The Impact of Monetary Policy on European Corporate Investments

Sebastian Johann Heymann

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professor Diana Bonfim

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Abstract

This thesis investigates the effects of monetary policy on corporate investment decisions in major European economies — Germany, France, Italy, Spain, and the Netherlands — during the period 2002 to 2023. By leveraging quarterly panel data from publicly listed firms and employing a Local Projections Instrumental Variables (LP-IV) methodology, the analysis identifies how firm-specific characteristics such as age and dividend payment status mediate the impact of monetary shocks. The monetary policy shocks are derived from high-frequency changes in the 1-year Overnight Index Swap (OIS) rate around European Central Bank (ECB) policy announcements, serving as an exogenous measure of interest rate movements. The analysis uses the 1-year EURIBOR rate as a proxy for the interest rate set by the European Central Bank, thereby capturing medium-term monetary conditions that reflect both current policy stance and market expectations. The findings reveal substantial heterogeneity in firm responses. Younger, non-dividend-paying firms exhibit pronounced reductions in investment levels, driven by higher sensitivity to borrowing constraints, collateral devaluation, and earnings instability under tighter monetary conditions. In contrast, older, dividend-paying firms demonstrate resilience, with minimal changes in investment behavior due to their robust financial structures and diversified financing options. Among the examined transmission mechanisms, the cost channel emerges as the dominant driver of investment heterogeneity, highlighting the critical role of operational costs and earnings dynamics. Demand-side factors, while secondary, exhibit heightened volatility for younger firms, though their contribution to investment adjustments is less pronounced.

Keywords: Monetary policy, Corporate finance, Investment behavior, Financial constraints, Europe, Local Projections Instrumental Variables (LP-IV), Firm heterogeneity

O Impacto da Política Monetária nos Investimentos Corporativos Europeus

Sebastian Johann Heymann

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Resumo

Esta dissertação investiga os efeitos do aperto monetário nas decisões de investimento corporativo nas principais economias europeias — Alemanha, França, Itália, Espanha e Países Baixos — de 2002 a 2023. Com dados em painel trimestrais de empresas cotadas e Projeções Locais com Variáveis Instrumentais, a análise identifica como características específicas das empresas, como idade e política de distribuição de dividendos, influenciam o impacto dos choques de política monetária. Estes choques derivam de alterações de alta frequência na taxa de Overnight Index Swap de 1 ano em torno de anúncios do Banco Central Europeu, como medida exógena das variações das taxas de juro. A análise utiliza a taxa EURIBOR a 1 ano como proxy para a taxa de juro, capturando condições monetárias de médio prazo que refletem a política atual e expectativas de mercado. Os resultados revelam uma heterogeneidade substancial nas reações das empresas. Empresas mais jovens sem distribuição de dividendos apresentam reduções pronunciadas nos níveis de investimento, impulsionadas por maior sensibilidade a restrições de financiamento, desvalorização de garantias e instabilidade de ganhos sob condições monetárias mais rígidas. Em contraste, empresas mais antigas e que distribuem dividendos demonstram resiliência, com alterações mínimas no comportamento de investimento devido às suas estruturas financeiras robustas e opções de financiamento diversificadas. Entre os mecanismos examinados, o canal de custos emerge como o principal motor da heterogeneidade nos investimentos, destacando custos operacionais e dinâmica dos ganhos. Fatores relacionados com a procura, embora secundários, apresentam maior volatilidade para empresas mais jovens, com menor impacto nos ajustes de investimento.

Palavras-chave: Política monetária, Finanças corporativas, Comportamento de investimento, Restrições financeiras, Europa, Projeções Locais com Variáveis Instrumentais (LP-IV), Heterogeneidade empresarial.

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1. Introduction

Monetary policy decisions by central banks play a critical role in shaping economic dynamics, influencing inflation, employment, and corporate behavior. Among these effects, the impact of monetary policy on corporate investment decisions is particularly significant, as it directly affects firms' ability to grow and innovate. This relationship becomes even more pronounced during periods of economic uncertainty, such as the 2008 financial crisis, the post-COVID-19 recovery, and the ongoing geopolitical tensions stemming from the Russia-Ukraine war. These events have led to sharp fluctuations in interest rates and inflation, creating a challenging environment of uncertainty where firms hesitate to invest in projects, capital expenditures, or even hiring full-time employees, as elevated capital costs create significant barriers.

While monetary policy tools like interest rate adjustments are widely used to stabilize economies, their effects on corporate investment are not uniform across firms. According to Cloyne et al. (2023), they greatly depend on individual firm characteristics such as age, financial structure, and dividend payment behavior. Specifically, firms paying dividends are less likely to exhibit financial constraints, as they tend to use external financing countercyclically and face more minor discrepancies between internal and external capital costs. In contrast, non-dividend-paying firms rely more on external funding and experience greater spreads between internal and external capital costs. Furthermore, as highlighted by Davis and Haltiwanger (2019) and Haltiwanger et al. (2013), younger firms are hypothesized to be more financially vulnerable due to their limited cash flows and shorter credit histories. Younger firms are more likely to rely on collateral assets to secure financing, while older firms can often draw on their internally generated earnings for their funding needs (Lian & Ma, 2021).

While the existing literature has provided robust insights into these dynamics across various contexts, this thesis builds on these findings by applying them to new markets and timeframes. Specifically, it focuses on the five of Europe's current largest economies according to GDP[1] — Germany, France, Italy, Spain, and the Netherlands — over the extended period from 2002 to mid-2023. This comprehensive timeframe for the Euro Area ensures a broad understanding of monetary policy dynamics.

[1] Eurostat, & IMF. (September 11, 2024). Gross domestic product at current market prices of selected European countries in 2023 (in million euros). In *Statista*, from https://www.statista.com/statistics/685925/gdp-of-european-countries/

The analysis leverages quarterly panel data from publicly listed firms in these five countries and employs the Local Projections Instrumental Variables (LP-IV) methodology to estimate the dynamic causal effects of monetary policy shocks on firm-level outcomes (Stock & Watson, 2018). Monetary shocks are identified using high-frequency data from the Euro Area Monetary Policy Event-Study Database (Altavilla et al., 2019), which isolates exogenous changes in interest rates around European Central Bank (ECB) announcements. By categorizing firms, based on the foundation laid by Cloyne et al. (2023), according to age and dividend payment status, this study investigates how these characteristics mediate the transmission of monetary policy through channels such as capital costs, collateral constraints, and earnings dynamics.

My work demonstrates that the classification of firms based on the characteristics of age and dividend status, as proposed by Cloyne et al. (2023), also greatly captures the heterogeneity of investment patterns in Europe. The results highlight that younger, non-dividend-paying firms are significantly more affected by interest rate changes and display greater adjustments in their response. In contrast, older, dividend-paying firms show only minimal adjustments, reinforcing findings from the existing literature.

Further exploration into the key channels of influence that drive the observed heterogeneity uncovered additional insights. While several channels were analyzed, including the financial accelerator mechanism, the interest rate channel, the demand channel, and the cost channel, it was the cost channel that explained the changes in both investment ratios and borrowing rates over the entire forecasting horizon of five years (20 quarters) most effectively. The analysis demonstrated that as earnings rise, borrowing rates and investment ratios also increase in tandem, highlighting the cost channel as the most significant factor in understanding the variations for this dataset.

From my results, I conclude that young, non-dividend-paying firms should prioritize establishing stable cost structures, as this would help smooth their earnings during periods of monetary tightening. By achieving greater earnings stability, these firms could, like their older counterparts, rely more on internal funding or leverage their improved financial position to access external capital under more favorable terms. This financial resilience would enable them to maintain their investment levels, ensuring continued innovation and long-term growth despite challenging economic conditions.

The structure of this thesis is as follows. Section 2 provides an in-depth review of the existing literature on capital constraints and the heterogeneity of investment behavior. Section 3 outlines

the data sources and offers a detailed description of the dataset used in the analysis. Section 4 presents the analytical results derived from the LP-IV methodology, while Section 5 delves deeper into these findings by examining the potential channels of influence that explain the observed heterogeneity. Finally, Section 6 concludes the thesis, summarizing the key insights and implications of the study.

2. Literature Review

The relationship between corporate finance and monetary policy is a critical area of study that has attracted considerable attention from researchers. Through interest rate adjustments, monetary policy influences corporate behavior by changing the cost of capital and investment dynamics. Recent studies emphasize that firms respond differently to monetary policy changes based on their age and financial structure, thus highlighting the disparities in their vulnerability to such shifts.

Among the various factors influencing these differences, age and dividend status emerge as particularly critical determinants of firms' sensitivity to monetary policy. Cloyne et al. (2023) explore this in detail, showing that younger (those under 15 years old since their incorporation) and non-dividend-paying firms are particularly affected by monetary policy changes. They illustrate that this heightened sensitivity stems from their reliance on debt secured by collateral, such as physical assets, whose market values are directly affected by interest rate movements. As monetary policy tightens, younger firms face more considerable reductions in borrowing capacity and capital expenditures than their older, more established counterparts.

This reliance on collateral is consistent with findings by Lian and Ma (2021), who show that younger firms depend more heavily on asset-backed borrowing, whereas older firms tend to rely on earnings. This reliance on asset-backed borrowing exposes younger firms to significant risks during periods of monetary tightening, when declining asset values impair their ability to secure loans and thus lead to being financially constrained. These findings align with the Pecking Order Theory by Myers and Majluf (1984), which suggests that firms with limited internal resources prioritize external debt, making younger firms particularly vulnerable when external financing becomes costlier.

This relationship between credit constraints and monetary policy can be understood through the "credit view," which integrates the bank lending channel, the balance sheet channel (De Haan

& Sterken, 2006), and the financial accelerator mechanism (Bernanke et al., 1996). Together, these frameworks highlight how monetary tightening intensifies firms' financing challenges by creating a loop that amplifies the overall effects of the initial shock. The bank lending channel explains how tighter monetary policy reduces a bank's liquidity, thereby resulting in a contraction of the loan supply. As Jiménez et al. (2012) demonstrated, this effect is particularly pronounced for banks with weaker balance sheets, which are more likely to restrict credits during periods of higher short-term interest rates or when GDP growth is slower. As a result, firms cannot fully offset this reduction by switching to other lenders, ultimately leaving them more exposed to credit constraints. Simultaneously, the balance sheet channel emphasizes how monetary tightening diminishes firms' financial health by lowering their net worth and the value of their collateral. This decline in creditworthiness makes it more difficult for firms to secure the loans they need, creating a dual constraint that limits both their access to credit and their ability to invest. This situation triggers a "flight to quality", where lenders prefer safer investments and further restrict credit to riskier borrowers. This self-reinforcing loop is encapsulated by the financial accelerator mechanism described by Bernanke et al. (1996). As firms' creditworthiness declines and their borrowing costs increase, access to financing becomes even more constrained. Reduced investment and diminished economic activity deepen the downturn, which further deteriorates firms' financial conditions. Together, these channels illustrate how monetary policy affects firms unevenly, amplifying existing financial vulnerabilities and driving disparities in their ability to respond to economic shocks.

These theoretical frameworks are particularly relevant in the European context, where diverse financial systems vary across countries, and the reliance on bank lending creates unique challenges for firms facing monetary tightening (Deutsche Bundesbank, 2023). Altavilla et al. (2019) examine how conventional and unconventional European Central Bank (ECB) policy surprises influence corporate financing conditions. Their analysis, based on high-frequency asset price changes around policy announcements, reveals that short-term interest rates respond primarily to target rate surprises, while forward guidance and quantitative easing surprises significantly impact longer-term yields. The publicly accessible dataset from their research is regularly updated and serves as a key resource in my research to identify the policy shocks that are needed for the LP-IV forecast.

3. Data

In this section, I explore the key variables that allow me to evaluate the impact of interest rate fluctuations from Q1 2002 to Q3 2023 on the companies' investment decisions in Germany, France, Spain, Italy, and the Netherlands.

Drawing on the work of Cloyne et al. (2023), I also provide descriptive statistics that regress various financial company data against a polynomial in company age. This analysis reveals how firm characteristics vary across different stages of a company's lifecycle and uncovers trends in asset growth, changes in leverage, liquidity, and profitability.

3.2. Sources & Variables

The primary source for data in this analysis is the S&P Capital IQ database, as it is known for its vast financial data availability. To get an initial list of company tickers, the screening function was used to search for companies that are based in either Germany, France, Italy, Spain, or the Netherlands. The analysis focuses on publicly listed companies as they are legally required to disclose financial information through regulatory filings such as annual and quarterly reports, which are generally more accessible and reliable than for private companies. This standardized reporting also allows for better cross-sectional and longitudinal comparisons. As is common in the academic literature, I left out companies operating in the Finance sector due to their unique capital structures and investment behaviors. Their balance sheets are often asset-heavy with financial assets rather than physical capital investments, which makes them less comparable to non-financial firms focused on capital expenditures and physical investment. Furthermore, companies within the finance sector are directly impacted by monetary policy through various mechanisms, such as interest rate spreads and liquidity regulations. These mechanisms differ significantly from channels that primarily affect non-financial firms. No further criteria were applied, which gave me a sample of initially 2,118 public companies.

The analysis begins by defining key variables, beginning with the investment rate. Following the work of Chaney et al. (2012) and Cloyne et al. (2023), the investment rate is defined as capital expenditure in a given period (t), divided by the physical capital stock, which is measured using net plant, property, and equipment (Net PPE) from the beginning of the period, specifically the lagged Net PPE from the previous period (t-1). The benefit of this ratio is that it facilitates the comparison of investment decisions among companies with differing levels of

available capital. Age and dividend payments are equally crucial in our analysis. Company Age is derived by subtracting the year of foundation recorded in the S&P Capital IQ database from the year of each respective quarter being analyzed. The dividend status is captured using a dummy variable that takes the value of 1 if the company paid out a dividend in the previous year. Additionally, financial statement variables such as EBITDA, which serves as a proxy for a company's cash flow, the book value of total assets, representing the firm's size, and the change in that value, will give me the growth rate. Furthermore, total debt and interest expenditures will provide insights into the financial leverage and cost of borrowing that the firms face. Additional indicators such as the firm's liquidity, measured by short-term cash and investments divided by the book value of total assets, and Tobin's Q ratio, defined as the ratio of the market value of assets to book value, are crucial for understanding the mechanisms through which monetary policy affects corporate behavior. Liquidity directly measures a firm's ability to meet short-term obligations and finance investments without relying on external funding, which can become costlier during tightening periods. Similarly, Tobin's Q ratio reflects the attractiveness of new investments by comparing the market's valuation of a firm's assets to their replacement cost. A high Tobin's Q indicates favorable investment opportunities, suggesting that firms may continue to invest despite tighter monetary conditions if their market valuation remains strong. These variables highlight how financial health and market expectations shape firms' capacity and willingness to invest in response to monetary policy changes.

In analyzing the impact of recent monetary policies within the Euro area, I focus on the period from Q1 2002 to Q3 2023, leveraging the most recent and comprehensive data available. To proxy monetary policy, I will use the 1-year EURIBOR rate, which offers distinct advantages over traditional policy rates like the ECB's main refinancing operations (MRO) rate in the context of my LP-IV analysis. While the MRO rate is a key policy instrument, it reflects only the ECB's short-term intentions and does not fully capture the broader market dynamics or expectations that influence firms' investment decisions (European Central Bank, 2024b). The 1-year EURIBOR, on the other hand, represents the average rate at which eurozone banks lend to one another for a one-year horizon. This makes it a relevant proxy for medium-term monetary conditions, as it incorporates not only the current policy stance but also market expectations of future economic developments and monetary actions. Unlike the MRO rate, which is typically adjusted in discrete steps of 25 basis points and changes less frequently, the 1-year EURIBOR

fluctuates more dynamically. These frequent adjustments provide a more granular and realistic measure of the financing costs that firms encounter.

In addition, I will use monetary policy shock data provided by Altavilla et al. (2019), which captures unexpected changes in the one-year OIS rate within a narrow window around ECB monetary policy announcements. These shocks serve as instruments in my LP-IV analysis, providing a precise measure of unanticipated monetary policy changes and isolating their causal impact on firms' investment behavior. By combining the 1-year EURIBOR rate as a proxy for broader monetary conditions with these high-frequency monetary policy shocks, I aim to isolate the unexpected component of monetary policy, ensuring a causal analysis of its effects on corporate investment.

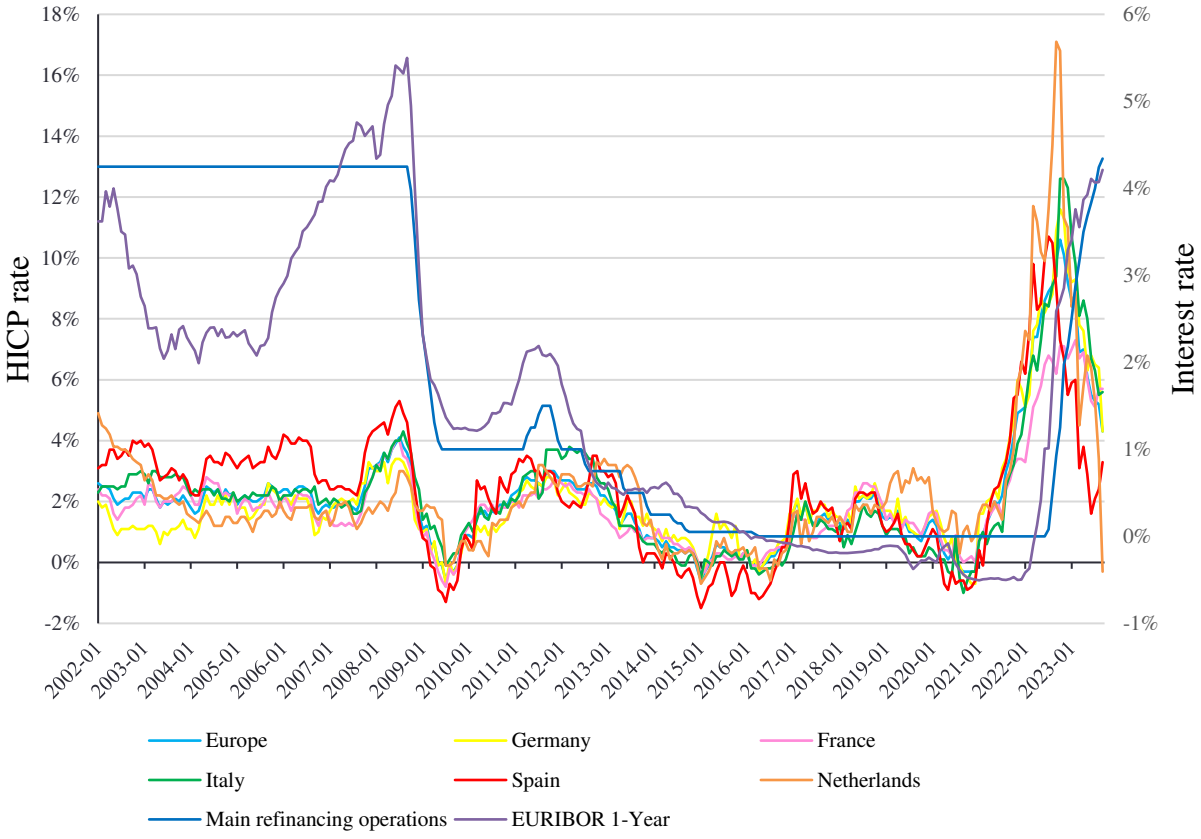

Figure 1: This graph illustrates the inflation rates of the analyzed Eurozone countries, measured by the Harmonized Index of Consumer Prices (HICP), alongside the MRO (Main Refinancing Operations) rates and the 1-year EURIBOR rates, spanning from 2002 to 2023.

Figure 1 shows that inflation remained stable between 1% and 4% until the 2008 financial crisis, after which it fluctuated, followed by a prolonged period of low inflation and near-zero interest rates from 2012 onwards. A sharp surge in inflation after 2021, driven by the economic fallout

from COVID-19, supply chain disruptions, rising energy costs, and geopolitical shocks, including the Russia-Ukraine war, prompted the ECB to steeply raise the Main Refinancing Operations rates (European Central Bank, 2024a). This led to the 1-year EURIBOR rate surpassing 4% by 2023, reaching levels last seen 15 years before. The countercyclical movement of inflation and interest rates emphasizes the essential function of interest rates in addressing inflation by reducing borrowing and controlling demand, thereby stabilizing prices within the Eurozone. The two interest rates exhibit a notable correlation of 0.9 during the specified time frame, which indicates that the 1-year EURIBOR rate serves as a robust proxy for the interest rate determined by the ECB.

Building upon these observations, it is essential to consider the broader implications for investment behavior. The extended period characterized by low inflation and near-zero interest rates fostered an exceptionally favorable environment for corporate investment, even if part of it was marked by the global financial crisis and the ensuing Euro area sovereign debt crisis. This context of inexpensive financing enabled firms to pursue long-term projects, expand their operational capacities, and invest significantly in innovation. However, the dramatic shift in inflationary pressures and monetary policy initiated after 2021 has fundamentally changed these dynamics. Rising interest rates have increased the cost of borrowing, which poses a particular challenge for younger firms. Having only experienced an environment of low inflation and low interest rates, these firms may struggle significantly to adapt to the new market conditions and tighter financial constraints.

It is important to note that the impact of rising interest rates is not the same across all sectors. Industries that are especially sensitive to interest rate changes, like real estate and manufacturing, are likely to scale back their investment plans more during periods of tighter monetary policy. On the other hand, companies with strong internal cash flows or less reliance on external borrowing are better positioned to keep their investment strategies on track. Next, I will conduct initial analyses using the company data. Through descriptive statistics, I aim to highlight fundamental trends related to the company age within the dataset.

3.3. Descriptive statistics

Cloyne et al. (2023) argue that company age indicates firms' potential financial constraints. To test their statement for the European market using recent data, I run polynomial regressions on

various firm metrics with company age as the independent variable. The dependent variables in this analysis will include firm size, represented by the log of total assets; leverage, computed as the ratio of total debt to total assets; Tobin's Q, defined as the market-to-book value of assets; liquidity, measured by the ratio of short-term cash and investments to total assets; and EBITDA ratio, specified as EBITDA over total assets. Table A1 in the Appendix provides the group averages, the median, and the standard deviations for each variable, categorized by age and dividend status.

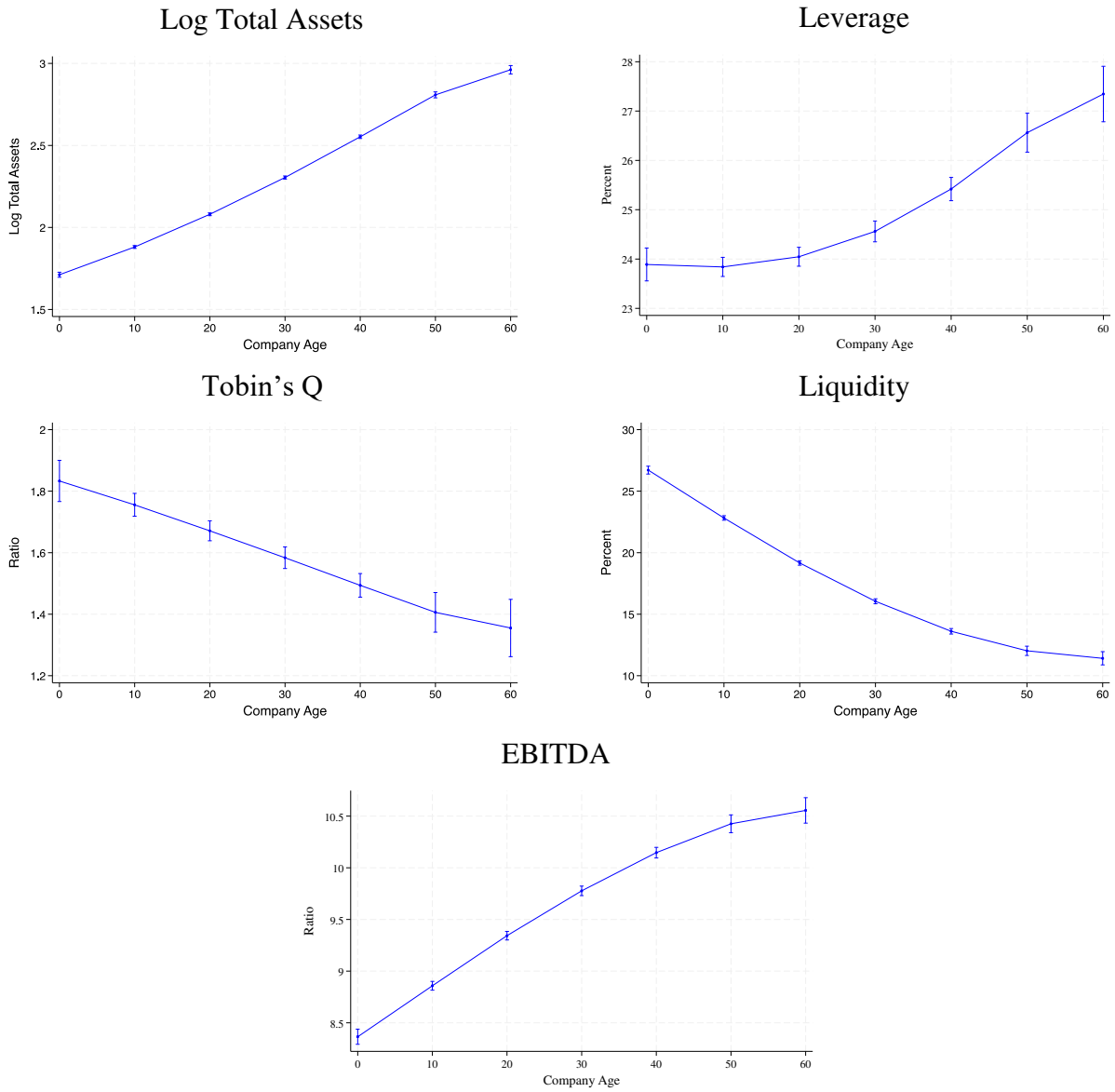

Figure 2: Each graph is a polynomial regression with company age as the independent variable and the log of total assets (top left), leverage (top right), Tobin's Q (bottom left), liquidity (bottom right), and EBITDA ratio (bottom) as the dependent variable. The error bands display the 90% standard error bands.

The Log Total Assets graph demonstrates a positive relationship between company age and total assets, indicating that firms tend to grow in asset size as they mature. This aligns with the expectation that older firms leverage their operational stability to expand. Similarly, the leverage graph shows that younger companies are slightly less leveraged than their older counterparts, consistent with findings by Dinlersoz et al. (2018) for publicly listed firms. However, their work also highlights that the leverage-age relationship is negatively sloped for private firms, which reflects different financing strategies between private and public entities. In contrast, the two graphs in the middle, depicting Tobin's Q ratio and liquidity, illustrate a downward trend as companies age, aligning with the conclusions of Cooley & Quadrini (2001) for Tobin's Q and Bates et al. (2009) for liquidity. These findings suggest that older companies, having generally accumulated stable revenues and lower financial uncertainty, may rely less on high liquidity holdings and find fewer high-return investment opportunities, thus reducing the Tobin's Q ratio. The EBITDA ratio graph indicates that as firms age, they generate higher earnings relative to their total assets. This reflects operational efficiency and stable revenue generation in more established companies.

In summary, the descriptive statistics highlight distinct patterns tied to the company age. Younger firms tend to have a significantly smaller asset base and thereby possess less collateral, which potentially limits their access to external financing. This challenge is particularly pronounced during periods of monetary tightening, where their already constrained asset base may lose even more value, worsening their financing difficulties. To counterbalance this volatility, younger firms tend to maintain higher cash reserves, which serve as a buffer against operational risks and provide flexibility for seizing investment opportunities that arise. Conversely, older firms benefit from their larger asset base, which offers them enhanced collateral for external financing and thereby reduces their dependence on liquidity reserves. These firms also generate relatively higher earnings, reflected in their EBITDA ratios, which further support their financial stability. However, their lower Tobin's Q ratios suggest fewer high-return investment opportunities, pointing to potentially diminished growth prospects. This combination of factors positions older firms with enhanced resilience to external shocks like monetary tightening, allowing them to maintain stable operations even under more challenging conditions. These findings are consistent with those of Cloyne et al. (2023), who analyzed firms from the United States and United Kingdom, and underscore that firm age is a particularly important characteristic for understanding the heterogeneity in investment ratios.

4. Methodology

Analyzing the impact of monetary policy on economic outcomes, like investment, is complicated due to the bidirectional causality between monetary policy and the broader economy (Ramey, 2016). Monetary policy decisions, such as interest rate changes, influence economic activity, yet current economic conditions also shape these decisions (Nakamura & Steinsson, 2018). Consequently, identifying and isolating exogenous monetary policy shocks is essential to assess their effects on investments accurately.

To address this challenge, I utilize an instrumental variables approach based on the use of the Euro Area Monetary Policy Event-Study Database (EA-MPD) provided by Altavilla et al. (2019). This database offers high-frequency data on asset price/yield changes around ECB policy announcements. The dataset captures monetary policy surprises by recording asset price/yield shifts in a time event window around the ECB's policy communications. The time window that I focus on is the "Policy Decision Window", which isolates the immediate impact of the policy announcement itself. Precisely, the asset price change is measured from the median value in the 13:25–13:35 interval window (pre-announcement) to the median value in the 14:00–14:10 interval window (post-announcement), following the ECB's policy decision at 13:45. This change reflects the monetary policy surprise directly attributable to the decision, as the short time window around the announcement isolates the asset price/yield changes that can be specifically linked to the interest rate decision itself. By narrowing the focus to this limited period, external factors and broader market dynamics are effectively filtered out, which ensures that the observed changes are a direct response to the central bank's policy announcement.

Within the Euro Area Monetary Policy Event-Study Database, I focus on changes in the 1-year Overnight Index Swap (OIS) rate. According to Abbassi and Linzert (2011), the 1-year OIS rate is a comprehensive measure of monetary policy expectations over a medium-term horizon, making it particularly relevant for understanding firms' investment behavior. Unlike shorter-term rates, the 1-year OIS incorporates market expectations of average overnight rates for the following year, reflecting broader shifts in monetary and economic conditions. This makes it a natural proxy for the financing costs associated with medium- to long-term corporate investment decisions and a robust instrument for identifying monetary policy shocks.

To identify the heterogeneous dynamic causal effects of monetary policy on a corporate level, I employ the panel LP-IV approach as outlined by Jordà et al. (2020) and Cloyne et al. (2023). This methodology allows me to utilize the just-described identified monetary shocks from the

EA-MPD by Altavilla et al. (2019) as instruments for interest rate changes while estimating impulse response functions (IRFs) using firm-level panel data.

$$\Delta_h X_{i,t+h} = \gamma_i^h + \sum_{g=1}^{G} \beta_g^h * I\left[Z_{i,t-1} \epsilon\, g\right] * \Delta R_t + \sum_{g=1}^{G} \alpha_g^h * I\left[Z_{i,t-1} \epsilon\, g\right] + \varepsilon_{i,t+h} \quad (1)$$

In this analysis, I use a quarterly time index t to track periods and an index i to represent individual firms. The dependent variable X represents firm-specific outcomes such as investment rates, borrowing levels, collateral values, sales, or cash flows observed over various horizons following a monetary policy shock. Here, h specifies the number of periods after the shock, which helps me to analyze changes in these firm outcomes over time.

The left side of the equation, $\Delta_h X_{i,t+h}$, represents the change in the dependent variable X for firm i at time $t + h$, measuring the outcome shift following a monetary policy shock over the specified horizon h. To account for firm-specific differences that remain constant over time, the model includes firm-fixed effects, γ_i^h, which control for unobservable firm-level characteristics that could influence X independently of the policy shock.

The summation term involving $\beta_g^h$and $I\left[Z_{i,t-1} \epsilon\, g\right]$ allows for heterogeneous effects of monetary policy shocks across different groups of firms, classified into groups G according to characteristics $Z_{i,t-1}$, such as, dividend status or age. The indicator function $I\left[Z_{i,t-1} \epsilon\, g\right]$ equals 1 if firm i belongs to group g based on these characteristics. This grouping approach enables the model to estimate group-specific impulse response functions, consistent with the approach of Cloyne et al. (2023), who estimate group-specific impulse response functions based on firm characteristics rather than imposing linear relationships. The coefficient β_g^h captures the sensitivity of each group g to changes in the 1-year EURIBOR rate ΔR_t, which is instrumented by a monetary policy shock. In this study, the monetary policy shock is reflected in the changes in the 1-year OIS rate, sourced from the Euro Area Monetary Policy Event-Study Database provided by Altavilla et al. (2019).

The model further incorporates group-specific intercepts, α_g^h, which control for baseline differences in trends across groups, independent of any policy intervention. For example, older firms may systematically exhibit higher baseline levels of investment or borrowing compared to younger firms, regardless of any monetary policy shocks. Finally, the error term $\varepsilon_{i,t+h}$ accounts for any unexplained variation in the dependent variable X after controlling for all other variables. To mitigate issues of serial correlation in these forecast errors, I cluster standard errors by both firm and time, following the approach of Driscoll and Kraay (1998).

As in the study by Cloyne et al. (2023), I set the lags to 12 months and forecast the impulse response functions (IRFs) over a horizon of 5 years (20 quarters). This specification aims to capture a wide range of firm responses, considering both time-dynamic effects and variations based on firm characteristics. However, the long forecasting horizon should be interpreted with caution, as the LP-IV model assumes that no other structural changes or shocks influence the variables during this period. This isolates the influence of the monetary policy shock on the dependent variable, but the interpretability of the results becomes increasingly limited as the horizon extends. Despite this limitation, the model allows for the identification of certain trends, providing insights into the dynamic responses of firms to monetary policy changes over time.

5. Empirical Analysis and Results

To better understand how changes in interest rates impact firms' investment ratios, I first examine the overall effect of monetary shocks on these ratios without further segmentation. This approach allows for comparing the results of individual groups with the overall average effect. To conduct this analysis, I employ the LP-IV model and winsorize the dataset to the 1st—99th percentiles of the investment ratio to minimize the distorting influence of outliers on the overall results. Given that higher interest rates lead to increased financing costs, the hypothesis is that this will lead to a significant decline in companies' investments.

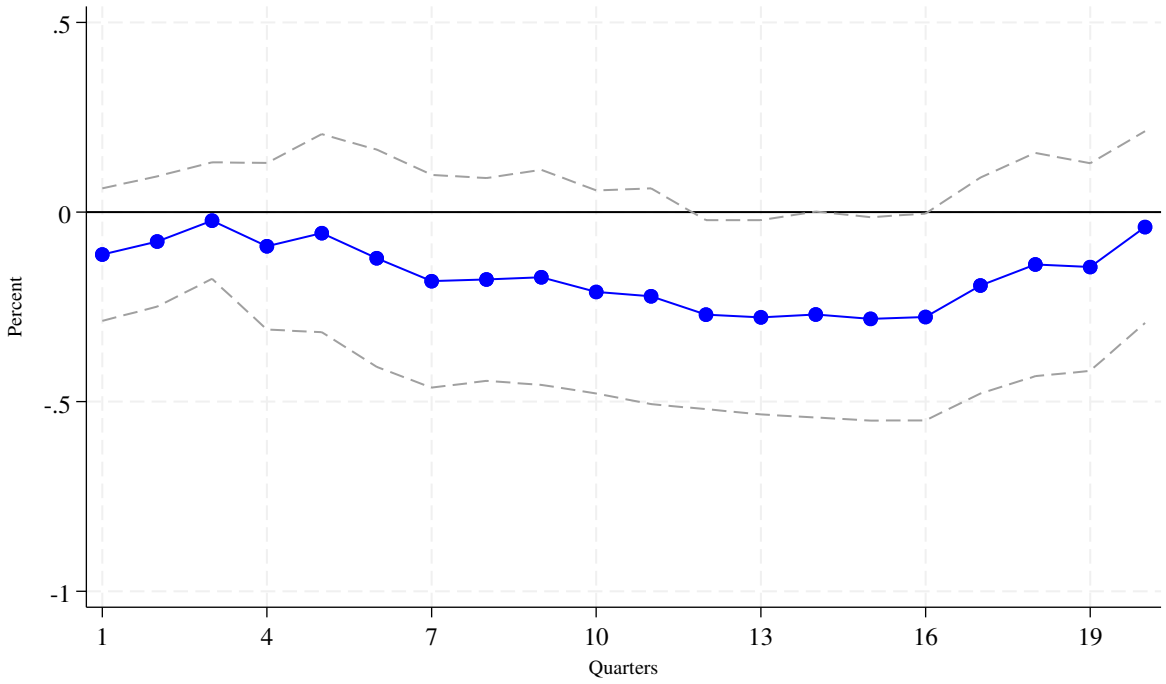

Figure 3: This graph shows the average reaction of the investment ratios to an increase of the 1-year EURIBOR rate by 25 basis points. The impulse response function (IRF) is estimated using the LP-IV method. The dashed lines represent the 90% standard error bands calculated according to the Driscoll-Kraay method.

Figure 3 depicts the average response of investment ratios to a 25 basis point increase in the 1-year EURIBOR rate, derived using the Local Projections Instrumental Variables (LP-IV) method. The impulse response function (IRF) remains consistently below zero throughout the observed 20 quarters, indicating an overall negative impact of an increase in the interest rate on investment ratios. While there is a slight recovery within the first three quarters, where the values briefly approach zero, the investment ratios subsequently worsen, reaching their lowest point at -0.25% around the 12th quarter. However, there is a gradual return closer to zero by the 20th quarter. Importantly, the estimated effects on investment decisions are not statistically significant for most periods, except for quarters 12-16. Nonetheless, the interpretive power of Local Projections Instrumental Variables (LP-IV) estimates tends to weaken over longer time horizons because the theory behind LP-IV assumes that no other structural changes or shocks influence the variables during the observation period and highlights the difficulty of isolating long-term causal effects using this approach (Li et al., 2024).

5.2. Impulse response functions (IRFs) based on the country

To gain a more comprehensive understanding of the dataset, I analyze the heterogeneity in investment ratios at the country level by grouping companies according to their country of origin. The corresponding graphs are available in the appendix under Figure A1.

In Germany, the IRF shows a significant initial uptick in investment ratios of about +0.1% after the monetary policy shock. This shifts to a drop of around -0.2% by the seventh quarter, with investment gradually returning towards the 0% level. For the companies from France, the IRF follows a very similar pattern, with investment declining to roughly -0.25% on average after a 25 basis point increase in the 1-year EURIBOR rate, with the magnitude of the reactions being marginally larger than in Germany. Moreover, most of the results for France are statistically significant throughout the observation period, underscoring the robustness of these findings and highlighting a somewhat stronger reaction compared to Germany.

Italy's investment response is also characterized by an initial significant increase in investments followed by primarily statistically significant fluctuations in the negative range, similar to Germany. Overall, the magnitude of the reactions ranges between -0.25% and +0.25%, which is similar to the results of France. In contrast, Spain shows the most pronounced fluctuations among all the countries analyzed. Initial investment ratios increase by +0.25% until quarter 3, followed by a decline to -0.25% in quarter 6, with this pattern repeating throughout the forecasting period. Toward the end, the fluctuations intensify, reaching +0.6% in quarter 19 and -0.55% in the final quarter. However, the statistical conclusiveness is limited due to the extended forecast horizon, and statistical significance is only observed from quarter 19 onward. It can, therefore, not be directly assumed that the variation in responses is solely due to changes in interest rates.

Lastly, firms based in the Netherlands demonstrate the least pronounced responses to monetary policy changes. Their investment behavior follows a pattern similar to that of Germany, where the IRF ranges from +0.1% in the beginning quarters to about -0.2% in the subsequent periods, with most of the changes being statistically significant.

The country-specific IRFs show that, overall, the investment responses to monetary policy shocks in Germany, France, Italy, Spain, and the Netherlands are broadly similar, with only minor differences in timing and magnitude. Across all countries, the responses to an interest rate hike were predominantly negative, and in all cases except Spain, these declines were statistically significant. This indicates that the observed reductions in investment can be reliably

attributed to the monetary policy shock. These slight variations across countries likely stem from differences in sectoral compositions, as different industries exhibit varying sensitivities to monetary policy changes (Dedola & Lippi, 2000). A closer look at the sectoral breakdown, as shown in Appendix Figure A2, reveals that certain sectors are particularly affected by interest rate hikes. As expected, the Real Estate sector stands out as one of the most negatively impacted due to its heavy reliance on debt financing and sensitivity to borrowing costs (Peersman & Smets, 2002). Additionally, the Communication Services sector also displays more pronounced reactions compared to other industries. These sectoral dynamics help explain the subtle fluctuations in the aggregate investment responses across countries while maintaining a consistent overall pattern of negative effects. Given this relative coherence at the country level, the focus now shifts to exploring firm-level characteristics that may explain differences in sensitivity to monetary policy shocks. This analysis aims to identify specific attributes that drive variation at the firm level, providing a more granular understanding of the factors influencing investment behavior.

5.3. Impulse response functions (IRFs) based on Age and Dividends

Having analyzed the overall impact of an increase in the 1-year EURIBOR rate on the investment ratio, I now aim to examine its effects on smaller, distinct groups within the dataset. This allows me to integrate insights from descriptive statistics, providing a better understanding of how the heterogeneity in the summary data translates into varied responses to monetary policy shocks across different firm segments. Precisely, I will segment the dataset into distinct groups: younger firms (20 years or less since their founding), older firms (more than 20 years since their founding), dividend-paying firms (those that distributed dividends in the previous year), and non-dividend-paying firms. Setting the cutoff age at 20 years ensures that sufficient data is available for younger companies, enabling robust statistical analysis. This threshold aligns with the approach used by Durante et al. (2020) and effectively captures significant differences in firm behavior, growth potential, and structural characteristics between younger and older firms.[2] The descriptive statistics provide a clear indication that younger firms, with their smaller asset bases and higher reliance on external financing, are more likely to face financial constraints during periods of monetary tightening. This observation forms the basis

[2] Additionally, according to Cloyne et al. (2023), there is no theoretical basis for favoring a particular age cutoff, as their analysis shows that the results remain consistent regardless of the chosen threshold. This has also proven to be the case in my analysis.

for the hypothesis that, given these financial frictions, younger firms that do not pay dividends are expected to adjust their investment ratios and borrowing levels more significantly in response to monetary tightening. Dividing the dataset into these subgroups will help to analyze this issue and understand which firm characteristics drive specific reactions.

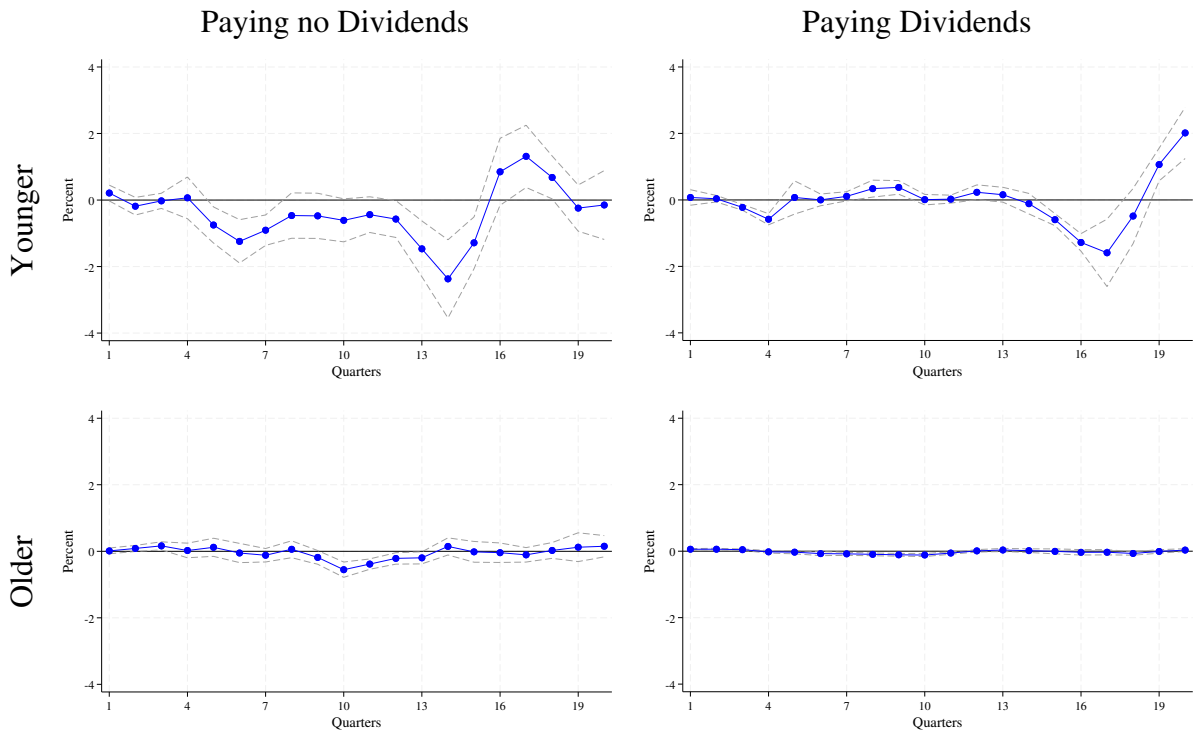

Figure 4: These graphs depict the IRFs for the investment ratio in response to a 25 basis point increase in the 1-year EURIBOR rate, differentiated by the respective groups. The dashed lines represent the 90% standard error bands which are calculated according to the Driscoll-Kraay method.

In Figure 4, it becomes evident that firms with different characteristics exhibit varying degrees of sensitivity to changes in interest rates. For older firms, the response remains minimal and close to 0% throughout the forecast horizon. In contrast, younger firms show more pronounced and statistically significant responses, particularly at the beginning of the forecast. For firms that do not pay dividends, there is a slight increase in response initially, which then statistically significantly declines to -1% by quarter 6. After that, it generally remains below 0% for most subsequent periods and drops to -2.1% by quarter 14. In contrast, for dividend-paying firms, the negative response reaches approximately -0.5% by quarter 4. This response remains near 0% for the following periods until quarter 14, when it drops significantly for three periods to around -1.8%. These results remain robust even when testing with various cutoff ages around 20 years.

Overall, this analysis's findings align with those of Cloyne et al. (2023) and demonstrate the diversity in firms' responses to monetary policy shocks. It underscores how variations in characteristics like age and dividend policy affect the magnitude and direction of these effects. The contrast is particularly evident for younger, non-dividend-paying firms, which show highly dynamic and pronounced fluctuations in response to monetary policy changes, thus confirming the hypothesis. In contrast, older, dividend-paying firms demonstrate minimal and stable investment responses throughout the observation period.

5.4. Channels of Influence

In Section 5.3, we observed that the investment rates of younger non-dividend-paying firms are more significantly affected by a 25 basis point increase in the 1-year EURIBOR rate. In this section, I explore why they respond more strongly to interest rate changes. Existing studies identified the balance sheet channel, bank lending channel, and financial accelerator mechanism as possible causes. Among these, the balance sheet channel suggests that changes in interest rates influence firms' net worth, as higher interest rates increase borrowing costs and reduce asset values, thereby increasing borrowing constraints. On the other hand, the bank lending channel focuses on the supply of credit, where higher interest rates reduce banks' willingness or ability to lend, particularly to smaller or riskier firms. The financial accelerator mechanism combines these channels by emphasizing an amplification process: as monetary policy tightens, the resulting decline in firm net worth (balance sheet channel) and reduced credit supply (bank lending channel) interact to further aggravate credit constraints. This compounding effect intensifies the impact of monetary policy on firm investment. However, there may be other channels that could also influence investment reactions. To explore this further, I will conduct additional IRF analyses, focusing on various firm characteristics and examining their responses to interest rate increases. In doing so, I make use of the previously established groups. However, as noted, the two main groups of companies with the most divergent results are the younger non-dividend-paying firms and the older dividend-paying firms, which I will focus on in the upcoming section.

To assess whether the accelerator mechanism plays a significant role, I examine the growth rates of total debt alongside the growth rates of collateral value, represented by the book value of net property, plant, and equipment. In line with the former analysis, I now take these variables as dependent variables in the LP-IV model to observe how they respond to a 25 basis point

increase in the 1-year EURIBOR rate. These factors are crucial because collateral value directly influences firms' borrowing capacity, while variations in total debt reflect how financing constraints adapt to changes in monetary policy.

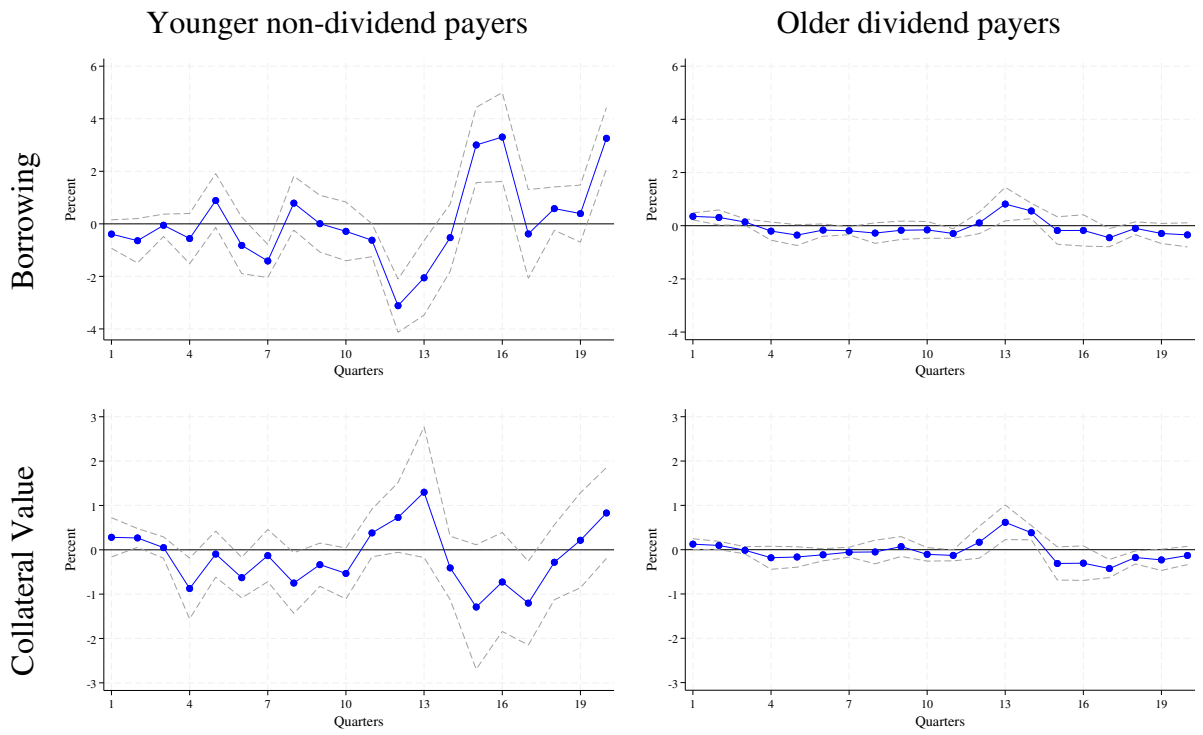

Figure 5: These graphs depict the IRFs for the total debt growth rate (top row) and the collateral value growth rate represented by the book value of the net property, plant, and equipment (bottom row) each for younger non-dividend-paying firms (left side) and older dividend-paying firms (right side) in response to a 25 basis point increase in the 1-year EURIBOR rate.

The outcomes depicted in Figure 5 highlight the differing responses of borrowing and collateral value to monetary policy tightening, as distinguished between the two identified groups. These findings are robust to alternative cutoff ages, thus demonstrating that the classification of "younger" and "older" firms does not materially change the observed trends or conclusions. For younger non-dividend-paying firms, borrowing growth shows an average decline of approximately -1.0% in the initial quarters following an increase in the interest rate by 25 basis points. This result is statistically significant in quarters 7 and 12, as well as in the following quarters. In contrast, older dividend-paying firms exhibit much smaller variations, with borrowing growth remaining close to 0% throughout the forecasting horizon, except for quarter 13, where it increases to +1%. The more pronounced reactions observed in younger non-dividend-paying firms suggest a potential vulnerability to stricter monetary conditions, likely due to their greater dependence on asset-based external financing and limited stable cash flows

(Lian & Ma, 2021). The presence of statistically significant periods clearly demonstrates the direct impact of interest rate changes on borrowing behavior, which provides strong evidence of a causal relationship. Even in periods without statistical significance, a meaningful trend can still be observed.

Examining the collateral values reveals a similar picture. For younger non-dividend-paying firms, collateral values depict an average decrease of about -0.5% during the first two years, after which they rise to about +1.1% in quarter 14 and correct then again to -1% in the following time. The standard errors, however, indicate that variance increases significantly in the later periods. In contrast, older dividend-paying firms exhibit minimal fluctuations in collateral values, generally ranging from +0.1% to -0.5%. This trend suggests a more stable response to monetary policy tightening of older, dividend-paying companies. Due to their robust balance sheets, diversified financing options, and reduced reliance on market-sensitive assets, such firms may depend less on collateral-based borrowing.

It is worth noting that for older dividend-paying firms, the two graphs exhibit a remarkably similar pattern. Since these established and typically more stable companies are less affected by fluctuations in interest rates, this facilitates a more nuanced interpretation of the graphs. Given that the collateral value graphs depict book values, the observed changes can also be viewed as indicative of investments in the company, which are intrinsically linked to borrowing patterns associated with these investments. Particularly during periods when both graphs are statistically significant, one can point to their dependence on each other. This is primarily the case in the first two quarters, as well as later in quarters 13 and 14, where there is a significant jump in the graphs. In contrast, younger, non-dividend-paying firms tend to exhibit greater volatility in response to interest rate changes, revealing a disconnect between their borrowing patterns and collateral values. Additionally, there are no periods where the borrowing and collateral value graphs are simultaneously statistically significant. This indicates that, unlike their older counterparts, investments in these younger firms cannot be indirectly inferred from the collateral values. The increased volatility and sensitivity to monetary policy among these firms highlight the impact of additional factors, such as external financing constraints, unpredictable cash flows, cost considerations, and broader economic uncertainties, which disrupt the relationship between borrowing and investment.

Building on the analysis of borrowing and the growth of collateral values, which reflects the financial accelerator mechanism and emphasizes the significance of asset values in determining

firms' borrowing capacity, I will now explore additional channels of influence. Specifically, I will examine changes in interest payments, the demand channel as indicated by fluctuations in sales, and the cost channel as measured by variations in EBITDA.

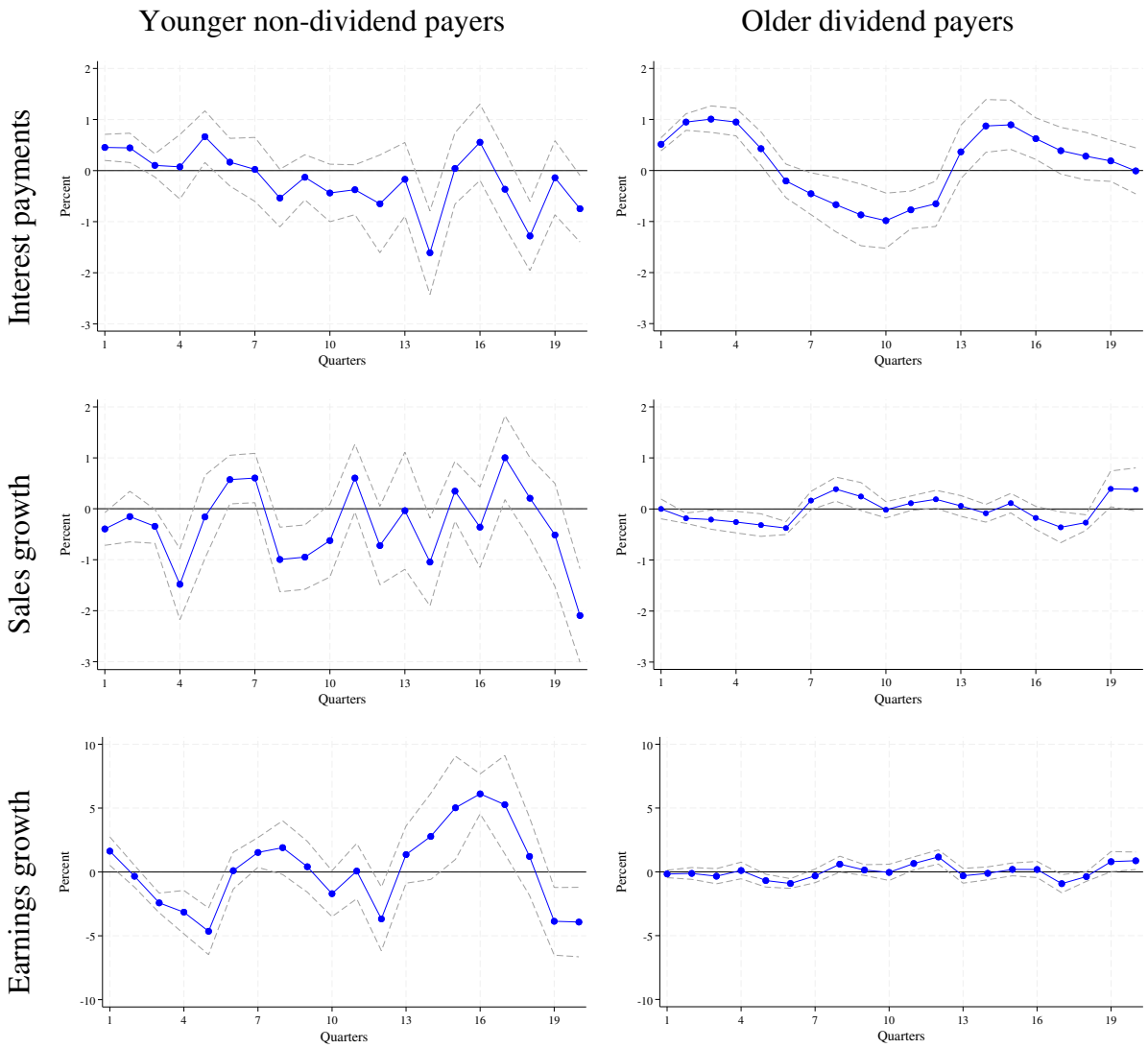

Figure 3: These graphs depict the IRFs for the log interest payments (top row), sales growth (middle row), and earnings growth (bottom row) for younger non-dividend-paying firms (left side) and older dividend-paying firms (right side) in response to a 25 basis points increase in the 1-year EURIBOR rate.

The analysis of interest payments, sales growth, and earnings growth following a 25-basis-point increase in the 1-year EURIBOR rate again reveals significant differences between the two groupings of firms, with these results remaining consistent across various cutoff ages around 20 years. However, interpreting the IRFs for interest payments is not as straightforward because interest payments are influenced by the firm's debt level and the prevailing interest rate. Thus, we must consider the reactions of borrowings and investment ratios to make conclusions.

The response of interest payments shows a clear and statistically significant increase within the first year following the monetary policy shock, peaking at around +0.5%. It is important to note that during this period, neither borrowing nor investment (as shown in Figures 4 and 5) demonstrates significant growth that could account for the rise in interest payments. This suggests that the increase in interest payments is not tied to fluctuations in debt levels or investment choices but rather reflects the direct consequences of heightened interest rates on the existing debt obligations. From the second year onward, the interest payment response becomes insignificant and then turns negative, reaching a low of approximately -1.5% by quarter 14. This pattern aligns with the significant reduction in borrowing observed during the second and third years in Figure 5, as firms adjust to tighter monetary conditions by reducing their debt levels. The declining debt stock in subsequent periods reduces the overall interest burden, which explains the negative response in interest payments. Despite the declining interest payments from the second year onward, investment continues to fall significantly during this period, which suggests that interest payments are not the primary driver of the observed investment contraction.

Older dividend-paying firms show a response that is less volatile throughout the periods. Initially, the response exhibits a slight positive reaction, peaking at approximately +1% within the first few quarters. This is followed by a gradual decline, crossing into negative territory around quarter 6 and reaching its lowest point at approximately -1% by quarter 10. The standard error bands reveal an increasing uncertainty in the later quarters as they widen over time. Similarly to the younger non-dividend-paying firms, their investments (Figure 4) and debt positions (Figure 5) grow less than the interest payments do, which suggests that the rise in interest rate payments is primarily due to the rise in the interest rate. This stability suggests that older dividend-paying firms rely less on external financing and are largely insulated from the effects of tighter monetary conditions.

A different channel that could affect the investment ratio is the demand channel. The greater the slump in demand, the less liquid funds companies have available for their investment needs. Analyzing the IRFs of sales growth after an interest rate increase reveals that younger non-dividend-paying firms experience significant volatility over the observed horizon. Within the first two years following the monetary policy shock, fluctuations range from -1.5% to +0.5%. This volatility continues into later periods, peaking at +1% before declining sharply to around -2% by the end of the forecast horizon. These patterns suggest that the demand for products from younger firms is more susceptible to interest rate changes, potentially due to less stable

market positions and weaker customer bases. When viewed alongside the investment ratio for younger firms (Figure 4), which exhibits similarly large shifts in magnitude but follows a different time profile, it becomes evident that the sales growth patterns and investment behavior are not fully aligned. While sales growth may play a role in influencing investment ratios, it does not appear to be the primary driver in this analysis.

In contrast, older dividend-paying firms exhibit remarkably stable sales growth in response to the monetary policy shock. Their response remains within a narrow range of -0.5% to +0.5% throughout the forecast horizon, indicating a consistent and predictable demand for their products. This stability suggests that older firms benefit from established market positions and diversified revenue streams, insulating them from the demand-side impacts of monetary policy changes. Similarly, the investment ratio for older firms (Figure 4) shows minimal variation, remaining nearly flat across the entire horizon. However, sales growth and investment movements do not align temporally, which does not support the idea that the demand channel is a primary factor driving investment changes, proposing that other mechanisms, such as operational cost-side factors, may play a more dominant role in influencing investment behavior.

To test this, I also compute the LP-IV for earnings growth, which is measured by EBITDA changes. This variable is critical for younger companies because growing earnings can enhance their borrowing capacity, provide internal funding for investment, and signal financial health to potential investors. For these firms, a decrease in earnings could significantly constrain their ability to secure financing and invest in growth, making earnings growth a key factor in understanding their sensitivity to monetary policy shocks.

The earnings growth of younger non-dividend-paying firms demonstrates notable fluctuations in response to the monetary policy shock, overall ranging between -5% and +5%. Earnings decline sharply in the first year, followed by a strong recovery to +2% in the second year. This pattern repeats itself until the end of the forecasting period. This instability highlights how sensitive these firms are to monetary tightening. The comparison of earnings with the borrowing and investment responses reveals a clear connection. Borrowing declines during the first year, aligning with the drop in earnings, and begins to recover as earnings growth improves. While slower to respond, investment ratios also follow a similar trajectory, declining until quarter 6 before gradually rebounding. These overlapping trends indicate that earnings growth influences the companies' borrowing capacity, ultimately affecting their investment opportunities.

Contrary to Cloyne et al. (2023), who do not consider earnings-based borrowing constraints as a primary channel by which monetary policy impacts younger firms, this seems to be true for the European market.

In contrast, older dividend-paying firms show much greater stability. Their earnings fluctuate only slightly, staying within -0.5% to +0.5%, while borrowing and investment remain nearly flat throughout the period. This consistency underscores their financial resilience, facilitating easier access to external financing, which in turn enables them to better navigate the uncertainties that arise from monetary policy.

6. Conclusion

This study examines the impacts of monetary policy shocks on firm-level investment decisions in five major European economies — Germany, France, Italy, Spain, and the Netherlands — over the period from 2002 to 2023. By leveraging the LP-IV methodology and a comprehensive dataset of publicly listed firms, the analysis sheds light on how firm characteristics such as age and dividend payment status influence their sensitivity to changes in monetary conditions.

One of the key takeaways from my analysis is the substantial heterogeneity in how firms respond to monetary tightening. Younger, non-dividend-paying firms exhibit the most pronounced and volatile adjustments to interest rate increases, particularly in their investment ratios. This heightened sensitivity reflects their reliance on external financing, limited collateral, and less stable earnings, which aggravate their exposure to financial frictions. In contrast, older, dividend-paying firms demonstrate minimal adjustments, supported by their larger asset bases, stable cash flows, and diversified financing options. These findings align with existing theories, such as the financial accelerator mechanism and the credit view, which highlight the amplifying effects of financial constraints during periods of monetary tightening.

My analysis also identifies the cost channel as the primary driver of investment heterogeneity. Changes in borrowing and earnings, closely linked to interest rate adjustments, significantly influence firms' investment behaviors. Younger firms, with their limited ability to absorb higher costs, face substantial declines in both borrowing capacity and investment levels. This is further compounded by their dependence on collateral values, which deteriorate under tighter monetary conditions. On the other hand, older firms with more robust financial structures maintain relatively stable investment levels despite changes in borrowing costs, underscoring their

resilience to monetary shocks. Thus, it should be a priority for younger companies to strengthen their profitability by developing stable cost structures. This would enable them to rely more on internal funding or use their improved financial position to get external capital on more favorable terms if they are able to achieve more earnings consistency.

While the demand channel plays a secondary role, its impact is more pronounced for younger firms, whose sales growth exhibits significant volatility following monetary policy shocks. However, the lack of temporal alignment between sales and investment changes suggests that demand-side factors are not the primary drivers of investment adjustments. Instead, the interplay between cost pressures and financial constraints emerges as the dominant mechanism affecting firm investment decisions.

This study contributes to the existing literature by providing firm-level evidence on how monetary policy shocks affect investment decisions differently across firms with varying characteristics. It extends frameworks like the financial accelerator and credit view by demonstrating how younger, non-dividend-paying firms are disproportionately impacted due to external financing constraints and limited collateral. By emphasizing the role of cost pressures and financial frictions in driving these differences, it offers a better understanding of monetary policy transmission mechanisms.

From a policy perspective, these findings highlight the importance of considering firm heterogeneity when designing monetary interventions. Policies that disproportionately impact borrowing costs or collateral values are likely to intensify investment disparities across firms, particularly disadvantaging younger, non-dividend-paying entities. Addressing these disparities may require targeted measures, such as improving access to stable financing for younger firms or implementing countercyclical credit policies that mitigate the adverse effects of monetary tightening on financially constrained entities. Such measures would help maintain investment levels of younger companies, fostering their innovation and long-term economic growth, even in more challenging monetary environments.

Appendix

Summary statistics

Summary statistics

		Younger No div	Younger Div	Older No Div	Older Div	Total
Investment Ratio	Average	15,98	10,61	9,11	6,64	9,34
	Median	6,73	5,00	4,00	4,41	4,55
	St. Dev	(27,33)	(19,49)	(18,92)	(10,11)	(17,94)
Log Total Assets	Average	1,72	2,52	2,30	3,04	2,46
	Median	1,62	2,29	2,20	2,97	2,35
	St. Dev	0,78	0,99	0,91	0,91	1,03
Leverage Ratio	Average	22,60	23,22	26,59	24,16	24,53
	Median	17,38	20,35	24,87	23,29	22,57
	St. Dev	(21,73)	(18,94)	(19,35)	(15,79)	(18,75)
Tobin's Q	Average	1,69	1,50	1,36	1,44	1,45
	Median	1,38	1,25	1,15	1,21	1,20
	St. Dev	(0,94)	(0,81)	(0,73)	(0,75)	(0,78)
Liquidity Ratio	Average	23,84	16,80	13,96	12,39	15,48
	Median	15,68	11,64	9,44	9,35	10,16
	St. Dev	(22,49)	(16,32)	(13,97)	(10,72)	(15,84)
Total Debt Growth	Average	5,02	5,57	2,80	3,89	3,85
	Median	0,00	0,00	0,00	0,00	0,00
	St. Dev	(41,39)	(37,27)	(33,78)	(32,20)	(35,44)
Net PPE Growth	Average	3,37	3,14	1,67	2,39	2,39
	Median	0,00	0,00	0,00	0,00	0,00
	St. Dev	(21,50)	(17,08)	(16,79)	(13,00)	(16,52)
Log Interest Payments	Average	-0,93	-0,23	-0,30	0,27	-0,22
	Median	-0,99	-0,31	-0,33	0,24	-0,28
	St. Dev	(1,03)	(1,23)	(1,09)	(1,12)	(0,88)
Revenue Growth	Average	6,83	4,64	4,11	2,75	4,10
	Median	0,00	0,00	0,00	0,00	0,00
	St. Dev	(35,46)	(28,71)	(29,10)	(20,58)	(27,76)
EBITDA Growth	Average	-5,22	-1,02	-7,55	0,45	-3,65
	Median	0,00	0,00	0,00	0,00	0,00
	St. Dev	(52,10)	(48,66)	(55,81)	(43,39)	(50,30)

Table A1: This table presents the average, the median, and the standard deviation values for each variable, categorized by age and dividend status. As defined in the text, "young" refers to companies that have been in operation for 20 years or less. All ratios and growth rates are expressed as percentages. Parentheses are used to indicate the standard deviations.

Investment ratio IRF based on the country

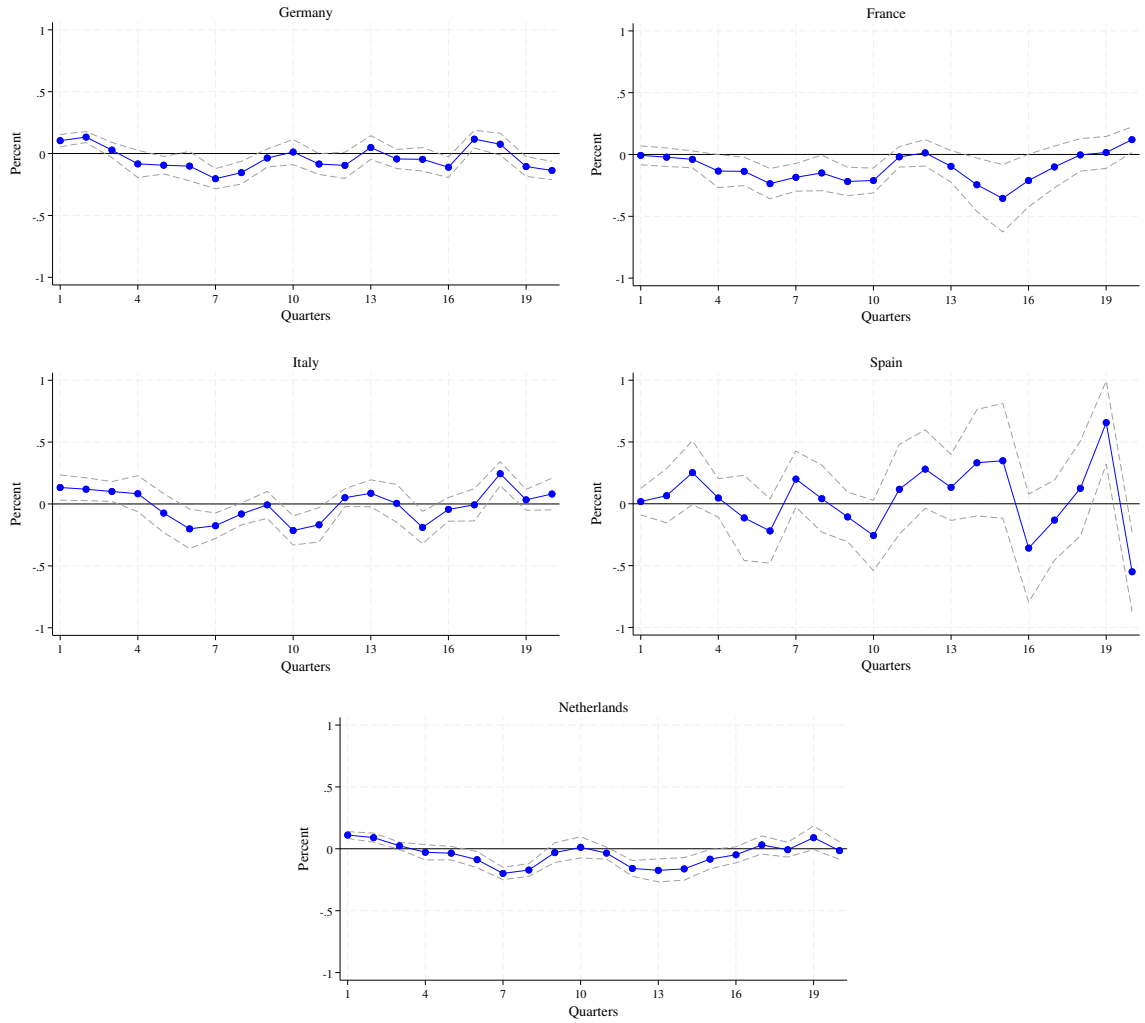

Figure A1: These graphs show the average reaction of the investment ratios to an increase of the 1-year EURIBOR rate by 25 basis points of companies from the ***respective countries****. The dashed lines represent the 90% standard error bands, which are calculated according to the Driscoll-Kraay method.*

Investment ratio IRF based on the sector

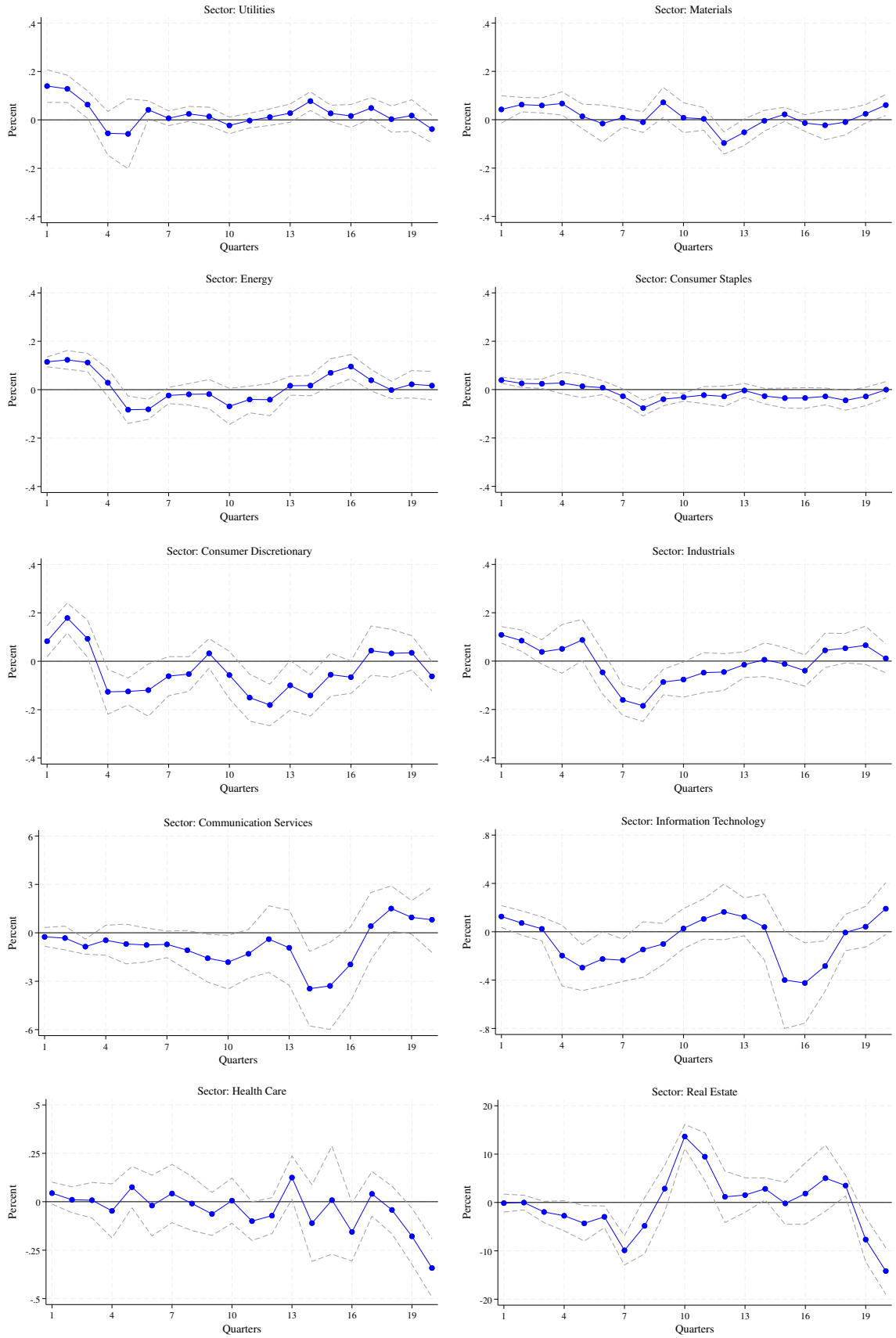

Figure A2: These graphs show the average reaction of the investment ratios to an increase of the 1-year EURIBOR rate by 25 basis points of companies operating in the ***respective sector****. The dashed lines represent the 90% standard error bands, which are calculated according to the Driscoll-Kraay method.*

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