

The heterogeneous impact of European Central Bank asset price surprises on corporate liquidity demand

Benedicta Marzinotto

University of Udine and Johns Hopkins University

Correspondence

Benedicta Marzinotto, University of Udine, Department of Economics and Statistics, Via Tomadini 30/A, 33100 Udine, Italy
Email: benedicta.marzinotto@uniud.it

Abstract

Theories of corporate liquidity demand build on the notion that firms accumulate cash to safeguard their activities in the face of costly external finance. Monetary policy provides a clear source of exogenous variation in the external finance premium. Using high-frequency-identified asset price surprises, I estimate the impact of European Central Bank monetary policy shocks on euro area corporate cash holdings over 2001–2019. Old firms with large fixed assets react forcefully to expansionary shocks that result in higher asset prices by reducing demand for precautionary liquidity, and access borrowing to finance tangible investment in a second period. This is because these firms are more exposed to valuation effects and can use more debt when accommodating monetary policy is transmitted through the revaluation of assets or, relatedly, when the collateral constraints that they face are predominantly asset-based, which appears to be the case for the euro area.

KEYWORDS

cash holdings, corporate saving, credit constraints, intangible assets, monetary policy

JEL CLASSIFICATION

D21; E40; E50; G30

1 | INTRODUCTION

The bulk of the literature on monetary policy transmission via the corporate sector has been mostly concerned with investment and exploited variation in firms' balance sheet variables to account for the heterogeneous effects of monetary policy shocks (e.g. Cloyne *et al.* 2018; Jeenas 2019; Ottonello and Winberry 2020; Durante *et al.* 2022; Döttling and Ratnovski 2023). For example, cash-rich firms have been found to be insulated from monetary policy because they can finance investment with abundant internal resources anyway (Jeenas 2019).

This is an open access article under the terms of the [Creative Commons Attribution](https://creativecommons.org/licenses/by/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2026 The Author(s). *Economica* published by John Wiley & Sons Ltd on behalf of London School of Economics and Political Science.

The available literature has not devoted attention to the impact of monetary policy innovations on corporate cash itself, with a few exceptions (Deng and Yao 2021; Han and Wang 2023). This is surprising for at least two reasons. First, optimizing firms take decisions on investment and saving simultaneously (e.g. Acharya *et al.* 2007; Bacchetta and Benhima 2015).¹ Second, and central to the approach that I take in this paper, monetary policy operating via the credit channel affects net worth and the external finance premium, whose existence is often regarded as the main reason why firms accumulate precautionary cash in the first place (e.g. Opler *et al.* 1999; Almeida and Campello 2007; Bates *et al.* 2009; Denis and Sibilkov 2010; Lei *et al.* 2018; Falato *et al.* 2022). A monetary shock that delivers a change in the external finance premium should also alter current or future corporate liquidity demand, all else equal.

This paper studies the impact of the monetary policy of the European Central Bank (ECB) on euro area firms' cash holdings over the last two decades building on a representative firm-based dataset developed in the framework of the Competitiveness Research Network (henceforth CompNet) that covers a large number of European countries, nine one-digit macro-sectors, and up to five class sizes defined in terms of the number of employees. CompNet data are aggregated from all firms to provide variables at the year, country, one- or two-digit industry, and class-size levels, while containing moments of the firm-level distributions (means, medians, percentiles and standard deviations). This allows us to analyse firm heterogeneity within those aggregation levels.

Monetary accommodation operates in an environment with financial frictions, and is transmitted through the revaluation of assets and net worth, which affects firms' capacity to borrow, as in some influential theoretical tradition (e.g. Bernanke *et al.*, 1996). Exogenous monetary policy shocks are taken from Jarociński and Karadi (2020), who use a high-frequency approach and conveniently differentiate between pure monetary and so-called information shocks—an aspect that I will partly exploit in the empirical strategy. An expansionary policy shock increases net worth and reduces the external finance premium, where net worth is here assumed to result mainly from short-term movements in asset prices, for reasons that I explain below.² The median firm in each sector and class size reduces demand for liquid assets, here defined by the ratio of cash and cash equivalents to total assets, because it expects to finance future tangible investment with debt, consistent with the principle that asset liquidation value determines a firm's debt capacity (e.g. Barro 1976; Hart and Moore 1994; Kiyotaki and Moore 1997; Chaney *et al.* 2012).

This is the basic yet so far untested hypothesis that I put forward. I further innovate along a number of dimensions.

First, and differently from the thin literature on the effects of monetary policy on corporate cash holdings (Deng and Yao 2021; Han and Wang 2023), I presume that some firms will react more strongly than others. More precisely, I argue that collateral-abundant firms in each sector and employment-based class size will adapt their liquidity demand more forcefully than collateral-poor firms just because they are more exposed to valuation effects and can use more debt to begin with.³ This is similar to Döttling and Ratnovski (2023), who study standard investment responses. For collateral, I use the capital stock (i.e. fixed assets) as a proxy, which also captures redeployable assets available to the firm even if they are not necessarily pledged as collateral (for a similar approach, see Winterberg 2025).⁴ The choice is driven by the fact that European firms typically access unsecured debt. To test my proposition, I interact the monetary shock with sector- and size-level characteristics focusing on asset-dependent collateral (or, for robustness, firm age) so as to extrapolate the differential impact of monetary policy shocks across sectors and employment-based class sizes characterized by different levels of fixed assets (or different shares of either old or young firms).

Second, I start the analysis by looking specifically at the ECB's asset price surprises, whether stemming from a standard monetary or an information shock, because especially when the capital stock is high, asset prices directly and linearly affect net worth and the external finance premium, which in turn motivates the decision to hold more or less cash buffers out of precaution.⁵ By contrast, given very high levels of debt in the average euro area firm, the short-term impact of

parallel interest rate surprises on net worth operates mainly via interest payments and financing gaps as a non-linear function of leverage (Bernanke *et al.* 1999). Moreover, their ultimate effect on net worth is offset if, following a change in market interest rates, contemporaneous asset prices move in the same direction in the case of information shocks, to which the euro area seems to be particularly exposed (Altavilla *et al.* 2019; Jarociński and Karadi 2020).⁶ Because this might still be an over-simplification of the credit channel of monetary policy, later in the paper, I introduce interest rate along with asset price surprises, and exploit differences in results across standard and information shocks to test for potential asymmetric effects of monetary policy on corporate cash.⁷ My analysis offers much needed evidence on monetary policy transmission in Europe across both listed and non-listed firms, thereby contributing to a stream of research that is typically US-centred and restricted to the behaviour of listed firms.

The standard narrative put forward in the literature is that expansionary monetary policy shocks relax financial constraints and hence trigger stronger responses from firms that are relatively constrained to start with (e.g. Cloyne *et al.* 2018; Jeenas 2019; Durante *et al.* 2022). Yet a subset of studies finds stronger responses from non-risky and allegedly less constrained firms (Ottonello and Winberry 2020; Caglio *et al.* 2021). Overall, as noted in Ottonello and Winberry (2020), the issue remains theoretically ambiguous. This paper is specifically concerned with heterogeneous financial frictions and with the effects of monetary policy conditional on the prevailing type of collateral constraints. Along similar lines, Caglio *et al.* (2021) show that the sensitivity of the marginal cost of funds to monetary policy shocks depends on the type of collateral pledged by firms. Döttling and Ratnovski (2023) demonstrate that intangible firms have a muted response to monetary policy because they do not benefit from the policy-induced revaluation of assets, which equally suggests that the type of financial friction drives results. Building on this latter literature, I argue that the evidence showing that high-fixed-assets firms significantly reduce their liquidity demand in response to a monetary-policy-induced rise in asset prices (i.e. a positive asset price shock) indicates that the predominant financial friction in Europe is asset-based collateral constraints, which are by definition more binding for firms with fewer assets. Relatedly, the theoretical intuition is that expansionary monetary shocks that specifically increase the value of assets have a modest effect on financial constraints if a firm does not own assets anyway, as in Döttling and Ratnovski (2023). This implies that euro area low-collateral firms remain externally constrained even after unexpected monetary accommodation if borrowers are normally asked to pledge a minimum amount of assets. As such, my analysis offers—amongst others—a crude methodology for verifying the nature of borrowing constraints and their distribution by firm type in the absence of granular information based on debt contracts, as done elsewhere (Lian and Ma 2021). One of the key contributions of this paper is to show that the response of corporate cash sheds some light on the channels through which monetary policy affects the real economy. Specifically, my results confirm the empirical relevance of the credit channel for the euro area.

Part of the argument is also that at high initial levels of the capital stock, firms release more cash in response to expansionary monetary shocks because they have no efficient and/or viable alternative to financing their subsequent marginal investment with external finance. This relates to the opportunity cost of their cash holdings. It is here assumed, quite conventionally, that the additional remuneration from holding cash reflects the marginal product of capital (MRPK) in a standard Cobb–Douglas production function with decreasing returns to scale as in the theoretical setup of Hsieh and Klenow (2009).⁸ To wit, each unit of cash matters insofar as it allows firms to self-finance future investment, and is more valuable, the more profitable future investment. It follows that low-MRPK firms featuring a very high-fixed-asset share tend to price each unit of internal finance less, and should be prompted to release more precautionary cash in response to expansionary monetary policy than their high-MRPK counterparts.

All in all, this paper shows that in the presence of asset-based collateral constraints, the ECB's positive asset price surprises with their strong informational content elicit a stronger negative cash response from high-collateral firms, leaving them short on liquidity and in turn potentially more

exposed to tightening cycles. In my robustness checks, I show that they release cash not because they have reached the limit of their capital stock and would start dis-investing, but rather, as hypothesized, because increased borrowing capacity induces them to engage in debt-financed tangible investment one year after the shock, with the effect gradually diminishing over time after the first-year peak. My findings are confirmed when accounting for firm age as opposed to collateral if one plausibly assumes that older firms are endowed with more fixed assets than younger firms. In sectors and class sizes with a high share of old firms, cash ratios fall in response to a positive asset price shock just as it happens when the representative median firm in each sector and class size has relatively high fixed assets each year. By contrast, my results show that young firms continue being dependent on their capacity to generate cash flows, and tend to exploit expansionary monetary shocks to further accumulate internal finance.⁹ Most interestingly, the cash response is not fully symmetric over the business cycle. Monetary policy shocks that reduce the value of collateral tend to increase precautionary cash, as expected, but the effect is not as robust or quantitatively comparable to what happens under accommodating shocks. In this respect, the paper offers also an analysis of whether the credit channel is symmetric, a largely under-investigated topic with the exception of Perez-Orive *et al.* (2023).

The policy implications can hardly be over-stated. Monetary policy affects not only real output but also corporate cash holdings. To the extent that internal funds are typically used to finance intangible investment (e.g. Bates *et al.* 2009; Brown and Petersen 2011; Adler *et al.* 2019; Falato *et al.* 2022), my findings indicate that the ECB's policy choices bear an impact also on the supply side, differently affecting a firm's capacity to invest in productivity-enhancing projects, especially after protracted monetary accommodation. High-fixed-assets firms (or sectors, given the nature of my data) are bound to remain stuck in a low-productivity trap as unexpected monetary expansions conveying positive information to financial markets leave them short on liquidity as well as more leveraged, whereas standard monetary restrictions do not provide sufficient incentives for the same firms to rebuild cash buffers, which would allow them to engage in self-financed intangible investment looking ahead.¹⁰

The rest of the paper is structured as follows. Section 2 sets the paper in the context of the available literature. Section 3 describes the data and the empirical strategy. Section 4 presents the results and provides various robustness tests. Section 5 concludes.

2 | RELATION TO THE LITERATURE

This paper relates to the fast-growing literature studying the impact of monetary policy in the presence of financial frictions at the firm level. Existing studies have analysed the effects of monetary policy shocks on either corporate investment (e.g. Cloyne *et al.* 2018; Jeenas 2019; Durante *et al.* 2022; Ottonello and Winberry 2020; Döttling and Ratnovski 2023) or capital allocation (e.g. Gopinath *et al.* 2017; Albrizio *et al.* 2024). There is a timidly emerging literature that is concerned with the impact on corporate cash holdings. Deng and Yao (2021) study how changes in Federal Funds rates affected US firms' liquidity positions before the Global Financial Crisis, finding that higher interest rates increase precautionary cash holdings. Han and Wang (2023) look at the uncertainty that may come from policy innovations, and show that both monetary policy uncertainty and tightening increase Chinese firms' liquid assets, which again suggests a strong precautionary motive for holding cash. My paper contributes to this emerging strand of research by providing much needed evidence on the behaviour of euro area firms, and crucially, by focusing on the effects of monetary policy on cash conditional on firm characteristics, which is one of the paper's main innovations.

I build on the credit channel, which is about the transmission of monetary policy in the presence of financial frictions (e.g. Bernanke *et al.* 1996; Kiyotaki and Moore 1997). Impaired access to external finance is a necessary condition for firms to hold cash out of precaution.

The mechanism triggered by monetary policy shocks relies extensively on the idea that collateral pledging enhances a firm's financial capacity (e.g. Barro 1976; Hart and Moore 1994; Chaney *et al.* 2012), which should in turn affect liquidity demand. My approach is thus akin to studies that have tried to isolate this transmission channel by looking at investment responses. Cloyne *et al.* (2018) show, for example, that the response to monetary policy is stronger for firms that more heavily rely on the liquidation value of their collateral. In their framework, collateral-dependence is inferred from firm age. US young firms react more forcefully because changes in the interest rate significantly condition asset prices and hence their access to asset-based borrowing, which is indeed dominant among young US firms.

In this paper, I move away from a standard analysis of investment and explore contemporaneous cash management practices, albeit still in the framework of the monetary transmission literature. Compared with the conventional view, I argue that asset-based borrowing would occur only in the presence of sufficiently high levels of collateral in the form of fixed assets. Thus the marginal effect of monetary policy on collateral-based borrowing is larger for firms with relatively high capital stocks. For that reason, these firms reduce their demand for precautionary cash in response to expansionary monetary shocks. Along similar lines, Döttling and Ratnovski (2023) show that US firms with more intangible assets display a muted investment response to monetary policy because intangible capital is less suited as collateral and these firms use less debt. My approach is similar to theirs, while focusing on liquidity demand rather than on investment. Cash management practices possibly provide for a neater identification of the nature and, relatedly, the relative importance of financial constraints because, differently from investment, the decision to hold precautionary cash stems directly from the entrepreneur's perception of the external finance premium,¹¹ which would be otherwise unobservable and hard to proxy in the case of Europe.¹²

My analysis is strongly indebted to the older corporate finance literature that tried to isolate the drivers of corporate cash accumulation. Despite nuances, the core argument is that cash hoarding is a prerogative of firms that have impeded access to external finance for one reason or another. Firms accumulate cash in the expectation of future binding constraints that may come from low asset tangibility (e.g. Opler *et al.* 1999; Almeida and Campello 2007; Bates *et al.* 2009; Denis and Sibilkov 2010; Lei *et al.* 2018; Falato *et al.* 2022), cash flow volatility (Han and Qiu 2007) and/or cash flow uncertainty (Almeida *et al.* 2004). This general precautionary motive remains broadly unchallenged and coexists with analyses showing that entrepreneurs may well use cash in a strategic fashion when they aim to preserve their competitive edge (e.g. Adler *et al.* 2019) and/or for deleveraging purposes (Acharya *et al.* 2012). Yet whilst this literature is normally concerned with the secular rise in corporate cash holdings, my empirical approach allows us to establish whether asset revaluation *causes* changes in corporate liquidity demand.

Apart from the monetary transmission research, the closest reference literature is the one dwelling on the negative relationship between cash holdings and asset availability in the form of pledgeable collateral (Almeida and Campello 2007; Bates *et al.* 2009; Lei *et al.* 2018; Falato *et al.* 2022). Differently from most of the available studies, my paper is explicit about the fact that the cash–capital sensitivity varies along the tangibility distribution, and is in this vein akin to Almeida and Campello (2007), who argue in favour of a non-monotonic effect of tangibility on investment–cash flow sensitivities. Their argument is that firms with abundant tangible assets become *de facto* unconstrained, hence internal funds do not matter for the investment behaviour of firms with a large tangible capital stock. My point is analogous because I argue that high-fixed-assets firms can rely on immediately available collateral or redeployable assets for their marginal borrowing when asset prices increase, and generally need less internal funds than low-fixed-assets firms.

Relatedly, this paper is tangent to an older literature that engaged in devising measures to capture otherwise unobservable financing constraints (Fazzari *et al.* 1988; Kaplan and Zingales 1997;

Almeida and Campello 2007). Compared with this literature, however, I am especially concerned with the nature of financial frictions, and study monetary policy transmission conditional on the type of collateral pledged by the firm. There is an emerging literature that looks at the empirical relevance and implications of earnings-based versus asset-based borrowing constraints, mostly in relation to US firms. For example, Lian and Ma (2021) show that large and old US firms borrow against earnings, whereas young and small firms are dependent on the liquidation value of assets. Drechsel (2023) equally establishes the empirical relevance of earnings-based borrowing constraints in the US context. I add to this literature by providing suggestive evidence on the European case. My strategy for testing the empirical relevance of asset-based collateral constraints is extremely simple: if firms borrow against their assets, then policy shocks that specifically drive asset prices in one or the other direction should cause changes in corporate behaviour, including as concerns their cash management practices, which are part of a firm's dynamic capital allocation.

3 | DATA AND EMPIRICAL STRATEGY

3.1 | The CompNet sample

The empirical analysis relies on the CompNet dataset, which draws from various administrative and public sources across numerous European countries, and includes both publicly listed and non-listed firms. Data have been collected based on a common protocol, which provides for full cross-country comparability, an essential feature when analysing the impact of the ECB's policies. The data are aggregated from all firms to provide variables at the year, country, one- or two-digit industry, and class-size levels, thereby allowing us to exploit within industry-size variation. They are further weighted so as to make them representative of the entire firm population in each macro-sector (CompNet 2021). Differently from most available datasets, CompNet data also contain moments of the firm-level distributions (means, medians, percentiles and standard deviations). That is, they provide figures for the average or median or other-moment firm representative of each sector. On the downside, the dataset is firm-based but indeed not firm-level, which implies that it is not possible, for example, to estimate cash responses to firm-specific shocks (e.g. managerial quality). Whilst potentially silencing an important chunk of firm-level heterogeneity, the analysis provides nonetheless relevant information about the aggregate distributional impact of the ECB's monetary policy, thus offering a unique opportunity for verifying the existence of distributive effects from common policies.¹³

The baseline estimation is performed on a subsample from the 8th vintage of the CompNet unbalanced panel dataset covering: eight euro area countries (i.e. Belgium, Finland, France, Germany, Italy, the Netherlands, Portugal and Spain) plus Denmark, which has been part of the European Exchange Rate Mechanism (ERM) II since 1999; nine one-digit industries (i.e. manufacturing, construction, wholesale and retail trade, transportation and storage, accommodation and food service activities, information and communication, real estate activities, professional, scientific and technical activities, administrative and support service activities); and the three largest class sizes comprising firms with more than 20 employees.¹⁴ The relevant time period after cleaning the data for missing values is 2001–2019.

The baseline uses CompNet's unconditional dataset. This provides the distribution of all indicators available in CompNet and is, as such, quite comprehensive. The term 'unconditional' indicates that the distributions are given for each indicator and firm sample separately, and do not provide additional information on other indicators or firm populations (CompNet 2021, p. 11). In the empirical motivation, Table 4 and some of the robustness tests in Online Appendix B, I use CompNet's 'joint' distributions, which give the moments of each variable where the respective firm sample is defined by the decile of another variable (CompNet 2021, p. 12). So, for example,

TABLE 1 Summary statistics.

Variable	Observations	Mean	S.D.	Min	Max
Cash	3252	0.066	0.047	0.003	0.446
Capital	3328	0.221	0.175	0.003	0.769
Cash flows	3034	-0.146	0.152	-2.725	0.04
Leverage	3143	0.399	0.222	0.024	0.969
Dividends	2206	0.004	0.011	0	0.076

Notes The table presents summary statistics from the CompNet subsample used for the statistical analysis, and includes eight euro area countries (Belgium, Finland, France, Germany, Italy, the Netherlands, Portugal, Spain) plus Denmark, nine two-digit macro-sectors (manufacturing, construction, wholesale and retail trade, transportation and storage, accommodation and food service activities, information and communication, real estate activities, professional, scientific and technical activities, administrative and support service activities), and three class sizes (20–49 employees, 50–249 employees, > 250 employees), over 2001–2019. The original data are winsorized at the top and bottom 0.02% of observations.

the joint distribution using asset tangibility as the conditioning variable provides data on cash holdings and collateral that uniquely relate to firms occupying each decile of the tangibility distribution.¹⁵ When building on joint distributions, I use a slightly smaller sample from 2001 to 2017 that excludes the Netherlands, whose data are not available. Joint distributions are generally preferable when using aggregated data to proxy firm-level data, but they are not available for all relevant conditioning variables, and especially not for total fixed assets, which is my main variable of interest. In this context, the broader weighted unconditional dataset remains nonetheless a valid source of data because it still allows us to exploit within industry-size–country variation for the representative median firm. Additionally, as will be explained below, the methodology used in the baseline econometric estimation applies multi-way fixed effects such that, in the end, the only remaining source of variation in the data is represented by the level of collateral (or firm age) that is specific to the industry level and size level.

Table 1 provides descriptive statistics for the following variables: (i) share of cash and cash equivalents to total assets; (ii) share of nominal capital to total assets (i.e. the fixed-asset share)¹⁶; (iii) ratio of cash flows to total assets; (iv) dividends to assets; and (v) leverage measured as long- and short-term debt to total assets.¹⁷ I winsorize my sample at the top and bottom 0.02% of observations for all used variables to make sure that results are not driven by outliers. All subsequent empirical specifications equally use winsorized data.

As indicated above, my proxy for collateral is total fixed assets. As such, it also captures redeployable assets available to the firm even if they are not necessarily pledged as collateral, as discussed in Winterberg (2025). Such a definition is appropriate in the European context. *De jure* collateral consists of secured debt, yet European firms typically access unsecured debt. Some of the existing assets might be encumbered under long-term debt contracts, but they can still serve as implicit collateral for unsecured debt. Importantly, in practice, this variable is also a proxy of firms' asset tangibility. This is because, under CompNet's reporting obligations, firms were asked as a first best to include both tangible and intangible fixed assets, but could simply report tangible fixed assets as a second-best practice, which a majority of them did (CompNet 2021).¹⁸

Descriptive statistics provide the following stylized facts: (i) cash ratios vary significantly across groups of firms, ranging from 3% to 45% of total assets, being thus a non-negligible financial variable that may well explain a great part of the underlying firm-based heterogeneity; (ii) capital-to-asset ratios vary even more, from 3% to 77%, with an average of 22%, while mean leverage is as high as 40% of total assets; (iii) annual dividends range from 0 to almost 8% of total assets; finally, (iv) cash flows to total assets are negative on average, which is indicative of biting liquidity constraints. The subsequent analysis leverages this wide heterogeneity.

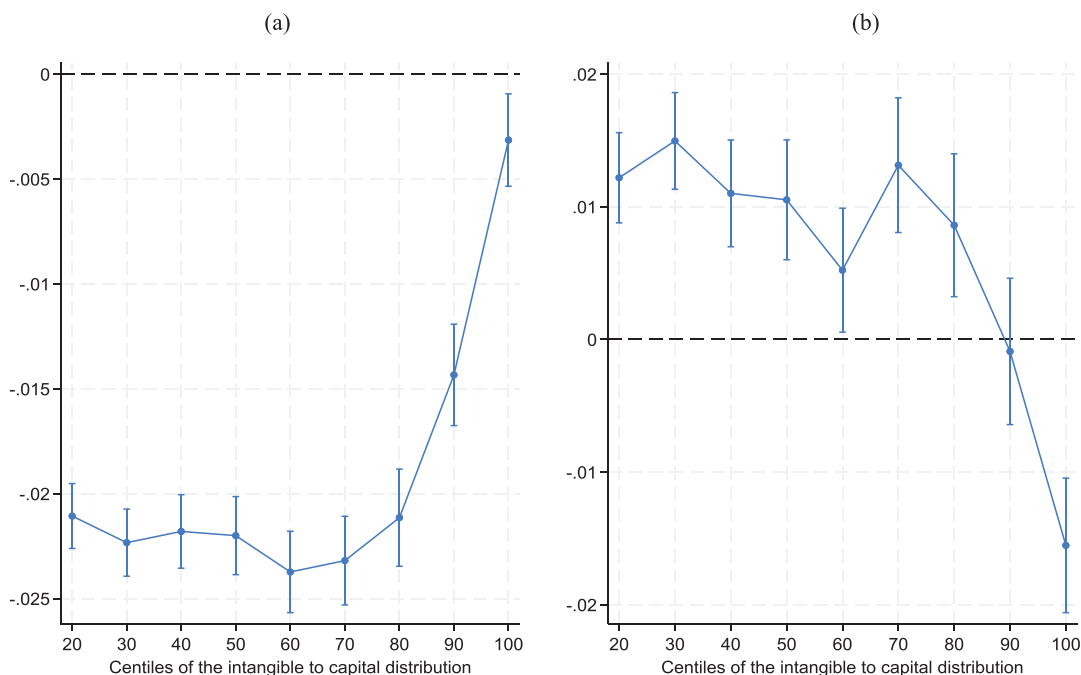


FIGURE 1 Average marginal effects of capital (ln) on (a) the cash ratio and (b) leverage by asset intangibility. *Notes:* The figure reports coefficient estimates from the equation $y_{dci} = \alpha_0 + \sum_{d=2}^{10} \beta_d D_{dci} + \gamma k_{dci} + \sum_{d=2}^{10} \delta_d (D_d * k_{dci}) + \gamma_t + \delta_{ci} + \epsilon_{dci}$, where y_{dci} is either cash holdings (i.e. cash and cash equivalents to assets) or leverage (i.e. long- and short-term debt to assets) in country c , sector i , and time t . The term $\sum_{d=2}^{10} \delta_d (D_d * k_{dci})$ interacts median real capital (ln) with a variable identifying all centiles in the distribution of firms' intangible-to-capital ratio after excluding centile 10; γ and δ are time and country–sector fixed effects, respectively. The estimate is by OLS with standard errors that are robust to heteroscedasticity and 95% confidence intervals. The sample includes seven euro area countries (Belgium, Finland, France, Germany, Italy, Portugal and Spain) plus Denmark (data for the Netherlands not available), and nine macro-sectors (manufacturing, construction, wholesale and retail trade, transportation and storage, accommodation and food service activities, information and communication, real estate activities, professional, scientific and technical activities, administrative and support service activities) over 2001–2017.

3.2 | The empirical motivation

To reiterate, two explanations may be superimposed to explain why fixed assets matter in monetary policy transmission. First, asset price surprises have a larger impact on the liquidation value of collateral, the higher its initial level. Second, and in relation to liquidity demand, in a standard Cobb–Douglas production function, the marginal benefit of holding internal funds falls as firms start generating decreasing returns to scale. Firms are expected to release precautionary cash for each additional unit of capital at sufficiently high levels of collateralizable fixed assets, or relatively, when the MRPK is low. By contrast, low-fixed-assets firms benefiting from high MRPK would increasingly ‘price’ their internal funds. This mechanism is consistent with the available empirical evidence. It is essentially intangible—that is, low-collateral and highly productive firms that mostly engage in cash hoarding (e.g. Opler *et al.* 1999; Almeida and Campello 2007; Bates *et al.* 2009; Lei *et al.* 2018; Falato *et al.* 2022).

The average marginal effects of firms' fixed assets on cash holdings are plotted in Figure 1(a), and on leverage in Figure 1(b) conditional on the asset-intangibility distribution. Coefficients for either cash ratios or leverage are estimated from an equation that interacts the median value of real capital (in natural logarithm, ln) with a variable defined from 2 to 10 capturing the deciles of the intangible-to-capital distribution after omitting the first decile as the base category. The

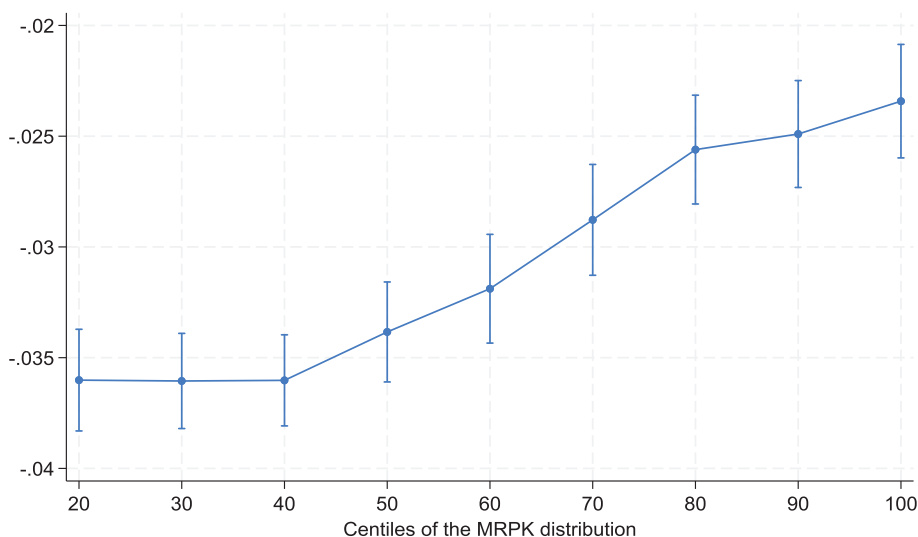


FIGURE 2 Average marginal effects of capital (ln) on the cash ratio by MRPK. *Notes:* The figure reports coefficient estimates from the equation $l_{c,it} = \alpha_0 + \sum_{d=2}^{10} \beta_d D_{decit} + \gamma k_{c,it} + \sum_{c=2}^{10} \delta_c (D_d * k_{decit}) + \gamma_t + \delta_{ci} + \varepsilon_{decit}$, where $l_{c,it}$ is cash holdings (i.e. cash and cash equivalents to assets) in country c , sector i and time t . The term $\sum_{d=2}^{10} \delta_c (D_d * k_{decit})$ interacts median real capital (ln) with a variable identifying all centiles in the distribution of firms' MRPK after excluding centile 10; γ and δ are time and country–sector fixed effects, respectively. The estimate is by OLS with standard errors that are robust to heteroscedasticity and 95% confidence intervals. The sample is the same as in Figure 1.

average marginal effect is thus the effect of capital for the baseline group plus the difference in the effect between each remaining decile and the baseline group ($\gamma + \delta_d$). As expected, the negative sensitivity of cash ratios to changes in capital is stronger for firms with high levels of tangibles that can serve as collateral. For each 1% increase in fixed assets, more tangible firms reduce their cash ratio by around 0.022 units. This tends to happen up to the 80th decile of the intangible-to-capital distribution, which in my sample is equal to a share of intangibles of 56%, after which there is much less substitutability between capital and cash, as is evident from Figure 1(a). That is, firms that have a share of intangibles that is greater than half of their total capital cannot rely on their poor collateral, and would increasingly consider cash as an independent source of financing rather than as a substitute for asset-based borrowing.¹⁹

Figure 1(b) provides consistent results. In tangible firms, a 1% increase in fixed assets raises debt capacity and hence borrowing by an average of 0.01 units. Instead, firms whose intangibles represent at least half of their total assets do not increase leverage as collateral becomes potentially available; quite the contrary, an additional unit of collateral in a context in which the production process uses mostly intangibles as inputs is associated with some deleveraging.²⁰

Figure 2 performs a similar exercise using the MRPK distribution instead of the intangibility distribution.²¹ It is found that for each additional unit of fixed assets, low-MRPK firms release more precautionary cash than high-MRPK firms. The interpretation is that the shadow value of cash diminishes together with the profitability of future investment. As expected in the framework of a standard Cobb–Douglas production function, the effect is rather linear, albeit after the 40th decile of the MRPK distribution, reflecting one of the assumptions in the paper's implicit theoretical setup, namely that each additional unit of cash has a lower shadow value in falling MRPK.

Figure 3 confirms that as a result of the mechanism described above, highly productive firms hold more cash and are less leveraged than poorly productive firms. Motivated by this evidence, the next subsection uses high-frequency identified monetary policy shocks to determine whether

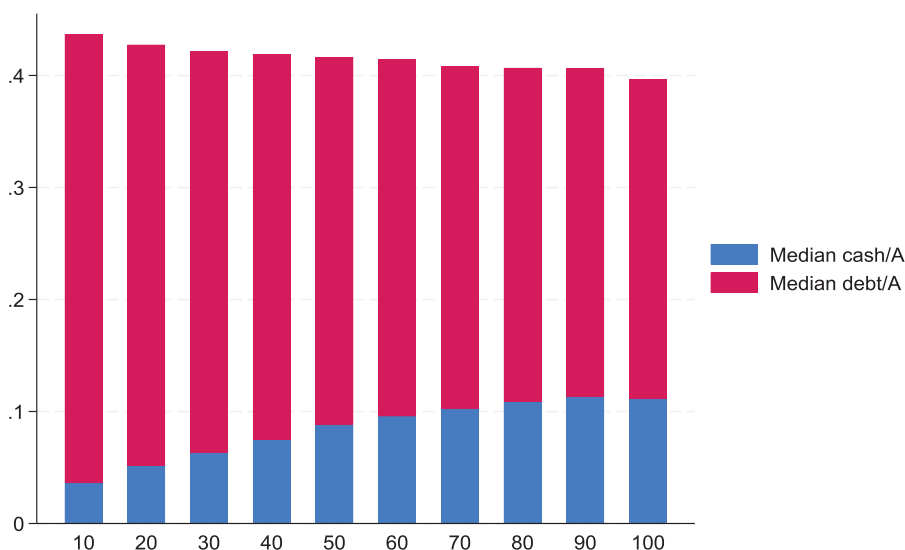


FIGURE 3 Cash ratios and leverage along the MRPK distribution. *Notes:* The sample is the same as in Figure 1.

cash holdings are causally related to the liquidation value of fixed assets induced by monetary policy shocks.

3.3 | Monetary policy shocks

Firms would reduce their demand for precautionary cash as their future debt capacity increases if and only if the value of the assets to pledge rises unexpectedly. This is for two reasons. First, corporate liquidity and investment decisions tend to be jointly determined (e.g. Acharya *et al.* 2007; Bacchetta and Benhima 2015). Second, the evolution of the external finance premium, which motivates precautionary cash hoarding, is driven by net worth endogenously. Monetary policy shocks offer the obvious exogenous source of variation in collateral value, net worth and the external finance premium. I use variables generated by Jarociński and Karadi (2020), whose methodology is closely related to proxy vector autoregressions and relies on high-frequency financial market surprises to identify monetary policy changes that are orthogonal to the information set of financial market participants (Gertler and Karadi 2015). This makes the monetary shock exogenous, which allows examining causality between monetary policy and corporate financial decisions.

Jarociński and Karadi (2020) differentiate between interest rate and asset price surprises, and rely on the sign of their co-movement to then distinguish between standard monetary and so-called information shocks (Nakamura and Steinsson 2018; Altavilla *et al.* 2019). While in a standard shock market, interest rates and asset prices move in opposite directions, in the case of an information shock, the two are positively correlated because the decrease (increase) in the policy interest rate is taken to convey negative (positive) information about the economic outlook. This reflects the fact that the direction of asset price movements largely depends on the type of information that the central bank conveys to financial markets.

Even if this paper is not directly concerned with the difference between standard monetary and information shocks, having separate interest rate and asset price surprises is useful to specifically isolate different potential drivers of net worth, especially where the two have opposing effects on net worth, as happens in the framework of information shocks. My simplifying assumption is

that, especially at high initial levels of the capital stock, asset price surprises directly and linearly affect net worth as opposed to interest rate surprises, whose impact on net worth operates mainly via interest payments and financing gaps, and most probably in a non-linear fashion (Bernanke *et al.* 1999).²² This and the documented empirical relevance of information shocks in the euro area explain why I start the analysis by focusing specifically on asset price surprises.

Asset price surprises from Jarociński and Karadi (2020) register unexpected percentage changes in the EURO STOXX 50, a market capitalization-weighted stock market index including 50 blue-chip companies from 11 euro area countries, as collected in a 30 minute window around press statements, and a 90 minute window around press conferences.²³ A positive shock reflects either an automatic response to an unexpected fall in the ECB's policy rate (i.e. a standard expansionary monetary shock) or good news about the economic outlook (i.e. a favourable information shock). Either way, it anticipates softer collateral constraints looking ahead, all else equal. The opposite is true of negative asset price shocks.

In the baseline estimation, original monthly shocks are aggregated to the annual frequency of CompNet data by simply calculating yearly sums (or the average) from 2001 to 2019. There are more or less equal numbers of positive and negative shocks. For robustness, I apply an alternative and more sophisticated time aggregation method that largely borrows from Ottonello and Winberry (2020). In this case, monthly shocks are weighted by the remaining number of months in the year when the shock occurs so as to account for the time firms have to react to the shock. Table 1B in Online Appendix B provides summary statistics of the original high-frequency shocks, their yearly sum and average, and the yearly smoothed shock, which uses the aggregation method described above. The moments of aggregated shocks do not differ significantly from those of the original high-frequency data. Additional materials in Online Appendix B show that also the overall results are robust to using smoothed shocks as an alternative to the yearly sum of monthly shocks.

3.4 | Baseline estimation

I assess firms' cash responses to monetary policy innovations using a static empirical specification because liquidity demand generally responds faster to an exogenous policy shock than either investment or output, which tend to react sluggishly. This is a standard approach in the relevant literature (Deng and Yao 2021; Han and Wang 2023). I interact the median firm's level of the capital stock in each sector and class size with the monetary-shock variable, and add multi-way fixed effects. This strategy allows me to isolate, within CompNet's unconditional dataset, groups of firms whose only distinctive difference pertains to the level of their collateral in the form of fixed assets.²⁴ I estimate variants of the fixed effects specification

$$l_{cist} = \beta_1 K_{cist-1} + \beta_2 (K_{cist-1} * MP_t) + \beta_3 X_{cist} + \beta_4 X_{cist} * MP_t + \mu_{cis} + \gamma_{ct} + \varepsilon_{cist}, \quad (1)$$

where the dependent variable l_{cist} stands for median cash ratios, a common way of accounting for corporate cash holdings (e.g. Bates *et al.* 2009), in country c , one-digit industry i and, for each industry, class size s at time t . Also, k_{cist-1} is median nominal capital (in natural logarithm) in the previous year, and MP_t is the monetary shock retrieved from the time series in Jarociński and Karadi (2020) and recalculated at annual frequency as the sum of all shocks in a given year t . Since the annual shock results from the aggregation of high-frequency market surprises around the time of the ECB's policy announcement, the relevant variable is the 'current' rather than lagged policy shock. The coefficient of interest is β_2 , which measures the differential impact of monetary policy in sectors and class sizes consisting of firms with different levels of fixed assets in the previous period. Here, X_{cist} are time-varying group-level control variables stemming from the standard corporate finance literature, including: (i) cash flows to assets to measure firm profitability, hence

also future investment opportunities, and/or the extent to which a firm is constrained and consequently retains more of its cash flows for future investment, as in Almeida *et al.* (2004); (ii) leverage in the previous period defined as the share of short- and long-term debt to assets, which conveys information about the extent to which the representative median firm either saves debt capacity by using current cash flows to reduce outstanding debt (e.g. Opler *et al.* 1999) or saves the proceeds from the debt issuance by hoarding cash to hedge against low levels of future cash flows (e.g. Acharya *et al.* 2007); (iii) dividends to assets to account for the extent to which the accumulation of liquid assets results from undistributed profits, while holding profitability (i.e. cash flows) constant. In the full specification, all control variables are interacted with the monetary shock to ensure that the differential impact of monetary policy across high- and low-fixed-assets firms is not driven by other observable firm characteristics.

The specification includes the following multi-way fixed effects: (i) country \times sector \times class size fixed effects (μ_{cis}) so as to identify the unit of analysis and focus on within size–industry–country variation; (ii) time \times country fixed effects (γ_{it}) to control for time-varying global conditions and for the fact that the same yearly conditions may have affected euro area countries differently given the level of financial fragmentation in the region over the relevant time span—their inclusion absorbs any differences across countries on each ECB’s announcement date. As such, the only remaining source of variation consists of fixed assets specific to class size s in industry i in country c during year t . By saturating the model with such multi-way fixed effects, I am able to provide a within-estimation of the effects of corporate fixed assets on the cash response to monetary policy. When $\beta_2 < 0$, the interpretation is that in sectors and class sizes where the median firm has relatively abundant collateral, cash ratios tend to fall in response to an expansionary monetary shock (i.e. a rise in asset prices). Standard errors are clustered at the time \times identifier level, where the identifier consists of groups of firms of a specific size in each industry and country.

4 | RESULTS AND ROBUSTNESS CHECKS

4.1 | Baseline results

Table 2 reports results from equation (1). Column (1) does not include the monetary shock, and establishes simply whether higher median values of nominal capital are associated with lower cash-to-asset ratios, or equivalently, whether firms with higher values of collateral have lower cash ratios, after controlling for unit (i.e. firms belonging to a specific class size, macro-sector and country) and for country \times time heterogeneity. The data document the expected negative association between cash and my proxy for collateral, confirming that firms generally hoard cash out of precaution, and that collateral-type constraints are an important source of financial frictions in the euro area. A one-standard-deviation increase in total fixed assets induces a 28% fall in cash, a value that is consistent with results from the available literature (e.g. Lei *et al.* 2018).

Columns (2), (3) and (4) of Table 2 explore whether sectors and class sizes in which firms hold higher fixed assets are more likely to adapt their liquidity demand in response to positive asset price surprises, whose immediate effect is to increase the liquidation value of collateral. The median euro area firm has approximately a 0.003 units higher (negative) semi-elasticity of the cash ratio to monetary policy when it has one standard deviation more collateral. The indication is that shocks that positively affect the value of collateral transmit more strongly into lower cash holdings in the case of sectors and class sizes where the representative median firm has more fixed assets to start with, as hypothesized.

Column (3) of Table 2 includes standard determinants of cash holdings, which are all significant. Their inclusion does not alter the point estimate of the coefficient of interest. Cash flows proxy for the profitability of firms as reflected in their capacity to generate revenues. As expected, they are found to enhance the stock of cash.²⁵ Dividends to assets indicate the extent which the

TABLE 2 Heterogeneous cash responses to asset price shocks: lagged fixed assets.

	Main effect	AP shock	AP shock with controls	AP shock with controls interacted
	(1)	(2)	(3)	(4)
Cash and cash equivalents to assets				
Nominal capital ($t - 1$) (ln)	-0.00646*** [0.00141]	-0.00631*** [0.00165]	-0.00585*** [0.00150]	-0.00571*** [0.00149]
Nominal capital ($t - 1$) (ln) \times AP shock		-0.000339*** [5.86e-05]	-0.000319*** [7.31e-05]	-0.000218*** [7.75e-05]
Cash flows to assets			0.170*** [0.0424]	0.173*** [0.0428]
Cash flows to assets \times AP shock				-0.000806 [0.00698]
Dividends to assets			0.235** [0.108]	0.313*** [0.104]
Dividends to assets \times AP shock				0.0815*** [0.0251]
Leverage ($t - 1$)			-0.0392** [0.0180]	-0.0354** [0.0180]
Leverage ($t - 1$) \times AP shock				0.00347* [0.00200]
Country \times sector \times size fixed effects	Yes	Yes	Yes	Yes
Country \times time fixed effects	Yes	Yes	Yes	Yes
Cluster level	Identifier \times event time	Identifier \times event time	Identifier \times event time	Identifier \times event time
Observations	2795	2360	1454	1454
R-squared	0.898	0.907	0.922	0.923

Notes The table reports coefficient estimates from equation (1). The sample includes eight euro area countries (Belgium, Finland, France, Germany, Italy, the Netherlands, Portugal, Spain) plus Denmark, nine macro-sectors (manufacturing, construction, wholesale and retail trade, transportation and storage, accommodation and food service activities, information and communication, real estate activities, professional, scientific and technical activities, administrative and support service activities), three class sizes (20–49 employees, 50–249 employees, > 250 employees), over 2001–2019. Robust standard errors in brackets.

***, **, * indicate $p < 0.01$, $p < 0.05$, $p < 0.1$, respectively.

accumulation of liquid assets results from undistributed profits, while holding profitability constant. They are equally found to drive cash holdings. Lagged leverage conveys information about whether a firm either saves debt capacity by using current cash flows to reduce outstanding debt or saves the proceeds from the debt issuance by hoarding cash to hedge against low levels of future cash flows. The indication coming out of the data is that the median euro area firm prefers to use cash for deleveraging purposes, a result probably driven by high aggregate leverage in the euro area, as reported in Table 1.

Finally, in column (5) of Table 2, I control for the interaction between determinants of liquidity demand and the monetary policy shock to ensure that differences in the cash response of high- versus low-collateral firms (or indeed sectors) are not driven by other observable firm-based characteristics, which would introduce an omitted variable bias. That is, the estimated coefficient measures the marginal single effect of total fixed assets on cash, while holding constant any other group-level characteristics. The size of the coefficient of interest retains statistical significance at 1%, thereby confirming that the response to asset price surprises is

TABLE 3 Heterogeneous cash responses to asset price and interest rate shocks.

	IR shock (1)	IR shock and AP shock (2)	IR shock and AP shock with controls (3)
Cash and cash equivalents to assets			
Nominal capital ($t - 1$) (ln)	-0.00619*** [0.00164]	-0.00637*** [0.00164]	-0.00582*** [0.00150]
Nominal capital ($t - 1$) (ln) \times IR shock	0.0107*** [0.00350]	0.00768** [0.00372]	0.00263 [0.00427]
Nominal capital ($t - 1$) (ln) \times AP shock		-0.000306*** [6.45e-05]	-0.000312*** [7.68e-05]
Cash flows to assets			0.170*** [0.0425]
Dividends to assets			0.231** [0.108]
Leverage ($t - 1$)			-0.0391** [0.0180]
Country \times sector \times size fixed effects	Yes	Yes	Yes
Country \times time fixed effects	Yes	Yes	Yes
Cluster level	Identifier \times event time	Identifier \times event time	Identifier \times event time
Observations	2360	2360	1454
R-squared	0.907	0.907	0.922

Notes The table reports coefficient estimates from a variant of equation (1). The sample is the same as in Table 2.

stronger where median collateral is high, or equivalently, in sectors and class sizes where the median firm has relatively high fixed assets. The indication from the data is that it is truly the size of the capital stock that is driving the results.²⁶ Additionally, it is found that the impact of monetary policy on cash is importantly conditioned by a dividend channel, thereby suggesting that positive asset price shocks also expand the volume of undistributed profits for the same level of collateral. Leverage plays an important role too. A positive asset price surprise lessens firms' incentive to use cash for deleveraging purposes, which is consistent with a scenario in which accommodative monetary policy has the effect of softening firms' need to reduce debt (and hence improve net worth) with the objective of expanding future borrowing capacity.

In Table 3, I separately explore the effects of interest rate surprises by interacting the size of nominal capital, as defined above, with deviations from market expectations in the three-month Euro Overnight Index Average (EONIA) swaps, equally taken from the time series in Jarociński and Karadi (2020). The three-month EONIA swap rate represents the market's expectation of movements in the ECB's main refinancing rate in the next three months. I invert the sign of the monetary policy shock to ease interpretation of the coefficients and to allow comparability with stock price surprises. A positive interest rate shock thus represents a conventional monetary expansion by the ECB.

Column (1) of Table 3 shows that a standard expansionary monetary shock that specifically results in lower market interest rates is associated with a rise in the demand for liquidity amongst high-collateral firms (or sectors). This is the opposite direction from what happens when stock prices increase, whether in the framework of a standard monetary shock or an information

TABLE 4 Summary statistics by age group.

Variables	<i>N</i>	Mean	S.D.	Min	Max
<i>Old firms (age > 25)</i>					
Cash	688	0.067	0.035	0.019	0.189
Collateral	679	0.235	0.193	0.03	0.797
Leverage	585	0.395	0.173	0.043	0.728
Intangible to capital	599	0.091	0.161	0	1.041
<i>Young firms (age ≥ 3 & ≤ 5)</i>					
Cash	542	0.072	0.042	0.019	0.189
Collateral	537	0.187	0.171	0.03	0.797
Leverage	462	0.498	0.151	0.043	0.728
Intangible to capital	379	0.19	0.261	0	1.041

Notes The table presents summary statistics from the sample used for Tables 1 and 2, and is part of CompNet's joint distributions.

shock.²⁷ Column (2) includes the contemporaneous asset price movement. Even when controlling for interest rate movements and their more or less robust effects on cash hoarding, favourable asset price shocks still reduce demand for precautionary cash and prove to be a statistically stronger determinant of cash management than parallel interest rate dynamics. Finally, column (3) controls for other drivers of cash accumulation. When including confounding variables, favourable interest rate surprises lose statistical significance. This suggests that the somehow counterintuitive results in columns (1) and (2) are probably driven by leverage (or other determinants of cash hoarding) rather than by the level of collateral. All in all, it is found that only asset price surprises differently affect corporate savings across high- and low-collateral firms.

4.2 | Firm age

My argument is that high levels of capital stock strengthen the transmission of monetary policy amongst those firms that are more reliant on assets for their marginal borrowing and investment. Similar to Döttling and Ratnovski (2023), I look at the interactive effect of financial constraints and fixed assets against the assumption that all firms are in some (different) way constrained. That is, in a world in which asset-based collateral constraints dominate other types of financial frictions (e.g. earnings-based constraints), the most constrained firms would be those that have too little fixed assets to start with, and that in turn retain as much cash as possible to substitute away from low physical capital.

To find confirmation for this interpretation, I use firm age as a generally accepted measure of financial constraints (e.g. Cloyne *et al.* 2018; Durante *et al.* 2022). As opposed to either size or other balance sheet variables, age is the only truly exogenous characteristic of firms that is related to financial frictions, with young firms typically considered constrained because they had too little time to build up the reputation that would give them easy access to external finance. As they typically hold low fixed assets, young firms weaken the transmission of monetary policy if asset-based constraints dominate, and deliver generally higher levels of precautionary cash. Summary statistics reported in Table 4 confirm that very young euro area firms have less collateral and more cash, and are generally more intangible than old euro area firms.

I re-estimate equation (1) by interacting *separately* the share of firms of a certain age with the monetary policy shock. This implies that, differently from the baseline estimation, I do not impose the restrictive assumption of linearity in the interaction term. I use two indicators. The variable 'old firms' measures the share of firms in each size–sector–country–year cell that is older

than 25 years. The variable ‘young firms’ accounts for the share of firms with an age between 3 and 5 years. This implies that my data convey information about the impact of monetary policy on the median cash ratio when the share of either old or young firms is high within a certain class size, sector and country each year. The results reported in Table 5 are in line with the previous ones if one plausibly assumes that old firms enjoy relatively higher fixed assets and young firms are in the opposite situation, as shown in Table 4. In sectors and employment-based class sizes where the share of old firms is higher, cash ratios fall the most in response to a positive asset price surprise (column (1) of Table 5). These results are robust to the inclusion of the same control variables used in previous specifications and their interaction with the monetary-shock variable, which ensures that any difference in the cash response between high and low fixed assets is not driven by other observable firm-based characteristics (column (2)).

An interesting result is that cash holdings behave in the opposite way when the median firm age is tilted in favour of much younger firms. A high number of young firms does not *per se* condition the level of cash at the identifier level (i.e. group of firms of the same size in the same sector and country), but the same positive asset price surprise comes with an increase in cash-to-asset ratios when the share of young firms is high (columns (3) and (4) of Table 5). This may happen, for example, because they do not pay dividends generated in good times, a common practice amongst firms transitioning to their optimal scale (Cloyne *et al.* 2018). Overall, my interpretation of the results is that young firms remain nonetheless externally constrained despite positive valuation effects because of the sheer size of their collateral. Relatedly, they value internal funds more than their low-MRPK counterparts when cash is remunerated at the level of the MRPK and the dominant technology generates decreasing returns to scale. This is consistent with the existing literature showing that young less tangible firms accumulate cash out of precaution and/or to successively self-finance R&D investment (Bates *et al.* 2009; Brown and Petersen 2011; Adler *et al.* 2019; Falato *et al.* 2022). By contrast, the effect of interest rate surprises is not conditioned by the share of either old or young firms within each size, sector and country (columns (4) and (5)).

Combined, my results point to the dominant role in the euro area of asset-based collateral constraints, which bind low-collateral young firms the most, encouraging them to hoard cash in transition to their optimal scale. At the same time, this leaves them less exposed to tightening cycles, as also found in Jeenas (2019). Instead, high-collateral old firms secure borrowing using their assets, and treat cash as a residual category, which might impair activities that are typically financed out of internal funds (e.g. R&D). My findings contain some relevant—albeit only suggestive—information about the anatomy of borrowing constraints in the euro area. The distribution of heterogeneous financial frictions across types of euro area firms appears to be in contrast with the evidence produced for the USA, whose old large firms pledge earnings rather than assets (Lian and Ma 2021). The diverse cross-section distribution of borrowing constraints between Europe and the USA might well explain differences in the real effects of monetary policy in the two regions.²⁸

4.3 | Tangible versus intangible investment

One obvious concern is that the reason why the liquidity demand of high-collateral old euro area firms responds negatively to the ECB’s expansionary monetary policy is that these firms do not need cash for future investment, having reached the limit of their capital stock. The argument developed in this paper is instead that these firms will exploit increased borrowing capacity to install additional physical capital in a second period.²⁹ On the asset side, the same monetary shock should thus increase tangible investment in industries and class sizes characterized by a high level of fixed assets, or equivalently, a high share of old firms, but would not bear an impact on intangible investment. If anything, the latter is expected to fall where the representative

TABLE 5 Heterogeneous cash responses to asset price and interest rate shocks: firm age.

Cash and cash equivalents to assets	Old firms and AP shock (1)	Old firms and AP shock with controls interacted (2)	Young firms and AP shock (3)	Young firms and AP shock interacted (4)	Old firms and IR shock (5)	Young firms and IR shock (6)
Share of firms by age ($t - 1$)	-0.0385*** [0.00985]	-0.0283*** [0.00897]	0.0194 [0.0122]	0.0128 [0.0114]	-0.0356*** [0.00980]	0.0128 [0.0150]
Share of firms by age ($t - 1$) × MP shock	-0.00548*** [0.00102]	-0.00432*** [0.00128]	0.0131*** [0.00420]	0.0118** [0.00497]	0.0891 [0.0554]	-0.0382 [0.196]
Country × sector × size fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country × time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Cluster level	Identifier × event time	Identifier × event time	Identifier × event time	Identifier × event time	Identifier × event time	Identifier × event time
Observations	1849	1132	1849	1132	1849	1849
R-squared	0.903	0.916	0.901	0.915	0.902	0.900

Notes: The table reports coefficient estimates from a variant of equation (1). The sample is the same as in Table 2.

median firm in each sector and class size has high collateral and contextually limited cash to self-finance intangibles.

To test for this, I use a specification similar to equation (1), where the dependent variable consists of either tangible or intangible real investment (in natural logarithm) one year after the shock, which is regressed on the interaction between the monetary shock and the same industry- and size-level characteristics as above.³⁰ Results in Table 6 indicate that positive asset price shocks increase tangible output in industry and class sizes characterized by high collateralizable assets (or consisting of much older firms), while bearing no equivalent impact on intangible investment. The latter is unaffected by the same monetary shock, in the short run at least.³¹

For robustness, I also test for the impact of asset price shocks on real capital (in natural logarithm) by asset intangibility and MRPK. The empirical exercise is similar to the one underlying Figure 1, where I interact the deciles of the intangibility or MRPK distribution with the monetary shock. Consistent with earlier evidence and with the overall argument, the marginal effect of the shock on real capital is larger for tangible firms (see Figure 1B in Online Appendix B). Similarly, the short-run expansionary impact of monetary policy is stronger for low-MRPK firms, and diminishes linearly in the case of firms occupying higher deciles of the MRPK distribution. That is, highly productive firms are less affected by expansionary monetary shocks that are identified through increases in asset prices (see Figure 2B in Online Appendix B). It should also be true that the same monetary shock does not affect the intangible investment of low-collateral and low-MRPK firms, but induces high-MRPK firms to become even more intangible as they accumulate savings in good times. Figure 3B in Online Appendix B confirms that positive asset price shocks make high-MRPK firms more intangible-intensive, as measured by the ratio of intangible to total assets, whilst leaving low-MRPK firms largely unaffected.

4.4 | Information shocks

Jarociński and Karadi (2020) use the signs of the relationship between interest rate and asset price surprises to distinguish between a standard monetary shock and an information shock. In the latter case, stock market responses are positively correlated with interest rate movements, indicating that markets extrapolate from the policy change information about the central bank's assessment of the economic outlook. In the previous exercise, I used asset price surprises irrespective of the contemporaneous change in market interest rates, whose impact was only tested separately. The shock variable was constructed in a way that did not allow us to distinguish across shocks in the same month. Namely, every month, the euro area could be hit by both a standard shock and an information shock, each having a different time-varying non-zero share. This comes with the risk of imprecise estimates when both surprises are included in additive fashion.

Here, I re-estimate equation (1) using shock variables equally retrieved from Jarociński and Karadi (2020) that are constructed in such a way that in each month and by aggregation each year, the euro area is hit by either a standard shock or an information shock. Building on this series, I account for a conventional monetary tightening marked by a negative co-movement between interest rates that increase and stock prices that fall, and a positive information shock, where both are on the rise. Through this approach, I am able to test for the symmetry in the effects of asset price surprises, which I obtain by separating information from standard monetary shocks. Across the two categories of shocks, interest rates rise equally, while asset prices move in opposite directions, effectively enabling the identification of potentially asymmetric effects on cash, holding the user cost of capital constant.

Table 7 reports the results. They confirm the differential impact of the ECB's asset price surprises on cash holdings, and in turn on dynamic capital allocation via the credit channel of monetary policy. Consistent with previous results, positive information shocks identified through rising asset prices and rising interest rates have a larger negative impact on corporate cash in

TABLE 6 Heterogeneous investment responses to asset price shocks.

Tangible or intangible real investment ($t + 1$) (ln)	Tangible investment and level of nominal capital (1)	Intangible investment and level of nominal capital (2)	Tangible investment and share of old firms (3)	Intangible investment and share of old firms (4)
Nominal capital ($t - 1$) (ln) or share of old firm ($t - 1$)	0.522*** [0.0931]	0.207*** [0.0509]	1.525*** [0.579]	0.396*** [0.111]
Nominal capital ($t - 1$) (ln) or share of old firm ($t - 1$) \times AP shock	0.0137*** [0.00382]	0.000293 [0.000874]	0.198*** [0.0646]	0.0176 [0.0139]
Country \times sector \times size fixed effects	Yes	Yes	Yes	Yes
Country \times time fixed effects	Yes	Yes	Yes	Yes
Cluster level	Identifier \times event time	Identifier \times event time	Identifier \times event time	Identifier \times event time
Observations	1317	2421	805	1910
R-squared	0.909	0.973	0.863	0.963

Notes The table reports coefficient estimates from a variant of equation (1). The sample is the same as in Table 2.

TABLE 7 Heterogeneous cash responses to standard and information shocks: asymmetries.

	Negative standard shock (1)	Negative with controls interacted (2)	Positive information shock (3)	Positive information shock with controls interacted (4)
Cash and cash equivalents to assets				
Nominal capital ($t - 1$) (ln)	-0.00614*** [0.00165]	-0.00571*** [0.00152]	-0.00640*** [0.00166]	-0.00574*** [0.00151]
Nominal capital ($t - 1$) (ln) \times MP shock	0.00541** [0.00225]	0.00407 [0.00255]	-0.0141*** [0.00236]	-0.00945*** [0.00266]
Country \times sector \times size fixed effects	Yes	Yes	Yes	Yes
Country \times time fixed effects	Yes	Yes	Yes	Yes
Cluster level	Identifier \times event time	Identifier \times event time	Identifier \times event time	Identifier \times event time
Observations	2360	1454	2360	1454
R-squared	0.906	0.921	0.907	0.921

Notes The table reports coefficient estimates from a variant of equation (1). The sample is the same as in Table 2.

high fixed assets (column (3)), including when accounting for other observable firm characteristics (column (4)). The results convey additional information. First, the contemporaneous rise in interest rates during favourable information shocks is not sufficient to revert positive valuation effects on net worth and on the external finance premium, which are arguably first order, as hypothesized initially. In other words, high-collateral firms release precautionary cash in response to positive information shocks even if the user cost of capital is on the rise probably because the main effect on net worth operates linearly via asset prices, which is the simplifying assumption with which I started the analysis.

Second, and most significantly, the impact of asset price surprises is only weakly symmetric: falling asset prices tend to deliver higher precautionary cash when collateral is high (column (1) of Table 7), just as rising asset prices are associated with lower demand for cash. Yet the differential effect on cash loses statistical significance when controls are added in interaction with the monetary shock (column (2)), which might indicate that the difference between high- and low-collateral firms is driven, during standard monetary contractions, by other observable firm characteristics (i.e. cash flows, dividends and/or leverage). Moreover, in quantitative terms, positive asset price shocks deliver much stronger results than negative asset price shocks. As discussed earlier, the estimation consists of a test of the symmetry of the financial-accelerator mechanism implicit to the credit channel, a largely under-investigated topic except for the analysis in Perez-Orive *et al.* (2023). In this respect, my data imply that long periods of unexpected monetary expansions that specifically stimulate asset prices leave high-collateral firms short on liquidity, while standard tightening is generally not sufficient to replenish cash buffers, all else equal.

For robustness, I also interact the two shocks used above with the share of old and young firms. The results are consistent with previous ones. Old and young firms treat cash in opposite ways over monetary policy cycles. Old firms respond to standard monetary contractions by increasing demand for liquid assets, which are probably needed to counteract lower borrowing capacity as well as to pay back the higher costs of accumulated debt. Young firms instead become less liquid in response to the same type of shock most probably because of the lower incidence of undistributed earnings during bad times. Positive information shocks elicit opposing outcomes. Old firms need less precautionary cash in the face of their enhanced capacity to

borrow, whereas young firms continue accumulating cash, which is arguably stemming from the monetary-accommodation-induced rise in dividends that are eventually not paid out but retained in transition to the optimal scale (see Table 5B in Online Appendix B).³²

4.5 | Additional robustness tests

I expose my results to an array of additional robustness tests. First, I provide results for an identification specification that uses current fixed assets in equation (1) as in the framework used by Chaney et al. (2012). The results are unaltered (see Table 3B in Online Appendix B). Second, I consider a different aggregation method of monthly shocks that accounts for the time that firms have to react to the shock. These ‘smoothed’ shocks produce the same estimates as the simple sum (or the average) of all monthly shocks (see Table 4B in Online Appendix B). Third, I re-estimate the specification using the complete firm population from the CompNet dataset, which includes firms with fewer than 20 employees. Results are largely preserved (see Table 6B in Online Appendix B).

5 | CONCLUDING REMARKS

This paper has estimated the impact of the ECB’s monetary policy and in particular its informational content on corporate cash holdings conditional on euro area firms’ fixed assets, which are here used as a proxy for collateral, whether immediately available or not. Positive asset price surprises lead to a relatively larger fall in precautionary cash amongst high-collateral old firms (or sectors). This is not necessarily because they have reached the upper limit of the capital stock but because the monetary-policy-induced rise in the liquidation value of their abundant collateral further improves access to external finance, which they exploit to finance tangible investment one year after the shock. On the downside, the central bank’s positive information shocks marked by rising asset prices and equally rising interest rates make these firms less liquid and more indebted than otherwise. This condition exposes them to tightening cycles and increases the probability that limited internal funds prevent them from investing in hardly collateralizable intangibles looking ahead. By being less exposed to valuation effects, low-collateral young firms react differently to the same asset price surprise by further accumulating internal finance. Arguably, this is because they fail to pay out pro-cyclical dividends, which typically happens when firms are in transition to their optimal scale.

The analysis comes with important implications that potentially open up new research avenues. First, the focus on corporate cash is informative of some under-investigated distributive effects of the ECB’s monetary policy. As firms use liquid assets to finance intangibles (e.g. Bates et al. 2009; Brown and Petersen 2011; Adler et al. 2019; Falato et al. 2022), one of the possible implications is that the ECB is differently conditioning firms’ ability to self-finance intangible investment, especially because standard tightening cycles do not allow for rebuilding cash buffers. Second and related, excessively accommodative monetary policies—and in particular their informational content—can lead to capital misallocation if, by mainly pushing up asset prices, they induce collateral-abundant low-MRPK firms to invest beyond optimal capital levels, whilst leaving the same firms less liquid and more indebted than before. Differently from the standard literature on capital misallocation (e.g. Gopinath et al. 2017), here, a firm’s liquidity arises endogenously, and over-investment becomes a specific feature of poorly productive firms. Third, the significant exposure to asset price shocks of euro area large firms might explain, from a micro-founded perspective, why information shocks are more indicative of long-term economic trends in Europe than they are in the USA, as shown in Altavilla et al. (2019) and Jarczyński and Karadi (2020). Based on the paper’s main results, I ascribe this pattern to the predominance

of asset-based collateral constraints in the euro area, and their specific relevance for the largest firms, whose investment behaviour probably shapes aggregate investment. This contrasts with the USA, whose large firms primarily rely on earnings-based collateral.

ACKNOWLEDGMENTS

I am grateful to the editor Wouter Den Haan and the anonymous referees for excellent comments and patient guidance. This paper benefited from valuable feedback at various internal research seminars held at the European University Institute, the Johns Hopkins University and the University of Trieste. I am also thankful for fruitful discussions with Daniele Aglio, Edouard Challe, and participants at the 54th Annual Conference of the Money, Macro and Finance Society, University of Portsmouth.

ENDNOTES

- ¹ Bacchetta and Benhima (2015) find that debt-financed investment is associated with a higher demand for cash in the first period, which is needed to finance working capital in the second period. This happens because firms employ a time-to-build technology. The positive relationship between investment and cash is not necessarily in place under different assumptions about the underlying production function.
- ² Theoretically, positive monetary shocks increase net worth and reduce the external finance premium via (i) falling interest expenses, (ii) rising asset prices, and (iii) lower financing gaps thanks to the fact that revenues (i.e. cash flows) rise at either constant or falling costs (see Bernanke *et al.* 1996). This paper is specifically concerned with point (ii).
- ³ To be precise, CompNet data allow us to capture sectors and employment-based class sizes in which the representative median firm has abundant collateral versus those where the median firm has low collateral.
- ⁴ It should be noted that total fixed assets as reported in CompNet largely consist of tangible fixed assets (see Subsection 2.1 for details). In this respect, my main variable of interest is a loose proxy of asset tangibility.
- ⁵ The assumption of linearity is important for the empirical model as well, and can indeed be tested empirically. By interacting the monetary shock with the fixed-asset variable, I do impose the rather restrictive assumption of linearity in the interaction term.
- ⁶ Additionally, asset price surprises better capture the effects of unconventional monetary policy since 2010 and especially from 2015 onwards. This is because these are generally transmitted along the yield curve, and might be muted when just looking at unexpected changes in short-term market interest rates.
- ⁷ The empirical strategy consists in juxtaposing two distinct monetary policy innovations where the sign of the interest rate movement is identical but asset prices move in opposite directions. This allows testing for the asymmetry of asset price surprises, holding constant changes in the user cost of capital.
- ⁸ The general setting is akin to Myers and Majluf (1984), where internal funds substitute out external financing as long as investment has diminishing marginal returns.
- ⁹ More precisely, the data show that in sectors and class sizes with a high share of young firms, median cash ratios increase in response to a positive monetary shock by more than in sectors and class sizes where the share of young firms is low.
- ¹⁰ This mechanism is somehow different from the one emphasized by the standard literature on capital misallocation (e.g. Gopinath *et al.* 2017). There, the fall in real interest rates induced by the European convergence process generated over-investment by high-net-worth liquid firms even if they were not more productive than their low-net-worth illiquid counterparts. Here, a firm's liquidity arises endogenously, and debt-financed over-investment becomes a feature of poorly productive firms.
- ¹¹ This says that the analysis is not exposed to the risk that balance sheet variables proxy investment opportunities, which would imply that investment is driven by such variables even in a frictionless environment (e.g. Kaplan and Zingales 1997).
- ¹² The available US-centred literature uses corporate bond spreads as a measure of the external finance premium. This approach is not empirically meaningful in the European context, where firms mostly finance investment with bank loans.
- ¹³ The CompNet dataset is increasingly used in empirical analysis. Notable examples of papers relying on these data are Autor *et al.* (2020), Bighelli *et al.* (2023), Ferrando *et al.* (2023) and Popov and Steining (2023).
- ¹⁴ Certain countries included in the CompNet database are legally obliged to report balance sheet data only when a certain size threshold is met. It follows that cross-country comparability is better preserved when excluding firms with fewer than 20 employees.
- ¹⁵ The weighted joint distributions offer an efficient description of the population of firms only if the sample is a random sample within the respective weight dimension (i.e. size one-digit industry year).
- ¹⁶ In the baseline estimation, I substitute the fixed-asset share used in Table 1 with the nominal value of fixed assets (in natural logarithm) given that cash and cash equivalents are scaled by total assets, which would introduce a mechanical relationship between the dependent and independent variables.

- ¹⁷ For the full list of variables and their definitions, see Online Appendix A.
- ¹⁸ As for the countries included in my main sample, only Finland uses the first best; Belgium, Italy, Spain and Denmark use the second best (i.e. only tangible fixed assets); France, Germany, the Netherlands and Portugal refused to disclose the relevant information (CompNet 2021, pp. 110–12).
- ¹⁹ The results show that cash ratios are not sensitive to changes in collateral at very high levels of asset intangibility.
- ²⁰ It is beyond the scope of this paper to analyse the mechanism through which deleveraging may take place at very high levels of asset intangibility.
- ²¹ The MRPK is derived from an OLS estimation of a revenue-based Cobb–Douglas production function at the macro-sector level (for details, see Online Appendix A).
- ²² See note 2.
- ²³ The surprise measure is the sum of the responses in the two windows.
- ²⁴ This is a source of permanent heterogeneity in responsiveness across firms. Consistently, when demeaning fixed assets to capture within-firm variation, as in Ottonello and Winberry (2020), I do not obtain statistically significant heterogeneous effects across low- and high-collateral firms (or sectors, given the nature of my data).
- ²⁵ Almeida *et al.* (2004) interpret the cash flow sensitivity of cash as evidence that a firm is constrained. I am agnostic with respect to the specific interpretation of the coefficient. If one were to use the same framework as in Almeida *et al.* (2004), then the estimated coefficient could be taken to represent the share of constrained firms and/or the strength of existing financial frictions.
- ²⁶ It should be stressed that total fixed assets proxy the sizes of firms in each employment-based class size and macro-sector. The Online Appendix shows that when including total assets (in natural logarithm) and specifically its interaction with the monetary shock, the effect of fixed assets on cash becomes statistically insignificant (see Table 2B in Online Appendix B).
- ²⁷ A possible explanation is that the estimated coefficient is biased (or spurious) simply because high-collateral firms pledge mostly assets and are in turn less sensitive to interest rate changes unless the latter are explicitly associated with a valuation effect of whatever sign. The full estimation shows that results for interest rate shocks are not fully robust.
- ²⁸ For a discussion of the macroeconomic implications of assuming different types of constraints, see Drechsel (2023).
- ²⁹ The evidence produced in Figure 1 is also supportive of this line of reasoning.
- ³⁰ The choice of this specific time horizon is justified by the fact that available research typically finds that the strongest investment response to monetary policy occurs one year after the shock. The dynamic specification in Online Appendix C confirms that this is indeed the case also in the euro area.
- ³¹ There is some evidence that *aggregate* intangible investment is unaffected in the first two years but falls three years after the shock, probably reflecting the investment behaviour of the largest European firms (see Online Appendix C).
- ³² These results are more supportive of the symmetry of the credit channel than previous ones. This is because when using the share of old firms in each macro-sector and class size, I am not imposing the restrictive assumption of linearity in the interaction. Differently put, the variable that I use here is capturing not the full distribution of fixed assets but just the highest moments.

REFERENCES

- Acharya, V., Almeida, H. and Campello, M. (2007). Is cash negative debt? A hedging perspective on corporate financial policies. *Journal of Financial Intermediation*, **16**(4), 515–54.
- , Davydenko, S. A. and Strebulaev, I. A. (2012). Cash holdings and credit risk. *Review of Financial Studies*, **25**(12), 3572–609.
- Adler, K., Ahn, J. and Dao, M. C. (2019). Innovation and corporate cash holdings in the era of globalization. IMF Working Paper no. 17.
- Albrizio, S., González, B. and Khametshin, D. (2024). A tale of two margins: monetary policy and capital misallocation. IMF Working Paper no. 121.
- Almeida, H. and Campello, M. (2007). Financial constraints, asset tangibility, and corporate investment. *Review of Financial Studies*, **20**(5), 1429–60.
- , ——— and Weisbach, M. S. (2004). The cash flow sensitivity of cash. *Journal of Finance*, **59**, 1777–804.
- Altavilla, C., Brugnolini, L., Gürkaynak, R. S., Motto, R. and Ragusa, G. (2019). Measuring euro area monetary policy. *Journal of Monetary Economics*, **108**, 162–79.
- Autor, D., Dorn, D., Katz, L. F., Patterson, C. and Van Reenen, J. (2020). The fall of the labor share and the rise of superstar firms. *Quarterly Journal of Economics*, **135**(2), 645–709.
- Bacchetta, P. and Benhima, K. (2015). The demand for liquid assets, corporate saving, and international capital flows. *Journal of the European Economic Association*, **13**(6), 1101–35.
- Barro, R. J. (1976). The loan market, collateral, and rates of interest. *Journal of Money, Credit and Banking*, **8**(4), 439–56.
- Bates, T. W., Kahle, K. M. and Stulz, R. M. (2009). Why do US firms hold so much more cash than they used to? *Journal of Finance*, **64**(5), 1985–2021.
- Bernanke, B., Gertler, M. and Gilchrist, S. (1996). The financial accelerator and the flight to quality. *Review of Economics and Statistics*, **78**(1), 1–15.

- , ——— and ——— (1999). The financial accelerator in a quantitative business cycle framework. *Handbook of Macroeconomics*, **1**, 1341–93.
- Bighelli, T., di Mauro, F., Melitz, M. J. and Mertens, M. (2023). European firm concentration and aggregate productivity. *Journal of the European Economic Association*, **21**(2), 455–83.
- Brown, J. R. and Petersen, B. C. (2011). Cash holdings and R&D smoothing. *Journal of Corporate Finance*, **17**(3), 694–709.
- Caglio, C. R., Darst, R. M. and Kalemli-Özcan, Ş. (2021). Collateral heterogeneity and monetary policy transmission: evidence from loans to SMEs and large firms. NBER Working Paper no. 28685.
- Chaney, T., Sraer, D. and Thesmar, D. (2012). The collateral channel: how real estate shocks affect corporate investment. *American Economic Review*, **102**(6), 2381–409.
- Cloyne, J., Ferreira, C., Froemel, M. and Surico, P. (2018). Monetary policy, corporate finance and investment. NBER Working Paper no. 25366.
- CompNet (2021). User Guide for the 8th Vintage CompNet Dataset; available online at https://www.comp-net.org/fileadmin/_compnetuser_upload/2023-10-31%208th%20Vintage%20User%20Guide%20Final.pdf (accessed 1 January 2026).
- Deng, Y. and Yao, H. (2021). Corporate cash holdings and monetary shocks: a test of the credit channel theory. *Review of Financial Economics*, **39**, 203–22.
- Denis, D. J. and Sibilkov, V. (2010). Financial constraints, investment, and the value of cash holdings. *Review of Financial Studies*, **23**(1), 247–69.
- Döttling, R. and Ratnovski, L. (2023). Monetary policy and intangible investment. *Journal of Monetary Economics*, **134**, 53–72.
- Drechsel, T. (2023). Earnings-based borrowing constraints and macroeconomic fluctuations. *American Economic Journal: Macroeconomics*, **15**(2), 1–34.
- Durante, E., Ferrando, A. and Vermeulen, P. (2022). Monetary policy, investment and firm heterogeneity. *European Economic Review*, **148**, 104251.
- Falato, A., Kadyrzhanova, D., Sim, J. and Steri, R. (2022). Rising intangible capital, shrinking debt capacity, and the US corporate savings glut. *Journal of Finance*, **77**(5), 2799–852.
- Fazzari, S., Hubbard, R. G. and Petersen, B. (1988). Investment, financing decisions, and tax policy. *American Economic Review*, **78**(2), 200–5.
- Ferrando, A., McAdam, P., Petroulakis, F. and Vives, X. (2023). Monetary policy, market power, and SMEs. *AEA Papers and Proceedings*, **113**, 105–9.
- Gertler, M. and Karadi, P. (2015). Monetary policy surprises, credit costs, and economic activity. *American Economic Journal: Macroeconomics*, **7**(1), 44–76.
- Gopinath, G., Kalemli-Özcan, S., Karabarbounis, L. and Villegas-Sanchez, C. (2017). Capital allocation and productivity in South Europe. *Quarterly Journal of Economics*, **132**(4), 1915–67.
- Han, H. and Wang, X. (2023). Monetary policy uncertainty and corporate cash holdings: evidence from China. *Journal of Financial Stability*, **67**, 101–38.
- Han, S. and Qiu, J. (2007). Corporate precautionary cash holdings. *Journal of Corporate Finance*, **13**(1), 43–57.
- Hart, O. and Moore, J. (1994). A theory of debt based on the inalienability of human capital. *Quarterly Journal of Economics*, **109**(4), 841–79.
- Hsieh, C. T. and Klenow, P. J. (2009). Misallocation and manufacturing TFP in China and India. *Quarterly Journal of Economics*, **124**(4), 1403–48.
- Jarociński, M. and Karadi, P. (2020). Deconstructing monetary policy surprises—the role of information shocks. *American Economic Journal: Macroeconomics*, **12**(2), 1–43.
- Jeenas, P. (2019). *Firm balance sheet liquidity, monetary policy shocks, and investment dynamics*. Mimeo.
- Kaplan, S. N. and Zingales, L. (1997). Do investment–cash flow sensitivities provide useful measures of financing constraints? *Quarterly Journal of Economics*, **112**(1), 169–215.
- Kiyotaki, N. and Moore, J. (1997). Credit cycles. *Journal of Political Economy*, **105**(2), 211–48.
- Lei, J., Qiu, J. and Wan, C. (2018). Asset tangibility, cash holdings, and financial development. *Journal of Corporate Finance*, **50**, 223–42.
- Lian, C. and Ma, Y. (2021). Anatomy of corporate borrowing constraints. *Quarterly Journal of Economics*, **136**(1), 229–91.
- Myers, S. C. and Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, **13**(2), 187–221.
- Nakamura, E. and Steinsson, J. (2018). High frequency identification of monetary non-neutrality: the information effect. *Quarterly Journal of Economics*, **133**(3), 1283–330.
- Opler, T., Pinkowitz, L., Stulz, R. and Williamson, R. (1999). The determinants and implications of corporate cash holdings. *Journal of Financial Economics*, **52**(1), 3–46.

- Ottonello, P. and Winberry, T. (2020). Financial heterogeneity and the investment channel of monetary policy. *Econometrica*, **88**(6), 2473–502.
- Perez-Orive, A., Timmer, Y. and van der Ghote, A. (2023). *The asymmetric credit channel of monetary policy*. Mimeo.
- Popov, A. and Steininger, L. (2023). Monetary policy and local industry structure. ECB Working Paper no. 2778.
- Winterberg, H. (2025). Natural bank reliance. IMF Working Paper no. 115.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Marzinotto, B. (2026). The heterogeneous impact of European Central Bank asset price surprises on corporate liquidity demand. *Economica*, 1–25.
<https://doi.org/10.1111/ecca.70028>