolute terms.

- On July 20, 2012 the ECB announces that Greek government bonds become ineligible as collateral from July 25. Market commentary: *Greek bankers took the decision in their stride. "It's something we were expecting," one banker speaking on the condition of anonymity said. "The only difference is the borrowing cost for the banks."* The bank stock reaction was unanimous and negative, and exceeded one percent in absolute terms.

- On February 4, 2015, the ECB lifts waiver on credit rating requirements for Greek bonds. Market commentary: *ECB move rekindled safe-haven demand for low-risk U.S. and German government debt as it stoked worries about runs at Greek banks and concerns the new Greek government would have trouble renegotiating debt terms with its euro zone partners, analysts said.* The bank stock reaction was unanimous and negative, and exceeded one percent in absolute terms.

[2] In this context it is also important to highlight that ECB announcements concerning collateral policy are typically narrowly focused collateral and of a very techincal nature, as illustrated by the example in section 2.3, and the comprehensive list of collateral announcements provided in Appendix A.1.

- On February 20, 2015, the ECB is ready to reintroduce waiver for Greek collateral once it assesses that program likely to be concluded. The bank stock reaction was unanimous and positive, and exceeded one percent in absolute terms.
- On April 22, 2020 the ECB says it takes steps to mitigate impact of possible rating downgrades on collateral availability. The bank stock reaction was unanimous and positive, and exceeded one percent in absolute terms.

The market commentary illustrates that the classification of high-frequency identified CPS into "expansionary" and "contractionary" events is generally consistent with the narrative account on the most relevant events.

3.3 The Transmission at the Micro Level

While our baseline empirical strategy focuses on the aggregate impact of collateral policy announcements — captured through the first principal component of individual bank stock price reactions — this section exploits bank heterogeneity to illustrate the transmission collateral policy at the micro level. In particular, we show that collateral policy changes has a differential impact on bank stock prices, depending on their balance sheet characteristics or funding structure. This is consistent with the heterogeneous transmission of conventional interest rate policy and lender-of-last-resort policy (see among others Kashyap and Stein, 2000, Drechsler et al., 2016) .

Bank Balance Sheet Characteristics To explore cross-sectional heterogeneity, we obtain balance sheet data from CapitalIQ for all banks for which we have intraday data, spanning the period from Q1 2007 until Q4 2024. We estimate the following regression at the bank-quarter level:

$$\Delta\text{bankstock}_{i,t} = \alpha + \beta\ \text{weak}_{i,t-1} + \gamma\mathbf{X}_{i,t} + \phi_i + \tau_t + \epsilon_{i,t} \tag{1}$$

where Δ bankstock is the (high-frequency) stock price reaction around a collateral policy change of bank i, cumulated over all events in quarter t. We define "weak" in terms of liquidity and solvency, respectively. First, we define a bank to be weak in terms of liquidity if its securities-over-assets-ratio is below the median of all the banks in the sample. Second, we define a bank to be weakly capitalized if its tier-one-ratio is below the median of all the banks in the sample. We expect that $\beta > 0$ as collateral policy changes are stronger for banks with less liquid / less capitalized banks, following Kashyap and Stein (2000).

We also include a vector of time-varying control variables at the bank level $\mathbf{X}$, where ln(Assets) is the log of total assets; Loans Ratio is the loans-over-assets ratio; ROE is the return on equity; Debt Ratio is the total debt-over-assets ratio; Deposits Ratio is the deposits-over-assets ratio of bank i in quarter t. We further include bank ϕ_i and quarter τ_t fixed effects.

	(1)	(2)
	Δ Stock$_i$	
Illiquid $(0/1)_{i,t-1}$	0.403**	
	(0.173)	
Low Capital $(0/1)_{i,t-1}$		0.208*
		(0.097)
ln(Assets)	-0.949	-0.897*
	(0.528)	(0.419)
Loans Ratio	-0.015	-0.014
	(0.010)	(0.009)
ROE	-0.005	-0.005
	(0.011)	(0.012)
Debt Ratio	0.002	0.002
	(0.006)	(0.006)
Deposits Ratio	-0.010	-0.010
	(0.012)	(0.012)
Observations	231	231
# of Banks	12	12
R-squared	0.823	0.819
Bank Controls	Yes	Yes
Bank FE	Yes	Yes
Quarter FE	Yes	Yes
Cluster	Bank	Bank

Table 1: Collateral Policy Surprises and Bank Heterogeneity. This table presents the results from estimating (1) over all collateral policy events. ***, **, * indicate significance at the 1, 5, and 10% level.

Table A.3 in Appendix A.2 presents descriptive statistics for the 12 banks in our sample, while Table 1 presents the from estimating (1) over all collateral policy events. Column (1) shows that less liquid banks react more to collateral policy surprises. The results are significant at the 5 % level. Column (2) shows that also less capitalized banks seem to react more to collateral policy changes, albeit with a lower magnitude. The results are slightly weaker but still significant at the 10 % level. Since collateral policy is primarily associated with banks' short-term funding needs, it is reasonable to expect that bank liquidity is a more important characteristic than bank capitalization. Overall, these results provide evidence that banks with less liquid balance sheets react stronger to collateral policy changes. This is in line with Kashyap and Stein (2000) who find similar results for changes in monetary policy.

Bank CDS Figure 5 displays the response of individual bank CDS spreads to an expansionary CPS. It is worth noting that the response is persistently negative for each individual banks. The

effects are quite substantial on impact and heterogeneous across countries. In particular, banks located in euro area periphery countries, such as Unicredit and Intesa Sanpaolo exhibit declines of almost 10 basis points, which persists over the entire estimation window of 10 trading days. Negative estimation horizons permit an assessment of pre-announcement trends, which turn out to be generally small and insignificant for all banks. The absence of pre-announcement effects further corroborates the validity of our identification strategy of the unexpected component of collateral policy announcements.

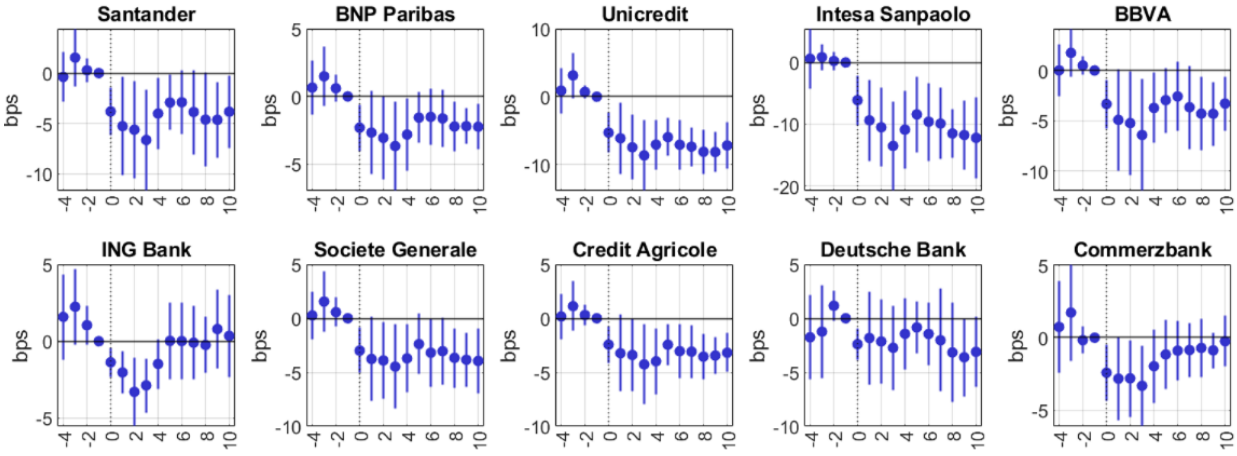

Figure 5: Bank CDS: Results from estimating (2) using all collateral policy surprises. The dependent variables are 5 Year senior CDS written on single-name banks, expressed in basis points. Dots represent estimated coefficients, and vertical lines denote 90% confidence intervals based on heteroskedasticity- and autocorrelation-consistent (Newey-West) standard errors. The horizontal axis reports event time in days relative to the policy announcements, with $t = 0$ marking the announcement dates.

4 Financial Market Effects

In this section, we now use our CPS to study the transmission of collateral policy to general financial markets and the euro area government bond market.

4.1 Empirical Specification

Following the literature on the financial market effects of monetary policy (Swanson, 2021; Bauer et al., 2023), we estimate local projections

$$y_{t+h} - y_{t-1} = \alpha + \beta_h cps_t + \epsilon_t \ , \tag{2}$$

where t indexes collateral policy announcements, h is the number of days after the announcement and ranges from $h = -4$ to $h = 10$, cps_t is the high-frequency collateral policy surprise series measured using intraday data, y_{t+h} is the asset price h days after the announcement, y_{t-1} is the asset price one day before the announcement, and ϵ_t is the residual. We estimate both the immediate and the delayed effects of policy surprises on asset prices, examining (i)

the contemporaneous asset price response on the announcement day and (ii) the lagged asset price responses over subsequent periods. As customary in the local projections literature, each time horizon is estimated separately. Standard errors are adjusted for serial correlation and heteroskedasticity. To check for pre-trends, we extend the local projection horizon to include four days prior to collateral policy announcements and find no meaningful evidence of such pre-trend patterns.[3]

4.2 Results

Table 2 presents the estimated effects of an expansionary one-standard deviation collateral policy surprise (CPS) across different estimation horizons. We focus on the contemporaneous (same-day) effect (β_0), while the effects over a 5-day (β_5) and 10-day (β_{10}) window are presented in Table B.2 in Appendix B.

Banks and Financial Markets Panel A of Table 2 reports the financial market responses. Following an expansionary CPS, the EURO STOXX 50 index increases significantly, indicating a broad-based positive market reaction. As expected, the EURO STOXX Banks index also reacts positively, since the identification of the shock is based on bank stock price movements. Crucially, its response is markedly stronger than that of the overall stock market. More formally, we find significantly positive excess returns over the EURO STOXX 50 index, which confirms the comparatively larger reaction of bank stocks and validates our identification strategy relying on bank stock reactions to measure collateral policy surprises.

Turning to variables that capture aggregate risk in financial markets, we find that expansionary collateral policy significantly reduces the V2X index, a common proxy for European equity market uncertainty, at all event horizons. Similarly, the implied volatility of EUR/USD currency options (EURUSDVOL) declines following an expansionary CPS. In both cases, the magnitude of the effect remains stable or even strengthens over time, suggesting a persistent dampening of financial market uncertainty.

A similar picture emerges for bank default risk as measured by CDS spreads. As illustrated in Figure 5 for individual banks, expansionary collateral policy causes a decline of default risk in the banking sector. At the aggregate level, we compute the cross-sectional average of bank CDS spreads for each trading day and find that a one–standard deviation CPS leads to a 3 basis point reduction in CDS spreads, which is also quite persistent. This supports the interpretation of expansionary CPS as positive "bank risk shock" and indicates that heightened risk-taking incentives are unlikely to be a primary concern in the transmission of collateral policy.

By contrast, we do not find any significant effect on the USD/EUR exchange rate, which stands in sharp contrast to the exchange rate channel typically observed for conventional mon-

[3]While asset prices prior to the announcements should already reflect all publicly available information, controlling for pre-trends allows us to account for other relevant news that may have occurred shortly before collateral policy announcements and could generate pre-event price drifts correlated with our surprise measure. These results are presented in Appendix B.

etary policy. We return to the comparison between our newly established collateral policy surprises and conventional monetary policy surprises in Section 4.4. For the full dynamic responses, we refer to Figure B.1 in Appendix B.

Variable	Contemp. (1)	5-day (2)	10-day (3)
Panel A: Financial Markets			
STOXX Overall	0.9***	1.2**	1.7***
STOXX Banks	1.8***	2.5***	3.5**
STOXX Banks-Overall	0.9***	1.3***	1.8**
V2X	-3.8***	-4.3**	-6.0***
EURUSDVOL	-1.5**	-2.7*	-3.3*
Bank CDS Spread	-3.2***	-4.2	-4.1*
EURUSD	0.2	0.0	0.4
Panel B: Government Bond Market			
Periphery-Core Spread, 10Y	-2.3**	-5.5**	-4.9*
Core Yield, 10Y	0.7**	-2.4*	0.8
Periphery Yield, 10Y	-1.6**	-7.9***	-4.1**
Periphery-Core Spread, 5Y	-2.3**	-6.6**	-5.3**
Core Yield, 5Y	1.0**	-0.8	4.3***
Periphery Yield, 5Y	-1.3*	-7.4***	-1.0
Germany CDS, 5Y	-0.4**	-1.3	-0.8
France CDS, 5Y	-0.9***	-2.5**	-2.7*
Italy CDS, 5Y	-3.6***	-7.4**	-9.1*
Spain CDS, 5Y	-3.1***	-6.3**	-8.4***

Table 2: Collateral Policy Surprises: Main Results. The table reports the contemporaneous, 5-day, and 10-day responses to a one standard deviation expansionary collateral policy surprise for the full sample (2008–2022). *Panel A* shows financial market variables (changes measured in percent); *Panel B* shows government bond market variables (changes measured in basis points). EUROSTOXX 50: overall euro area stock market index; EUROSTOXX Banks: bank sector index; EUROSTOXX 50 (exc. Fin.): excluding financial firms; V2X: implied volatility on EUROSTOXX 50 options; EURUSDVOL: 1-month implied volatility on EUR/USD options; Bank CDS: simple average 5y CDS spread of all banks in our sample; EURUSD: Euro to US Dollar exchange rate; yields and spreads are expressed in basis points. ***, **, * indicate significance at the 1, 5, and 10% levels.

Government Bond Markets We now turn to the government bond market effects of an expansionary CPS. Specifically, we examine responses of 10-year and 5-year government bond yields for the eight largest euro area sovereign borrowers. These include Germany, Belgium, France, and the Netherlands (the "core" countries), as well as Italy, Spain, Ireland, and Portugal (the "periphery"). In addition to the simple bond yields, we also estimate the effect on the periphery–core spread, defined as the difference between the (unweighted) average yields of the periphery and core country groups.

Panel B of Table 2 shows the results. The periphery-core spread declines significantly after an expansionary CPS for every estimation horizon and both bond maturities. The effect is quite

sizable and peaks at around -5 basis points several trading days after the shock. Examining core and periphery yields separately, we find that the effect on the periphery–core spread primarily reflects changes in periphery yields, both in magnitude and statistical significance. By contrast, core yields exhibit smaller and less consistent responses. The fully dynamic responses for 10-year bonds are presented in Figure B.2 and are very similar for five-year bonds (Figure B.3).

As a next step, we examine whether the government bond effects carry over to the pricing of sovereign risk more generally. Specifically, we obtain five year CDS-spreads for the four biggest euro area countries (Germany, France, Italy and Spain), which represents the most commonly traded CDS tenor. Again, we observe a significantly negative effect of expansionary collateral policy, which is more pronounced for riskier borrowers and consistent with the government bond market effects. The effect size for bond yields and CDS spreads is remarkably similar and suggests that collateral policy does not merely affect government bond prices by changing the collateral premia investors are willing to pay on them.

Instead, taken together with the positive effects of expansionary collateral policy on bank profitability, aggregate uncertainty, and bank default risk, these results give rise to an interpretation of expansionary collateral policy surprises as a positive "bank risk shock". In an intermediary asset pricing framework, banks' riskiness (equivalently, their net worth or leverage) is a crucial driver of asset prices. If their expected profits increase and their expected default risk declines, their willingness to pay for *all* assets - including sovereign CDS - rises, such that yields and spreads decline. In Section 5, we formalize these ideas in a simple intermediary asset pricing model.

Discussion The heterogeneous transmission of collateral policy to the government bond market can be illustrated by revisiting the narrative evidence presented in Section 3. In particular, we consider three individual events that triggered large movements in bank stocks, exceeding one percent over the short event window. On 31 March 2011, the ECB suspended the minimum rating requirement on Irish government bonds, making them eligible as collateral. This announcement was associated with an increase in aggregate bank stock prices and a narrowing of the 5-year Italian–German government bond spread by 4.2 basis points within one trading day. By contrast, on 20 July 2012, the ECB excluded Greek government bonds from the list of eligible collateral, inducing a decline in bank stocks and a widening of the Italian–German spread by 37.5 basis points within a single day. This contractionary collateral policy occurred during a period when periphery bond spreads exceeded 500 basis points. Finally, on 20 February 2015, the ECB began accepting again Greek government bonds as collateral, which was associated with positive bank stock returns and a reduction of the Italian–German spread by 6.4 basis points.

These events are noteworthy because they affect only the collateral treatment of (risky) sovereign debt while leaving haircuts on safe bonds, such as the German bund, unchanged. As a result, the collateral value of periphery government bonds changes, which in turn transmits heterogeneously to government bond prices. To the extent that long-term government bond

yields influence the interest rates at which firms in different jurisdictions borrow from banks, collateral policy surprises may also transmit heterogeneously to the real economy. Conversely, broadening the collateral framework could be justified by concerns about the transmission of interest rates to the real economy, particularly if some banks rely heavily on periphery sovereign bonds to collateralize their central bank borrowing.

4.3 Sample Splits

To deepen our understanding of the transmission of collateral policy to financial markets, we analyze how its effects differ across specific sub-samples in Table 3. Again, we focus on the contemporaneous effects in the main text and relegate the effects over one day and one week to Table B.1 and Table B.2 in Appendix B.

Variable	Non-Sov.	Sovereign	Expansion	Recession	Pre APP	Post APP
Panel A: Financial Markets						
STOXX Banks	1.9***	1.9***	0.6***	2.8***	2.2***	1.0
STOXX 50	0.8***	1.1***	0.3*	1.3***	1.2***	0.3
STOXX Banks-50	1.1***	0.8***	0.3***	1.5***	1.0***	0.7***
V2X	-3.7**	-4.5***	-2.6	-4.7**	-4.3***	-3.6
EURUSDVol	-2.0***	-1.2	-1.6***	-1.4	-2.5***	-0.5
Bank CDS	-3.6***	-3.2**	-1.2	-4.6***	-4.3***	-0.9
EURUSD	0.3***	0.1	-0.1	0.3***	0.2	0.1
Panel B: Government Bond Market						
Periphery-Core, 10Y	-3.0**	-1.8**	-1.3*	-3.1*	-3.0**	-0.9**
Core Yield, 10Y	2.7**	-0.2	1.2**	-0.1	0.2	1.1*
Periphery Yield, 10Y	-1.3	-2.0***	-0.1	-3.2**	-2.8***	0.3
Periphery-Core, 5Y	-3.3*	-1.6	-0.9	-3.5*	-2.9*	-1.0***
Core Yield, 5Y	2.2**	-0.2	1.1**	0.6	0.7	0.9
Periphery Yield, 5Y	-1.1	-1.7	0.3	-2.9*	-2.3**	-0.2
Germany CDS, 5Y	-0.3*	-0.5*	-0.1	-0.6*	-0.5**	-0.1
France CDS, 5Y	-0.3	-1.6***	-0.6*	-1.5**	-1.1**	-0.7
Italy CDS, 5Y	-2.2*	-5.6***	-1.9***	-5.0***	-4.1***	-2.2**
Spain CDS, 5Y	-2.1	-4.5**	-1.6**	-3.7*	-4.3***	-0.4

Table 3: Collateral Policy Surprises: Contemporaneous Responses for Different Sub-Samples. The table reports the contemporaneous response to a one standard deviation expansionary collateral policy surprise for different sample splits. *Panel A* shows financial market variables (EUROSTOXX Banks and EUROSTOXX 50 indices, V2X volatility, EURUSDVOL, Bank CDS spreads, and EUR/USD exchange rate). *Panel B* shows government bond market variables (10 year yields, periphery-core spreads, and 5 year sovereign CDS spreads for Italy, Spain, Germany, and France). Columns (1)–(2) report results for non-sovereign and sovereign events, columns (3)–(4) for expansions and recessions, and columns (5)–(6) for Pre-APP and Post-APP periods. All yields and spreads are expressed in basis points. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Non-Sovereign vs Sovereign Events Collateral policy changes often refer to government bonds, which play a central role in banks' collateral management due to their extraordinary

safety and liquidity. However, given the broad scope of the Eurosystem's collateral framework implies that many events affect other assets, such as asset-backed securities. could also influence financial markets. To investigate this, Column (1) of Table 3 focuses on events that only affect private sector assets, but leave the collateral treatment of government bonds unaffected. By contrast, Column (2) considers events that also or exclusively affect government bonds.

We find that equity market responses are generally similar across sub-samples. Similarly, the volatility measures and bank CDS spreads decline for both types of events. While these results are not surprising, they further support our empirical approach based on bank stock returns rather than on sovereigns as the issuers of collateral, as the uneven effects extend beyond events targeting sovereign bonds. Indeed, it is important to note that the periphery-core spread also narrows significantly for events unrelated to sovereign bonds. This holds irrespective of the bond maturity and the estimation horizon.

To reconcile these findings with the similarly symmetric effects on financial market volatility and bank CDS spreads, it is helpful to revisit the bank-specific CDS responses in Figure 5. Here, we observed a much stronger reaction for periphery banks, which were also holding more periphery sovereign bonds during our sample period, as documented by the European Banking Authority's transparency exercise in 2013.[4] Hence, an intermediary asset pricing framework that also takes into account high domestic government bond holdings predicts an uneven transmission of a symmetric collateral policy surprise to the government bond market. Our analysis suggests tentatively, that the source of the uneven transmission lies in bank heterogeneity rather than in heterogeneity in fiscal fundamentals.

Business Cycle Next, we investigate the role of the macroeconomic environment for the transmission of collateral policy. If adverse economic conditions are associated with elevated stress in the banking system, an expansionary CPS might have more pronounced effects on banks and the government bond market. For example, Brunetti et al. (2011) study the effects of central bank policy interventions on interbank market stress and find different effects in crisis and normal times. Hence, we separately estimate our baseline specification during periods classified as expansions and recessions by the CEPR, respectively.[5] In this context, it is important to note that collateral policy typically accommodates the temporarily high demand for central bank funding, which otherwise might be constrained by limited availability of eligible collateral. However, our CPS isolates the unexpected change in collateral policy, so our results do not reflect the systematic responses of collateral policy to the macro-financial environment, but can be interpreted as differences in the transmission mechanism.

Consistent with a temporarily high liquidity demand during downturns, we observe that bank stocks react more strongly during recessions (Column 4). Consequently, the bank excess return is larger at 1.5 percent, while it is only 0.3 percent during expansions. At the same time, collateral policy induces around twice the decline in the V2X during recessions, while bank CDS

[4]More details on the EU-wide transparency exercise can be found under this link.
[5]The CEPR recession indicator can be found under this link.

spreads decline by almost 5 basis points compared to merely one basis point during expansions. In line with the larger financial market effects, *Panel B* shows that periphery-core spread is also compressed much more during recessions (around 3 basis points) than in expansions (around one basis point). Again, these responses are primarily driven by periphery yields. Similarly, periphery CDS spreads decline much more during recessions. Taken together, this suggests that the macroeconomic environment plays an important role in the transmission of collateral policy.

Asset Purchases and Excess Liquidity In addition to the macroeconomic environment and hence liquidity demand, it is also natural to examine the role of liquidity supply for the transmission of collateral policy. The overall amount of central bank liquidity in the form of excess reserves may soften the effects of collateral policy by reducing banks' reliance on central bank facilities. Arguably, large-scale asset purchases by the Eurosystem expand central bank reserves and arguably lower the demand for collateral. Consistent with this mechanism, we find stronger and highly significant effects for most variables in the period preceding these purchases (Column 5). Nevertheless, we still observe significant effects in the Post-APP subsample (Column 6), especially when it comes to government bond yields and CDS spreads. This observation suggests that some banks continue to benefit from access to central bank facilities even in periods of elevated aggregate liquidity.

4.4 Comparison to Monetary Policy Surprises

To benchmark the effects of our newly established collateral policy surprises against conventional monetary policy surprises, we estimate equation (2), using the monetary policy surprise series from Jarociński and Karadi (2020). While an expansionary one standard deviation monetary policy surprise raises the STOXX 50 index by 0.4 percent, we normalize the effects of the MPS so that they imply the same STOXX 50 increase as an expansionary one standard deviation CPS. Table 4 presents the results for CPS in Column (1) and MPS in Column (2), focusing on the contemporaneous response (β_0). Similar results can be obtained for different estimation horizons.

Panel A of Table 4 reports financial market effects. Monetary policy surprises have little significant effects on equity markets, the responses of the EUROSTOXX 50 and the EURO STOXX bank index are smaller in magnitude and less statistically insignificant. Importantly, there is no visible excess return by the bank index in comparison to the wider stock market. While the effects of monetary policy surprises on the V2X are also negative, they are only a third of magnitude compared to CPS effects. Furthermore, there appears to be no effect on FX-option-implied volatility and bank CDS spreads. However, we observe the well-documented impact on the exchange rate, which is absent for the collateral policy surprise.

Turning to the effects on the government bond market in Panel B of Table 4, we document that an expansionary MPS depresses government bond yields. Importantly, the magnitudes are almost the same between core and periphery countries, i.e. the spread between core and periph-

Variable	CPS (1)	MPS (2)
Panel A: Financial Markets		
STOXX 50	0.9***	0.9**
STOXX Banks	1.8***	0.9*
V2X	-3.8***	-2.7**
EURUSDVOL	-1.5**	0.2
Bank CDS Spread	-3.2***	-0.5
EURUSD	0.2	-0.2**
Panel B: Government Bond Market		
Core Yield, 10Y	0.7**	-4.7***
Periphery Yield, 10Y	-1.6**	-3.8***
Periphery-Core Spread, 10Y	-2.3**	0.9***
Germany CDS, 5Y	-0.4**	0.9
France CDS, 5Y	-0.9***	-0.7
Italy CDS, 5Y	-3.6***	1.1
Spain CDS, 5Y	-3.1***	3.4

Table 4: Collateral and Monetary Policy Surprises. The table reports the contemporaneous response (β_0) to a one standard deviation expansionary collateral policy surprise (CPS) and an expansionary monetary policy surprise (MPS, Jarociński and Karadi, 2020) normalized to the same STOXX 50 reaction. *Panel A* shows results for financial markets; *Panel B* for the government bond market. STOXX 50 is an overall euro area stock market index; STOXX Banks is the banking sector index; STOXX (exc. Financials) excludes financial firms; V2X: option-implied Euro STOXX 50 volatility; EURUSDVOL: 1-month implied volatility on EUR/USD options; Bank CDS: average 5y CDS spread of euro area banks; EURUSD: Euro to US Dollar exchange rate; Core/Periphery Yields: 5- and 10-year sovereign yields; CDS: 5-year sovereign credit default swap spreads. ***, **, * indicate significance at the 1, 5, and 10% levels.

ery bonds is essentially constant (Column 2). This is in sharp contrast to the heterogeneous effects of expansionary CPS (Column 1). Consistent with this observation, we do not find any effect on sovereign CDS. Taken together, these results highlight that collateral policy operates through very different transmission channels compared to monetary policy, both across financial and government bond markets.

5 A Simple Model of Collateral Policy

In this section, we present a stylized intermediary asset pricing model to illuminate the transmission of collateral policy to banks and asset prices. There are two periods $t = 0, 1$ and two assets, indexed by A and B. The expected per-unit payoffs are denoted by $\mathcal{R}_1^A$ and $\mathcal{R}_1^B$, respectively. Investors are perfectly competitive and do not have inside funds in period 0, such that dividends are given by

$$div_0 = q_0^D d_1 - q_0^A b_1^A - q_0^B b_1^B \tag{3}$$

At the beginning of period 1, banks draw a liquidity deficit $\delta_1 \cdot d_1$, where $\delta_1 \sim \exp(l)$, in the spirit of Bianchi and Bigio (2022). Banks settle their liquidity with the central bank against eligible collateral. The collateral value of bank assets depends on central bank collateral policy:

$$\bar{b}_1 = \underbrace{(1-\phi^A)\mathcal{R}_1^A b_1^A}_{\equiv \bar{b}_1^A} + \underbrace{(1-\phi^B)\mathcal{R}_1^B b_1^B}_{\equiv \bar{b}_1^B}, \tag{4}$$

where we restrict attention to the case of $\phi^A, \phi^B \in [0,1]$. Banks default if their collateral is insufficient to enable them to replace the withdrawn funds by central bank borrowing, i.e. if $\bar{b}_1 < \delta_1 \cdot d_1$. Using the exponential distribution assumption on the liquidity deficit δ_1, we can write the default probability as $F(\bar{b}_1/d_1) = \exp\{-l \cdot \bar{b}_1/d_1\}$. All else equal, making assets eligible as collateral or lowering the applicable collateral haircuts decreases the bank failure probability, which directly follows from differentiating the default probability with respect to ϕ^A:

$$\frac{\partial F(\bar{b}_1/d_1)}{\partial \phi^A} = \frac{l\mathcal{R}_1^A b_1^A}{d_1} \exp\{-l \cdot \frac{\bar{b}_1}{d_1}\}. \tag{5}$$

Bank liabilities d_1 are priced competitively at their expected repayment probability $q_0^D = 1 - F(\bar{b}_1/d_1) = 1 - \exp\{-l \cdot \bar{b}_1/d_1\}$. Dividends in period 1 read

$$div_1 = \mathbb{1}\{\bar{b}_1 > \delta_1 d_1\}\big(\mathcal{R}_1^A b_1^A + \mathcal{R}_1^B b_1^B - d_1\big) \tag{6}$$

Banks maximize expected dividends in period one subject to a balance sheet constraint in period 0 that arises because banks have no funds in period 0. This constraint binds since banks only value dividends in period 1. Formally, we have

$$\max_{d_1, b_1^A, b_1^B} \mathbb{E}_0[div_1] \quad \text{s.t.} \quad div_0 = 0. \tag{7}$$

Using equations (3) and (6), the maximization problem can be written as

$$\max_{d_1, b_1^A, b_1^B} \big(1 - F(\bar{b}_1/d_1)\big)\Big(\mathcal{R}_1^A b_1^A + \mathcal{R}_1^B b_1^B - d_1\Big) \quad \text{s.t.} \ \big(1 - F(\bar{b}_1/d_1)\big)d_1 = q_0^A b_1^A + q_1^B b_1^B$$

The first-order conditions with respect to asset holdings b_1^A and b_1^B are given by

$$q_0^A = \Big(\big(1 - F(\bar{b}_1/d_1)\big) + \frac{\bar{b}_1^A}{d_1} F(\bar{b}_1/d_1)\Big) \cdot \mathcal{R}_1^A, \tag{8}$$

$$q_0^B = \Big(\big(1 - F(\bar{b}_1/d_1)\big) + \frac{\bar{b}_1^B}{d_1} F(\bar{b}_1/d_1)\Big) \cdot \mathcal{R}_1^B. \tag{9}$$

The possibility of bank failure affects asset prices in two ways. First, the expected payoff from purchasing *any* asset is discounted more strongly since banks receive the payoff from their investment in fewer states of the world. Put differently, the marginal utility of bankers'

consumption in period 1 is smaller and their sdf shifts downwards. Second, acquiring pledgeable assets reduces the bank default probability, since they increase the likelihood that the collateral value of their assets is sufficient to cover the liquidity shock $\delta_1 d_1$. Hence, this increases the marginal benefit from holding any *specific* asset than can be pledged as collateral. This marginal benefit counteracts the negative effect of bank failure on the pricing of government debt but does not overturn it, since $\bar{b}_1^A/d_1 \leq 1$, even if the asset can be pledged without collateral haircuts ($\phi^A = 0$).[6]

How does central bank collateral policy affect banks' pricing of assets? Since we assume that collateral policy does not affect each asset's expected payoff, we can write the partial derivatives of the asset pricing condition with respect to its own collateral parameter ϕ^A and the other assets' collateral parameter ϕ^B:

$$\frac{\partial q_0^A}{\partial \phi^A} = \Big(\underbrace{\big(-1 + \frac{\bar{b}_1^A}{d_1} \big) \frac{l \mathcal{R}_1^A b_1^A}{d_1}}_{\text{More bank failure}} - \underbrace{\frac{\mathcal{R}_1^A b_1^A}{d_1}}_{\text{Smaller coll. service}} \Big) \cdot F(\bar{b}_1/d_1) \cdot \mathcal{R}_1^A \,, \tag{10}$$

$$\frac{\partial q_0^A}{\partial \phi^B} = \underbrace{\Big(-1 + \frac{\bar{b}_1^A}{d_1} \Big)}_{\text{More bank failure}} \cdot F(\bar{b}_1/d_1) \cdot \frac{l \mathcal{R}_1^B b_1^B}{d_1} \cdot \mathcal{R}_1^A \,. \tag{11}$$

The first part of the own derivative, equation (10), is unanimously negative, since $\frac{\bar{b}_1^A}{d_1} < 1$ by the balance sheet constraint and the assumption that $0 < \phi^A 1$. This term captures that a collateral policy tightening depresses banks' valuation of all assets by reducing expected bank failure. Intuitively, the marginal utility of dividends in period 1 is larger and banks receive the asset payoff with a higher probability. This effect is reinforced by the second term $\frac{\phi^A \mathcal{R}_1^A b_1^A}{d_1}$, which indicates that the benefit of holding asset A is lower due to its smaller marginal effect on the bank failure rate. Summarizing both effects, our model clearly predicts that raising the collateral haircut on asset A depresses banks' demand for it.

The cross-derivative with respect to ϕ^B, equation (10), only contains the negative effect of an increase in ϕ^B on bank default risk. The only channel through which the pricing of asset A is affected by the collateral treatment of other assets are spillovers operating through the bank failure rate. Ashcraft et al. (2010) obtain similar predictions in a model where banks face collateral constraints.

The model's implications are consistent with the substantial reaction of (periphery) government bond yields in response to events unrelated to the treatment of sovereign bonds. We can also interpret the sample splits into expansions/recessions and the pre- and post-APP period through the lenses of the simple intermediary asset pricing model by further differentiating the partial derivatives with respect to the parameter l which governs the size of liquidity needs and hence collateral demand. Since equations (10) and (11) are linear in l, it follows immediately that asset price responses are more pronounced if liquidity needs are higher.

[6] It is worth noting that in the absence of bank default, our stylized intermediary asset pricing framework reduces to a consumption based asset framework, where all assets are priced at their expected payoff.

Sovereign CDS To understand the transmission of collateral policy to sovereign CDS, it is helpful to note that we can price an asset that reflects the payoff profile of a sovereign CDS in our stylized model:

$$q_0^{CDS} = \Big(1 - F(\bar{b}_1/d_1)\Big) \cdot \mathcal{R}_1^{CDS} \ . \tag{12}$$

While the CDS price is also negatively affected by the bank failure rate, it does not contain the second term related to the *marginal* bank failure rate, since a CDS cannot be used as collateral. The partial derivative of the CDS price with respect to each collateral parameter reads

$$\frac{\partial q_0^{CDS}}{\partial \phi^A} = \underbrace{\Big(-1 + \frac{\bar{b}_1^A}{d_1}\Big)}_{\text{More bank failure}} \cdot F(\bar{b}_1/d_1) \cdot \frac{l\mathcal{R}_1^A b_1^A}{d_1} \cdot \mathcal{R}_1^{CDS} \ , \tag{13}$$

$$\frac{\partial q_0^{CDS}}{\partial \phi^B} = \underbrace{\Big(-1 + \frac{\bar{b}_1^B}{d_1}\Big)}_{\text{More bank failure}} \cdot F(\bar{b}_1/d_1) \cdot \frac{l\mathcal{R}_1^B b_1^B}{d_1} \cdot \mathcal{R}_1^{CDS} \ . \tag{14}$$

Similar to the spillovers between asset classes discussed above, the transmission of collateral policy to sovereign CDS prices operates through bank default risk. If we interpret periphery banks as more risky and assume that the marginal investor in periphery government bonds and sovereign CDS is such a bank, the same comparative statics with respect to l would predict a stronger transmission of collateral policy to periphery bonds and CDS spreads.

6 Conclusion

In this paper, we develop a high-frequency approach to identify the effects of central bank collateral policy on banks, general financial markets, and sovereign bonds. We identify collateral policy surprises using bank stock price changes over short time windows around Eurosystem collateral announcements. By broadening access to central bank funding, expansionary collateral policies increase bank stock excess returns, reduce common financial market measures of risk and bank CDS spreads, in particular for banks located in the periphery. These effects are more pronounced during times of economic stress and in the pre-APP period, when liquidity was less abundant and central bank borrowing played a greater role.

We then show that expansionary collateral policy reduces government bond yields, in particular for the euro area periphery. A similarly uneven decline is observed for sovereign CDS spreads, in line with intermediary asset pricing theory. Importantly, the periphery-core spread also responds to events that do not affect the collateral treatment of sovereign bonds. The evidence suggests that the transmission of collateral policy differs across countries, and this variation seems to be closely linked to fragmentation in the banking sector.

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A Appendix: Collateral Policy Surprise Series

This section provides detailed information on the collateral policy events that received media coverage and are potential candidates to be included in our collateral policy surprise series. For each event, we know the exact time stamp of the ECB's policy announcement. We summarize briefly the main content of each announcement and report relevant market commentary and additionally relevant background information in the third column of Table A.1.

A.1 List of Collateral Policy Announcements

Date	Announcement	Market Commentary/Background Info	Narrative	Unanimous
04 Sep 2008 (1)	ECB's trichet on collateral	Monetary policy day; Overnight Index Swap (OIS) rates – briefly narrowed on Thursday after European Central Bank Jean-Claude Trichet announced details of new collateral rules. The spread has reached record wides over the last month as concerns mounted over the availability of cash over the year end period. However the spread was last testing new wides around 87 basis points after Trichet said some banks may have to bring forward extra collateral. Bund futures also pared gains as the market realised the changes would not effect year-end funding liquidity. "The market knew something was coming but the fact that these measures won't be implemented until February 2009 is seen as a small negative because short-term money market tensions that people might have been looking for after this will not come into play for six months," said a trader.	0	0
15 Oct 2008 (2)	ECB says list of assets to eligible as colleral in Eurosystem credit operations will be expanded until the end of 2008	In its latest bid to tame the financial market crisis, the ECB lowered its threshold for accepting assets to BBB- from A- and said it would accept assets denominated in foreign currencies and debt instruments issued by credit institutions, among other changes. The dollar and euro both pared losses against the yen on Wednesday after the European Central Bank said it would extend a series of efforts to boost liquidity until the end of 2009. The moves, which include a plan to offer U.S. dollar liquidity through foreign currency swaps, eased risk aversion. Money market interest rates have eased this week as banks now have fewer concerns about access to liquidity and analysts said the changes should help to bring wholesale rates down further.	1	1
26 Nov 2008 (3)	ECB says to no longer accept syndicated loans as collateral	No relevant market commentary.	1	1

Date	Announcement	Market Commentary/Background Info	Narrative	Unanimous
20 Jan 2009 (4)	ECB says to require a rating of AAA/Aaa for ABS as collateral issued as of March 1	Analysts were mixed in their reaction to the move, the third substantive change to the ECB's collateral framework since last September, as the financial crisis has intensified. "From the banks' perspective, it's more restrictive, but it's not so drastic that it will shrink the mortgage market," said an analyst specialising in structured credit at a German bank. RBS economist Silvio Peruzzo said the announcement was minor compared to other changes announced to the ECB's collateral rules. "It provides an additional control on the quality of assets," he said. But Tullett Prebon economist Lena Komileva said the move sent the wrong signal at a time when the Bank of England and the U.S. Federal Reserve were stepping in to support illiquid markets. "Rather than responding to an underlying improvement in market liquidity conditions, the ECB's collateral tightening reflects quite the opposite – poor asset quality and insufficient market transparency – resulting in greater financial stresses," she said.	1	1
08 Apr 2010 (5)	Q+A - ECB to announce changes to collateral rules	No relevant market commentary.	0	0
03 May 2010 (6)	ECB suspends limits on Greek debt	Move avoids Greek debt falling off collateral list * Removes role of rating agencies in Greek crisis * They want to make sure that the question of Greek banks having access to liquidity will not be an issue in this crisis. It's one less thing to worry about." "We always thought the ECB would be quite flexible and pragmatic.	1	0
28 Jul 2010 (7)	ECB lays out new sliding-scale of collateral haircuts	ECB tightens rules on weaker-rated collateral. The changes are slightly more aggressive than expected, but overall they should not impact banks financing too significantly, said Credit Agricole economist Frederik Ducrozet. "The biggest changes are on lower-rated assets and they are the type of assets that are not used to such a large degree."	1	0

Date	Announcement	Market Commentary/Background Info	Narrative	Unanimous
09 Oct 2010 (8)	ECB underscores power to limit banks' borrowing	The changes, published on Saturday, clarify the ECB's ability to bar or restrict banks from borrowing from the ECB and impose ad-hoc limits on what assets can be swapped for loans. "On the grounds of prudence, the Eurosystem may also reject assets, limit the use of assets or apply supplementary haircuts to assets submitted as collateral in Eurosystem credit operations by specific counterparties."	0	0
16 Dec 2010 (9)	ECB says it plans to introduce loan-by-loan information requirements for ABS in collateral framework within 18 months	News mainly about capital increase ECB. "We infer from this that the ECB ... is seeking a greater cushion in order to offset potential losses, given that its portfolio of securities holdings has risen substantially, as well as to protect itself from potential collateral losses," Barclays Capital economists said in a research note.	1	0
31 Mar 2011 (10)	ECB has decided to suspend the application of minimum credit rating threshold in collateral eligibility requirements for Ireland government bonds until further notice	* ECB helps Irish banks by loosening lending requirements * Commits to continue providing funds * But appears to shelve plan for new liquidity facility * Disagreements over plan within Governing Council.	1	1
29 Apr 2011 (11)	ECB to require loan-by-loan data for commercial MBSs	No relevant market commentary.	0	0
07 Jul 2011 (12)	ECB suspends rules on Portuguese collateral	HELPING HAND TO PORTUGAL The downgrading of recently bailed-out Portugal's credit rating to junk rattled financial markets on Wednesday and cast new doubt on European efforts to rescue distressed euro zone states without debt restructuring. The ECB has pledged to keep liquidity flowing to euro zone banks that need it, and Trichet said Portuguese debt would be accepted by the ECB as collateral for now, come what may.	1	1

Date	Announcement	Market Commentary/Background Info	Narrative	Unanimous
21 Sep 2011 (13)	ECB says Eurosystem has reduced limit for use of unsecured debt instrument issued by banks, such assets may be used as ECB collateral with value not to exceed 5 pct vs 10 pct earlier	ECB abolishes eligibility rules for some bank-issued debt * Reduces limit on bank-issued unsecured debt to 5 pct * Analysts see net loosening effect. The move comes amid growing fears of a renewed credit crunch as the euro zone sovereign debt crisis is shaking confidence in the region's banks. "They are really trying to make it easier for banks to access liquidity, widening the pool of assets they can use," Marie Diron, an economist at Oxford Economics, said. "They are trying to avoid problems in the sector which would then spill over to the economy." The 17-country bloc's central bank also said it had limited the use of bank-issued unsecured debt instruments. "Such assets may only be used as collateral to the extent that the value assigned does not exceed 5 percent of the total value of collateral submitted," the ECB said. The limit was previously 10 percent. "I'm not sure that's too much of a constraint, as big banks have not been able to issue many of these bonds lately, so it was not their main source of collateral," Diron said.	1	0
08 Dec 2011 (14)	Draghi says ECB to ease collateral rules for refinancing operations	Montary Policy Day and LTRO announcement! Traders also said the market perceived the easing of collateral requirements for euro zone banks as more risky because the ECB is lowering lending standards.	1	0
09 Feb 2012 (15)	ECB's Draghi - Credit claims will lead to increase in available collateral	Collateral easing could save banks over 100 mln eur per year * Ending of self-issued bonds wld give investors confidence * It gives additional confidence in the banks by further easing funding and liquidity concerns and it has the prospect of eradicating this self-bond issuance phenomenon. Just seven euro zone countries have signed up to take part in the central bank's looser collateral rules for lenders. The good news is that the ECB can now aim its cheap three-year loans at the countries where they're needed most. The bad news is that the recipients may not appreciate the exposure. Banks in Portugal, Ireland, Spain, Italy, France, Austria and Cyprus will now be able to pledge a broader array of single loans to their national central banks in return for cash.	1	0

Date	Announcement	Market Commentary/Background Info	Narrative	Unanimous
28 Feb 2012 (16)	ECB has decided to temporarily suspend eligibility of Greek bonds used as collateral	A senior Greek banker said the only access for banks during this period will be the Bank of Greece, which will expand the ELA facility to accommodate liquidity needs until the European Financial Stability Facility money is available. That the euro zone's deal makers and the ECB did not foresee the potential risk of the EFSF support scheme not being activated in time is likely to leave some with red faces. The issue is vital because Greek banks would almost certainly go bust if their central bank funding was withdrawn. Other banks in countries like France also own large chunks of Greek debt, though they have other assets to use as collateral. " The decision of the ECB to suspend temporarily Greek bonds as collateral has no impact on French banks, " a Ban k of France spokeswoman said.	1	1
08 Mar 2012 (17)	ECB says it will restart accepting Greek government bonds as collateral	Part of the "selective default" of Greek bonds, Greek debt restructuring, was done that week.	1	1
22 Jun 2012 (18)	ECB reduces rating threshold for ABS	German debt extended falls and stocks trimmed losses on Friday after the European Central Bank announced it would accept a wider range of assets as collateral, including those of a lower quality, in move designed to ease pressure on Spain. [ID:nF9E8F402O] "It just means that they are willing to take as collateral lower-quality credit, which is probably why the periphery is getting a bit of a bid against Germany," a trader said.	1	1
28 Jun 2012 (19)	Looser ECB lending rules come into force June 29	Last week, the ECB said would start accepting a wider range of collateral in its lending operations and assets of a lower quality to neutralise growing bank funding pressures.	1	1

Date	Announcement	Market Commentary/Background Info	Narrative	Unanimous
03 Jul 2012 (20)	ECB says banks may not submit government guaranteed bank bonds as collateral above nominal value without ECB Pre-approval	No relevant market commentary. Background info: banks in troubled euro zone countries such as Greece have been increasingly borrowing ultra-cheap funds from the ECB using self-issued bonds which are then given a state guarantee by the government which make them eligible at the ECB. The amounts involved could be over 100 billion euros. Central bank policymakers have become increasingly disgruntled by the practice in recent months, worried it could leave the ECB facing enormous losses if Greece or others doing the same left the euro.	1	0
05 Jul 2012 (21)	Draghi - Collateral situation varies by country	No relevant market commentary.	0	1
06 Jul 2012 (22)	ECB to require more data on ABS starting this year	No relevant market commentary.	1	1
20 Jul 2012 (23)	ECB says Greek government bonds to be ineligible as collateral from July 25	Greek banks would almost certainly go bust if their central bank funding was withdrawn. Banks in other euro zone countries also own large chunks of Greek debt, though they are more likely have other assets to use as collateral and are thus not hit as hard. "In this way the ECB could be putting pressure (on the Greek government) to bring about a positive review by the troika," Alpha Finance bank analyst Nikos Lianeris said. "If there is a positive review by the troika then the Greek banks will regain direct access to ECB funding." Greek bankers took the decision in their stride. "It's something we were expecting," one banker speaking on the condition of anonymity said. "The only difference is the borrowing cost for the banks." In a separate statement, the ECB said it would start accepting some Greek credit claims as collateral, but this move is unlikely to make up for much of the exclusion of the country's sovereign bonds. The ECB also said it had agreed to extend the collateral use of credit claims by banks in struggling euro zone members Cyprus, Portugal and Italy. The ECB could not provide immediate estimates of how much extra collateral the changes would provide for banks. It also could not say why Spain, whose ailing banks will receive a bailout, w as not included in the expansion.	1	1

Date	Announcement	Market Commentary/Background Info	Narrative	Unanimous
06 Sep 2012 (24)	ECB's Draghi - Council took decisions on collateral, details to follow	* Draghi expected to announce framework for bond buying (following up on OMT announcement in July) * No targets for intervention size, yields will be given -sources * Interest rate cut not up for discussion this month * Formal rate announcement at 1145 GMT.	0	0
27 Nov 2012 (25)	ECB delays implementation of ABS loan data reporting	No relevant market commentary.	0	0
19 Dec 2012 (26)	ECB - Greek sovereign debt shall again constitute eligible collateral for ECB credit operations, subject to haircuts	Lifting a ban in place since July, the ECB said it was making Greek debt eligible again in light of the country's progress with reform measures, budget cutting and privatisations. Greek bank shares extended gains on the news, some trading up more than 10 percent on the day. Greek bonds rallied sharply in response to the change, which makes the debt more attractive for domestic banks, with 10-year sovereign yields falling by almost 1.5 percentage points to 11.42 percent.	1	1
22 Mar 2013 (27)	ECB says it will stop collateral use of uncovered government-guaranteed bank bonds that have been issued by bank itself, or entity closely linked to it, from March 1, 2015	No relevant market commentary.	1	0
02 May 2013 (28)	ECB says Cyprus government bonds to become eligible collateral in ECB operations	No relevant market commentary.	1	0

Date	Announcement	Market Commentary/Background Info	Narrative	Unanimous
28 Jun 2013 (29)	ECB says it has decided to temporarily suspend eligibility of Cyprus debt for use as collateral at its monetary policy operations	Background: In response to Cyprus's announcement on the debt exchange, Standard & Poor's downgraded the sovereign foreign currency credit rating on Cyprus to SD (selective default) from CCC. S&P said that after the exchange, which is expected to occur on July 1, the liquidity strains on the government should be alleviated. After the exchange, the rating is expected to rise to CCC-plus. The ECB move is likely to be temporary.	1	0
05 Jul 2013 (30)	ECB lifts suspension on Cyprus debt eligibility	No relevant market commentary. Background info: The European Central Bank said on Friday it was lifting a suspension on the eligibility of Cyprus's debt for use in its refinancing operations after Standard & Poor's upgraded the island state's credit rating."	1	0
18 Jul 2013 (31)	ECB says to expand list of collateral it accepts at liquidity operations	*Banks rally as ECB expands collateral rules* French, Italian and Spanish banks extend gains, with sentiment on the sector bolstered after the European Central Bank expands the list of eligible collateral to include more asset-backed securities (ABS). Among the top risers are Popolare Milano (PMII.MI) and Bankinter (BKT.MC), which add 8.5 percent each. "Shares in Italian banks are boosted by the ECB move because they could be among the main beneficiaries of these new rules as they have high exposure" to loans for SMEs, says a trader in Milan.	1	1
09 Sep 2013 (32)	ECB says it could offer leniency in ABS loan reporting	Background info: this move offers some exceptions to the ECB's loan-level reporting requirements, which was designed to increase transparency for the hard-to-value assets.	1	1
19 Sep 2013 (33)	ECB asks for data on ABS backed by credit card debt	No relevant market commentary.	0	1
27 Sep 2013 (34)	ECB collateral rules to increase ABS eligibility apply from Oct	Background info: The European Central Bank's new collateral rules that let banks use more of the assets once blamed for triggering the financial crisis in the central bank's refinancing operations will come into force in October, the ECB said on Friday.	1	0
24 Jan 2014 (35)	ECB postpones minimum threshold for credit claims	No relevant market commentary.	1	1

Date	Announcement	Market Commentary/Background Info	Narrative	Unanimous
12 Mar 2014 (36)	ECB's Coeure - Development of ABS market is probably beyond remit of monetary policy, European Commission should lead it	No relevant market commentary.	0	0
19 Sep 2014 (37)	ECB's Praet urges governments to rethink support for ABS	The ECB will detail its plans at its October policy meeting. Some analysts have criticised the plan, saying it would fail to free capital on banks' balance sheets if the ECB sticks to only buying the senior and most secure ABS tranches, leaving the riskier parts with the bank.	0	1
04 Feb 2015 (38)	ECB lifts waiver on credit rating requirements for Greek bonds	U.S. Treasuries prices turned positive in late trading on Thursday, erasing earlier losses after the European Central Bank would not accept Greek government bonds as collateral for loans to banks. The ECB move rekindled safe-haven demand for low-risk U.S. and German government debt as it stoked worries about runs at Greek banks and concerns the new Greek government would have trouble renegotiating debt terms with its euro zone partners, analysts said.	1	1
20 Feb 2015 (39)	ECB ready to reintroduce waiver for Greek collateral once it assesses that program likely to be concluded - ECB sources	No relevant market commentary.	0	1
31 Aug 2015 (40)	ECB to accept loan bundles as collateral	The decision is aimed at expanding the pool of collateral available to euro zone banks and stimulating lending, which has been slow as the economy struggles.	1	1

Date	Announcement	Market Commentary/Background Info	Narrative	Unanimous
22 Jun 2016 (41)	ECB set to reinstate Greek banks' access to cheap funding	The reinstatement of the waiver for Greek assets by the ECB could benefit Greek core banks' net interest income by as much as around 80 million euros – after tax at around 60 million euros – depending on the eligibility of the Greek assets and the level of haircut imposed, Greek brokerage Euroxx said. "This, in our view, will be essential for the reduction of Greek banks funding costs, which along with the gradual easing of capital controls should also help the all-important return of deposits into the system," it said.	0	0
05 Oct 2016 (42)	ECB says it has decided to reduce, as of 1 Jan 2017, the usage limit for uncovered bank bonds from 5% to 2.5% for collateral eligibility	Background info: The European Central Bank will continue to accept unsecured bank bonds as collateral for lending, including some that may be written down if a bank fails, but it is restricting their use and increasing checks, it said on Wednesday. The move comes in response to new European rules stating that investors in a bank, including holders of bonds that are not backed by collateral, must suffer losses in case of default before public money can be used.	0	0
03 Nov 2016 (43)	ECB to tighten collateral rules	No relevant market commentary.	1	1
14 Dec 2017 (44)	ECB says UBSS that are subject to statutory, contractual or structural subordination (e.g., UBSS issued by bankholding companies) will become ineligible as collateral	No relevant market commentary.	0	0
08 Feb 2018 (45)	ECB says it amends criteria on interest payment structures for eligible credit claims and other technical changes related to collateral framework	No relevant market commentary. Background info: The European Central Bank is tightening regulations to prevent banks from pledging some riskier forms of collateral when they borrow from euro zone central bank.	1	1

Date	Announcement	Market Commentary/Background Info	Narrative	Unanimous
22 Mar 2019 (46)	ECB says eligibility requirements for loan-level data reporting in collateral framework to be adjusted to reflect EU securisation regulations and disclosure requirements	No relevant market commentary.	0	0
07 Apr 2020 (47)	ECB announces package of temporary collateral easing measures	No relevant market commentary. Background info: In a series of measures unveiled after an unscheduled Governing Council meeting, the ECB said it would ease collateral requirements, making it easier for banks to use its funding operations, which banks tapped for hundreds of billions of euros.	1	0
22 Apr 2020 (48)	ECB says it takes steps to mitigate impact of possible rating downgrades on collateral availability	Background info: Limited reaction to ECB, market focused on EU conference.	1	1
22 Sep 2020 (49)	ECB says to accept sustainability-linked bonds as collateral	Nevertheless, analysts expect that ECB announcement to trigger an issuance boom.	1	0
08 Jul 2021 (50)	ECB says it will introduce disclosure requirements for private sector assets as a new eligibility criterion or as a basis for a differentiated treatment for collateral and asset purchases	"Other central banks are going to be reading this and thinking hard about how they can show a similar commitment to greening monetary policy," said Paul Diggle, deputy chief economist of Aberdeen Standard Investments.	0	0

Date	Announcement	Market Commentary/Background Info	Narrative	Unanimous
24 Mar 2022 (51)	ECB to gradually phase out collateral-easing measures between Jul 2022 and Mar 2024	No relevant market commentary. Background info: "The ECB also reaffirmed a waiver on Greek government bonds for as long as it keeps investing the proceeds from its Pandemic Emergency Purchase Program (PEPP). In a hopeful sign for other countries with lower credit ratings, such as Cyprus, Portugal or Italy, the ECB added that it may disregard agencies' ratings again in the future." "The ECB's Governing Council reserves the right to deviate also in the future from credit rating agencies' ratings if warranted," the ECB said.	1	0
04 Jul 2022 (52)	ECB says it will limit the share of assets issued by high polluters that can be pledged as collateral when borrowing from the ECB	No relevant market commentary.	1	1
02 Dec 2022 (53)	ECB says Eurosystem reschedules launch of new collateral management system	No relevant market commentary.	0	1
20 Dec 2022 (54)	ECB tightens collateral rules. Bonds issued by the European Commission receive an haircut category upgrade	No relevant market commentary.	1	1

A.2 Bank Selection and Bank Heterogeneity

Table A.2 demonstrates that removing one large bank at a time does not affect the construction of the collateral policy surprise series. Specifically, the first column demonstrates that the correlation is at least 99.5%. The second column shows how the average stock price reaction changes when individual institutions are left out. A positive Δ mean reaction implies that the omitted bank profits relatively less from a collateral policy expansion. As the last column shows, the exact bank selection is also less relevant when it comes to classifying individual events into contractionary or expansionary. In Figure A.1, we compare how individual banks respond to each announcement, relative to the mean stock price reaction.

Bank	**Correlation**	**Δ Mean Reaction**	**# Sign Flips**
BBVA	0.998	0.020	1
BC Portugues	0.997	-0.013	4
BNP Paribas	0.997	0.003	1
UniCredit	0.997	0.011	1
Deutsche Bank	0.995	0.022	0
Intesa Sanpaolo	0.998	0.008	2
Santander	0.996	0.018	0
Societe Generale	0.996	0.005	1

Table A.2: "Leave-One-Out" Surprise Series

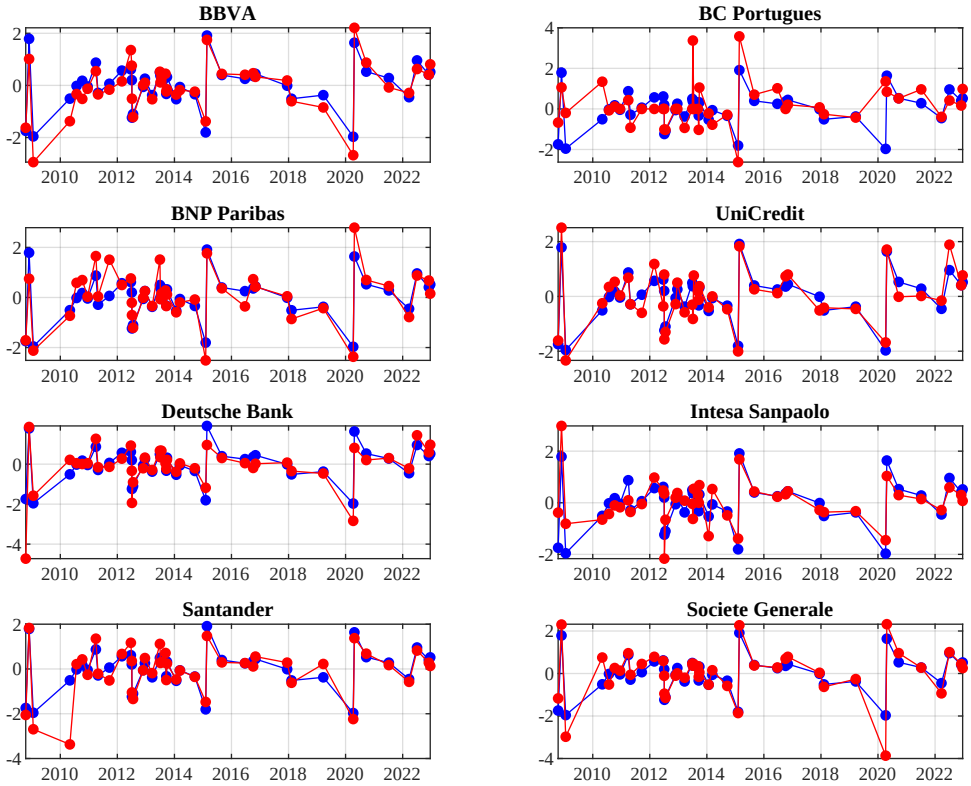

Figure A.1: Collateral Policy Surprises: Individual Stock Price Reactions. This figure plots the stock price response by each individual bank against the average stock price reaction. Note that average is different from, but highly correlated with the first principal component that we use as collateral policy surprise.

Variable	Mean	SD	Min	Max	N
Δ Stockreturn	0.29	1.42	-2.94	8.10	235
ln(Assets)	13.49	0.94	11.18	14.92	235
Loans Ratio	51.18	15.22	12.74	80.49	235
ROE	6.05	4.22	0.00	15.62	235
Debt Ratio	25.94	12.05	2.29	56.22	235
Deposits Ratio	52.58	15.73	19.87	81.88	235
Leverage Ratio	25.94	12.05	2.29	56.22	235
Sec over Assets	33.54	12.99	10.44	75.63	235
Tier1Ratio	13.19	2.62	7.10	19.10	216

Table A.3: Cross Section of Banks This table presents summary statistics for the banks in the sample to estimate equation (1).

B Additional Results: Financial and Sovereign Bond Markets

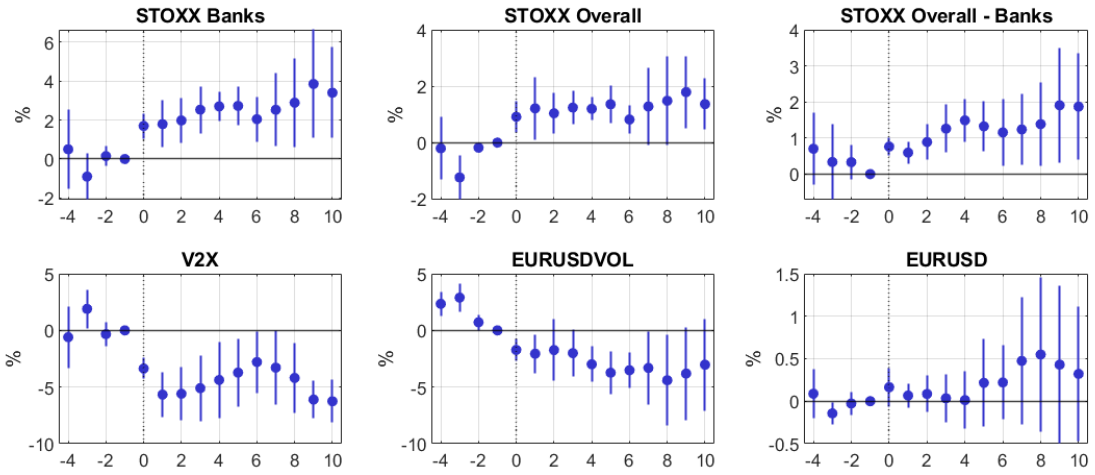

Figure B.1: Key Financial Indicators: Results from estimating (2) using all collateral policy surprises. The dependent variables in the top row are the EuroSTOXX Banks Index (see Appendix A.2 for details), the overall EuroSTOXX50 Index, and the excess return of EuroSTOXX Banks over the overall index. The dependent variables in the bottom row are the implied volatility of EuroSTOXX50 options, FX-option-implied volatility and the EUR-USD exchange rate. The dependent variables are specified in logs, and responses are measued in percent (%). Dots represent estimated coefficients, and vertical lines denote 90% confidence intervals based on heteroskedasticity- and autocorrelation-consistent (Newey-West) standard errors. The horizontal axis reports event time in days relative to the policy announcements, with $t = 0$ marking the announcement dates.

In Figure B.1, we report the dynamic responses of different financial market indicators, complementing our event study results presented Table 2 in the main text. The top row confirms the observation that bank stocks respond considerably stronger than the wider stock market. Similar to the V2X, the peak effect is almost reached on impact and are quite persistent over time. In the bottom row, we observe that the implied exchange rate volatility to the US Dollar declines significantly for several trading days, where the peak response is reached after around 10 days, both for the very short end (one month) and longer maturities (one year). By contrast, there is no clear effect on the exchange rate to the US Dollar itself.

In Table B.1, we provide a robustness check to our main results in *Panel A* of Table 3 by reporting the one day (upper panel) and one week responses (lower panel) to a collateral policy surprise. In comparison to the contemporaneous effects, the lagged effects on stock returns are still highly significant and we still that banks outperform the wider stock market. Consistent with the contemporaneous responses presented in the main text, the effect is generally stronger for events affecting sovereign bonds, during recessions and in the pre-APP period. Again, we the transmission of expansionary collateral policy on volatility and bank CDS seems to be quite similar for sovereign and non-sovereign events, while the results are more pronounced during recessions and in the pre-APP period.

In Table B.2, we provide further details on the transmission of CPS to the government bond market in different sub-samples, complementing the contemporaneous effects presented in *Panel B* of Table 3. In the upper panel, we show the one-day effects of an expansionary one

Variable *1-day*	(1) Non-Sov.	(2) Sovereign	(3) Expansion	(4) Recession	(5) Pre APP	(6) Post APP
STOXX Banks	1.7***	2.5*	0.9*	2.6*	2.8***	0.1
STOXX 50	0.7**	1.8	0.5*	1.1	1.5	-0.3
STOXX Banks-50	1.0***	0.7***	0.4	1.1**	0.9***	0.4***
V2X	-0.5	-9.9**	-3.9	-7.0*	-7.4***	-3.3
EURUSDVol	-0.1	-2.8	-2.0**	-1.2	-3.4***	2.5*
Bank CDS	-1.2	-7.2	-7.1	-1.1	-5.7*	-0.3
EURUSD	-0.3	0.2	0.1	-0.1	0.1	-0.1
5-day	Non-Sov.	Sovereign	Expansion	Recession	Pre APP	Post APP
STOXX Banks	1.5**	3.6**	0.9	3.8***	2.2**	3.2***
STOXX 50	0.6**	2.0**	0.8**	1.6*	1.5**	0.9**
STOXX Banks-50	0.9***	1.6***	0.1	2.2***	0.7	2.4***
V2X	1.2	-8.7***	-6.8***	-1.2	-3.9	-2.2
EURUSDVol	-0.4	-6.6*	-3.5	-5.7	-4.2	0.0
Bank CDS	-1.3	-7.2**	-3.9	-3.6	-5.0	-2.4
EURUSD	-0.2	0.5	0.0	0.3	0.4	-0.3

Table B.1: Fixed Horizon Event Study Results, Financial Markets. The table reports the one-day response (upper panel) and five-day response (lower panel) to a one standard deviation expansionary CPS for different sample splits. Columns (1) and (2) report the results for events affecting government bonds and other assets. Columns (3) and (4) report results for expansions and recessions. Columns (5) and (6) report the results for Pre- and Post-APP events. STOXX Banks and STOXX 50 are the bank and overall stock market index; V2X: option-implied Euro STOXX 50 volatility; EURUSDVol: 1-month implied volatility on EUR/USD currency options respectively; Bank CDS is the average 5y CDS spread of all banks in basis points; EURUSD: Euro to US Dollar exchange rate. ***, **, * indicate significance at the 1, 5, and 10% level.

standard deviation CPS, while we consider the five day horizon in the lower panel. Again, we observe broadly similar effects on the periphery-core spread for events unrelated to government bonds and the ones affecting government bonds as well. Furthermore, the transmission of CPS to government bond yields and the periphery-core spread is again stronger during recessions, irrespective of the estimation horizon.

Figure B.2 graphically illustrates the findings presented in Panel B of Table 2 by plotting for the dynamic responses of core versus periphery government bond yields to a one standard deviation CPS over a 10-day event window. For core countries (left panel), we observe a significant effect after three trading days, which is however quite small at -2 basis points and becomes insignificant after five trading days. By contrast, the periphery government bond yield declines significantly already after one day and the effect remains significantly negative more persistently (right panel). The effect also peaks after three days at around -8 basis points. In Figure B.3, we complement this result with 5 year government bonds. Core bond yields do not drop significantly on impact, while there is a significant and economically relevant drop in periphery bond yields of around -6 basis points. The effect peaks again after three days but reverts to zero faster than for 10 year bonds.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
1-day	Non-Sov.	Sovereign	Expansion	Recession	Pre APP	Post APP
Periphery-Core, 10Y	-3.1**	-3.1*	-2.5	-2.3	-3.4*	-1.4
Core Yield, 10Y	-0.1	-0.4	0.7	-2.0***	-1.0*	0.3
Periphery Yield, 10Y	-3.2*	-3.5**	-1.9*	-4.4*	-4.3***	-1.1
Periphery-Core, 5Y	-3.6**	-4.0	-2.5	-3.5	-4.3*	-1.4
Core Yield, 5Y	0.4	0.7	0.6	-0.2	0.4	-0.2
Periphery Yield, 5Y	-3.3*	-3.3	-2.0*	-3.6	-3.9*	-1.7
Germany CDS, 5Y	-0.5***	-1.2**	-0.3	-1.0**	-1.1***	-0-1
France CDS, 5Y	-0.4*	-2.5*	-0.8**	-1.5	-1.8**	-0.3
Italy CDS, 5Y	-2.3	-9.1***	-3.3*	-5.6*	-6.0**	-2.9**
Spain CDS, 5Y	-1.6	-7.8**	-4.6*	-3.0	-5.6*	-0.9
5-day	Non-Sov.	Sovereign	Expansion	Recession	Pre APP	Post APP
Periphery-Core, 10Y	-4.5	-5.5*	-4.9**	-4.0	-4.9	-5.0***
Core Yield, 10Y	-1.6	1.0	3.3***	-4.2*	-1.4	1.1
Periphery Yield, 10Y	-6.1**	-4.5	-1.6	-8.2**	-6.3**	-4.0
Periphery-Core, 5Y	-6.4*	-5.8*	-3.8	-7.1*	-5.6*	-7.1***
Core Yield, 5Y	-0.1	2.4	2.9***	-1.0	1.3	-0.5
Periphery Yield, 5Y	-6.6**	-3.5	-0.8	-8.1*	-4.3	-7.6**
Germany CDS, 5Y	-0.0	-1.8**	-0.5	-0.8	-2.0	-0.5
France CDS, 5Y	-0.7	-2.9***	-1.5*	-1.9	-1.9	-1.4**
Italy CDS, 5Y	3.1	-17.4***	-7.3***	-6.9	-2.9	-15.6***
Spain CDS, 5Y	-3.2	-5.2	-6.2***	-1.8	-4.7	-2.5

Table B.2: Fixed Horizon Event Study Results, Government Bond Market. The table reports the one-day response (upper panel) and five-day response (lower panel) to a one standard deviation expansionary CPS for different sample splits. Columns (1) and (2) report the results for events affecting government bonds and other assets. Columns (3) and (4) report results for expansions and recessions. Columns (5) and (6) report the results for Pre- and Post-APP events. All yields and spreads are expressed in basis points. ***, **, * indicate significance at the 1, 5, and 10% level.

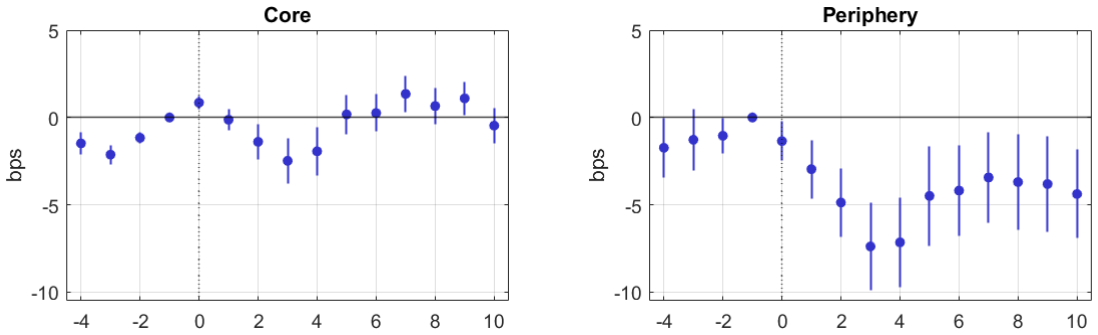

Figure B.2: Collateral Policy Surprises and 10Y Government Bond Yields: Results from estimating (2) for 10 year government bond yields. Core countries are Germany, Belgium, France and the Netherlands. Periphery countries are Italy, Spain, Ireland and Portugal. Dots represent estimated coefficients, and vertical lines denote 90% confidence intervals based on heteroskedasticity- and autocorrelation-consistent (Newey-West) standard errors. The horizontal axis reports event time in days relative to the policy announcements, with $t = 0$ marking the announcement dates.

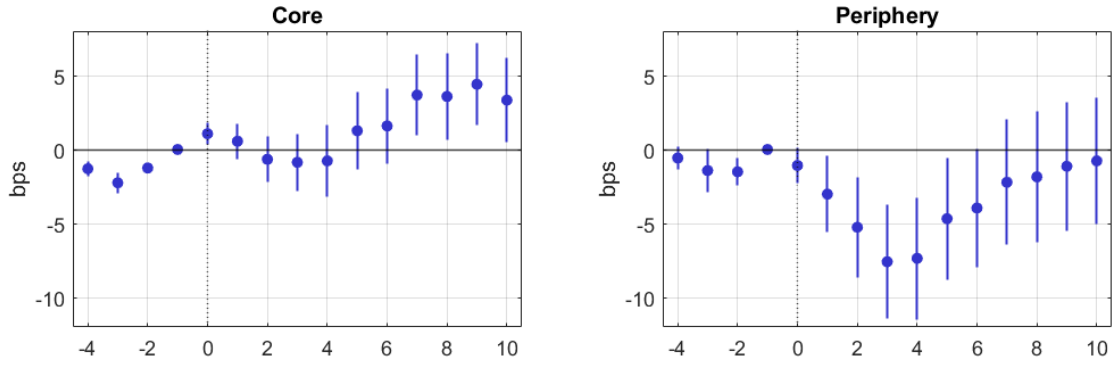

Figure B.3: Collateral Policy Surprises and 5Y Government Bond Yields: Results from estimating (2) for 5 year government bond yields for core versus periphery countries. Core countries are Germany, Belgium, France and the Netherlands. Periphery countries are Italy, Spain, Ireland and Portugal. Dots represent estimated coefficients, and vertical lines denote 90% confidence intervals based on heteroskedasticity- and autocorrelation-consistent (Newey-West) standard errors. The horizontal axis reports event time in days relative to the policy announcements, with $t = 0$ marking the announcement dates.

Complementing our main results in *Panel B* of Table 2, Figure B.4 graphically demonstrates the decline in sovereign CDS spreads. While there are significant results for France and Germany, the decline is particularly strong in Italy and Spain, representing the largest euro area periphery countries. The magnitude of the effect is comparable to the effect of a CPS on periphery-core yields.

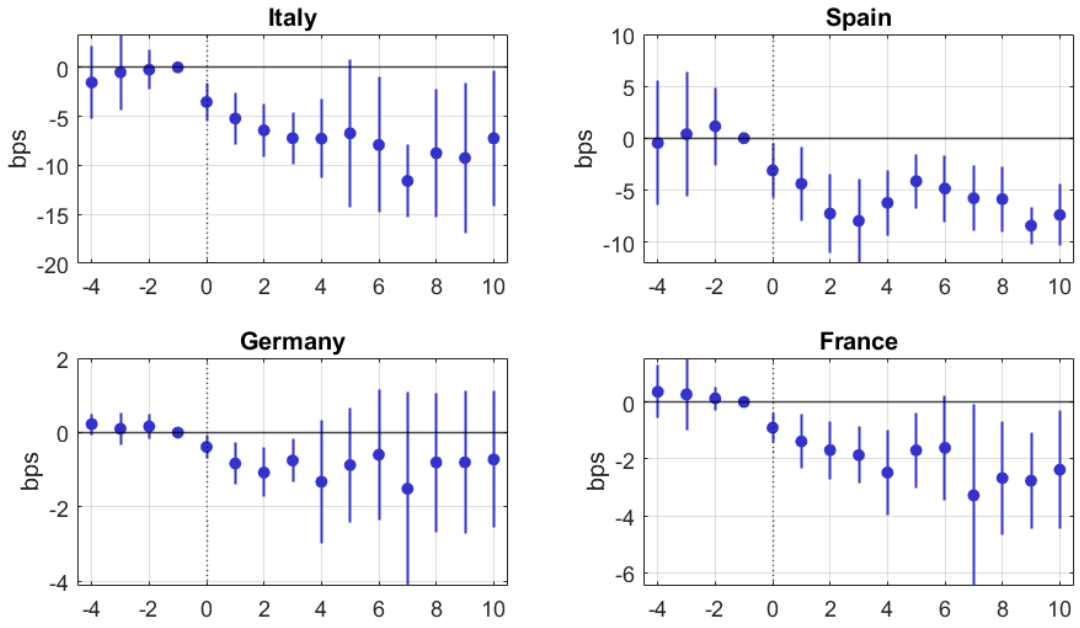

Figure B.4: Collateral Policy Surprises and Sovereign CDS: Results from estimating (2) for 5-year CDS written on Italian, Spanish, German and French government bonds. Dots represent estimated coefficients, and vertical lines denote 90% confidence intervals based on heteroskedasticity- and autocorrelation-consistent (Newey-West) standard errors. The horizontal axis reports event time in days relative to the policy announcements, with $t = 0$ marking the announcement dates.