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Abstract

Does increasing inflation affect firms' investment decisions? This article employs the European Investment Bank Investment Survey (EIBIS) dataset to explore the association between the increased inflation that the EU countries have experienced since 2021, and firms' investment decisions. We find evidence that very high rates of inflation (over 20%) are associated with higher probabilities of investment, likely driven by measures to improve energy efficiency (particularly for SMEs) and a desire to avoid the devaluation of cash reserves (for large firms). We further find a positive association between SMEs' ability to pass costs onto consumers (the so-called pass-through rate) and investment decision, suggesting a higher degree of reliance on the generation of continuous revenues for investment purposes compared with large firms. Inflation's by-products (increased interest rates, difficulties in accessing external financing, increasing uncertainty) are found to be important negative factors in investment decisions. (146 words)

Keywords: EIBIS, inflation, investment, cost pass-through rate, financial tightening, SMEs.

JEL classification: D22, D25, E31, E43.

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1. Introduction

In order to grow, firms need to invest in those areas they believe will provide the greatest payoffs, be it in land, equipment, training, intellectual property, digital technologies, or green practices to highlight a few examples. However, investment is riskier when the economic environment becomes uncertain (Dejuan-Bitria & Ghirelli, 2021; Kellogg, 2014; Larch et al., 2022). The supply shocks that followed the COVID-19 lockdowns, the spiralling energy prices, exacerbated by the Russian war of aggression against Ukraine, and the rising interest rates taken as a policy measure to counter inflation, have all deteriorated the investment environment (Delanote et al., 2022; EIB, 2023; Kolev & Randall, 2023; PPMI et al., 2023).

The goal of this article is to analyse the association between inflation, which began to soar in 2021, and firms' investment decisions, especially in the case of small and medium sized enterprises (SMEs). Increases in the price of energy and of raw materials raise operational costs, thus squeezing profit margins and reducing liquid assets. At the same time, however, some 80% of EU firms were profitable in 2023 thanks to the public support they received during the pandemic, and the ensuing rapid recovery in demand, which allowed firms to build up the necessary financial reserves for investment (EIB, 2024).

Furthermore, while firms with a large reserve of internal funding or easy access to external financing may navigate this environment relatively unscathed (Cleary, 1999; Cleary et al., 2007), this is not the case for liquidity-poor firms that cannot rely on external financing either because of structural issues (like being small, young and innovative with a high share of intangible assets) or which are strongly affected by the tightening financing conditions (due to, for instance, a large accumulated leverage or an unaffordable cost of financing compared with the lower profit margins). As inflation rises, central banks increase interest rates to lower the money supply in the economy, making this way borrowing money for businesses more costly or unattainable. This, in turn, may have important repercussions on the overall growth prospects.[1]

We further explore the extent to which inflation affects investment decisions, conditional on the ability of producers to pass costs onto consumers (the so-called 'cost pass-through rate') to maintain profit margins. Past (Peltzman, 2000) and recent works (Duprez & Magerman, 2021; Joussier et al., 2023; Loy et al., 2016) have shown that positive cost shocks induce more pass through than negative shocks (i.e. prices rise faster than they fall), but also that firms are not likely able to fully pass costs onto consumers. These findings suggest that producers may be as badly impacted by price shocks as the consumers – or even more. Indeed, recent Eurostat data shows that consumer price inflation throughout 2022 was mostly driven by energy price increases, which grew by over 40% between June 2021 and June 2022 (Eurostat, 2023b). Businesses were hit even harder, with annual producer price inflation for energy increasing by 98% in the same period across the EU-27 (Eurostat, 2023c). This paper goes a step further to understand not only how producer inflation has impacted firms' investment decisions, but also how inflation can affect investment depending on firms' desire and ability to pass the increased costs onto the final price. Thanks to the wealth of data included in the EIB's Investment Survey, we are able to inspect the mechanics of this relationship and analyse not only how the uncertain economic

[1] SMEs are structurally more financially constrained and might be more affected by the tightening conditions. They also represent an important share of the economy, making up 99.8% of EU businesses, and accounting for over half of the total value added to the EU economy (DG GROW, 2023).

environment pushed investment down, but also how addressing the source of the cost push – namely through energy efficiency measures – can improve the likelihood of firms continuing to invest.

The empirical findings indicate that, for the analysed period, inflation at very high levels (with yearly rates of change over 20%) is associated with a higher probability of undertaking more investment in the same financial year. This result is likely explained by the particularity of the recent inflation spike, which has been strongly driven by increases in energy costs and other inputs (e.g. raw materials) that have pushed firms to invest in energy efficiency as a cost-saving greening strategy. Nevertheless, the by-products of inflation, such as increased interest rates, difficulties in accessing external financing, and an overall increase of uncertainty are found to have a significant negative effect on firms' investment decision. We further find evidence that inflation may affect investment decisions depending on firms' ability to pass costs onto consumers (the so-called pass-through rate), and that this strategy is more important for SMEs compared with larger firms.

The paper unfolds as follows. In section 2 we discuss the related literature on which we build our argument. In Section 3, we present the data and propose an original operationalisation of producer inflation at the NACE 2-digit level for each country and time period to calculate the pass-through rates. Section 4 presents the methodology and the results of the multivariate regression analyses, whereas Section 5 concludes and discusses some policy implications.

2. Literature review

Since 2020, the European economy has experienced a series of shocks that have undermined the investment environment. First, the COVID-19 lockdowns halted production and reduced firms' sales, thereby squeezing profit margins and putting off investment decisions (Harasztosi et al., 2022). Then, the steep energy and input price hikes in 2021 began to change firms' market strategies due to the increased operational costs, spurring national governments and the European Commission to adopt a series of policies to keep the economy afloat (SME Envoys, 2022b). The Russian war of aggression against Ukraine in February 2022 exacerbated the previous two crises by disrupting trade routes – which led to scarcity in raw materials, supply chain bottlenecks, and higher food, commodity and energy prices (Brasili & Harasztosi, 2023; EIB, 2022; SME Envoys, 2022a).

Higher inflation affects both the internal and external sources of financing necessary for investment. Internally, unless firms manage to adjust prices immediately,2 inflation will increase the labour and production costs relative to their revenues. This, in turn, squeezes profit margins, reducing the amount of available liquid assets that could be used for investment purposes. However, the literature is rather inconclusive with regards to the association between inflation, profitability, and investment. Some past studies showed a negative association between the two because inflation constrains firms' liquidity by lowering their accounting profits (Hochman & Palmon, 1983; Madsen, 2003). Inflation was also found to have a non-linear effect in Jordan, whereby investment can be sustained only with yearly inflation rates up to 10% (Asab & Al-Tarawneh, 2018). Yet, according to the EIB's 2023-2024 Investment Report, despite the major increase in production costs and monetary tightening, firms have on average remained profitable, which encouraged them to invest. Indeed, the nature of the energy crisis and the political-economic context made it easier for firms to justify price increases in energy and food. Moreover, consumer demand remained strong thanks to the aggressive fiscal policies that followed the COVID-19 pandemic (EIB, 2024).

Inflation does not affect companies operating in different economic sectors to the same extent (PPMI et al., 2023). For instance, firms in energy-intensive sectors and in those countries where inflation was relatively high (Central and Eastern Europe) may still struggle to regain their competitiveness two years on (EIB, 2024). In agri-food, some research showed producers, wholesalers and retailers all passing costs onto consumers (EIU, 2023). 3 However, according to other studies, only big packaged-food players have been able to use their brand power and large distribution scale to pass on price increases to consumers, while the downstream segment is facing continued challenges as stubborn inflation and low consumer confidence reduce their ability to continue raising prices to boost profit growth (Allianz, 2023a). Finally, in construction, EU firms benefitted from the higher demand for housing renovations following the pandemic (e.g. thanks to governments' tax credits to finance energy-efficient buildings),4 though firms also suffered from the supply chain bottlenecks and increased input prices at least until early 2023 (Allianz, 2023c; Arce et al., 2023).

[2] Firms usually are not able to adjust prices immediately, since this would lead to firms losing market shares as consumers flock to cheaper alternatives. Moreover, the literature on price updating shows that firms are often unable to fully pass costs onto consumers.

[3] An example from Australia shows that the two major food retailing chains, Coles and Woolworths, saw increased profits of 17% and 14%, respectively, see: https://www.abc.net.au/news/2023-02-23/supermarket-profits-surge-as-inflation-spikes-coles-woolworths/102004616.

[4] An example is Italy's 110% superbonus scheme, with the government reimbursing 110% of the costs incurred for green house renovations, see https://single-market-economy.ec.europa.eu/system/files/2021-11/ECSO_CFS_Italy_2021.pdf.

Likewise, research in the US focusing on some manufacturing and services industries found that companies in higher inflation industries have profits that are falling less quickly, but also that decreases in profits are often followed by increases in profits, pointing to a non-linear relationship between the two (Andler & Kovner, 2022; see also PPMI et al., 2023 for a similar situation in Europe).

Going more in detail, the channel that affects firms' internal funding capacity and its investment decision is related to their ability to pass costs onto consumers. This is called the cost pass-through rate, and captures the effect of a change in input costs (prices) on firms' output prices (Bittmann et al., 2020; Duprez & Magerman, 2021; Walters et al., 2014). The cost pass-through is said to be complete (or absolute) when a given absolute change in cost causes a given absolute change in prices, whereas it is incomplete when firms absorb part of the costs and the increase in the output price does not reflect the increase in the input price (Walters et al., 2014). A third type of pass-through occurs when the increases in the output prices are *higher* than the shocks in the input prices. In this last case, firms become most likely to keep and even increase the profit margins and therefore the internal resources can be re-invested to grow.

The extent of the cost pass-through normally provides insights in the division of producer and consumer surplus, and are strongly related to market competition (Bittmann et al., 2020). Cost pass-through rates can also help understand the degree of common cost change – in particular the surge in energy prices and import costs due to the trade disruptions (Joussier et al., 2023; Walters et al., 2014). Depending on the price elasticity for demand and marginal costs, as well as the intensity of competition for each industry, firms may need to engage in more conservative price adjustments than what would be required to keep up with increased input prices, resulting in incomplete pass-throughs. Despite the increases in input costs, firms may be unable to increase their output prices by as much, for fear of losing customers and market shares, or because they are locked in fixed-price contracts. As such, firms are forced to absorb part of the cost increases, losing out on profits, therefore reducing their ability to undertake further investment through internal funding.

When it comes to external sources of funding for investment, inflation can also have adverse consequences. Central banks increase interest rates to fight inflation by lowering the money supply in the economy. However, by making the cost of borrowing higher, these financial costs affect firms' profitability and accessibility of external funding. External financing has indeed become harder to access, especially among SMEs (Andersson et al., 2023; EIB, 2024; PPMI et al., 2023). Bank lending surveys indicate a tightening in credit standards across European countries, with countries in Southern, Eastern and South-Eastern Europe especially expected to continue credit tightening (EIB, 2023a). Nevertheless, investment has so far outperformed historical trends, thanks to the resilient economic activity and the sharp increase in firms' profits in some areas (EIB, 2024). As such, we suspect that the tightening of external financing is likely to only have adverse consequences on investment, while other sources of financing such as high cash buffers from policy support, higher profitability thanks to the fast post-crisis recovery and successful cost pass-throughs represent the main channels through which investment can be kept positive.

The above review of the literature and recent empirical evidence therefore suggest an unclear relationship between inflation and investment decisions. In this paper, we test this relationship by exploring the mechanisms through which inflation may alter firms' behaviour. In particular we hypothesise that the effects of inflation are manifested through the ability of firms to pass higher costs onto customers. To this end, we employ an original operationalisation for both inflation and pass-through rates, detailed in the next section. We especially explore the impact of energy costs and the decisions by firms to undertake investment measures for energy efficiency purposes. We further take into account and test for indirect effects of inflation, such as the presence of cash reserves to navigate

liquidity issues, tightening financing conditions due to higher interest rates, and the overall uncertainty of the economic environment.

In the next sections we first present our main data source, the 7th wave of the EIB investment survey (EIBIS 2022), as well as our original operationalisation of inflation and cost pass-through rates. We then describe our estimation strategy and present the results. The findings are further reinforced from additional evidence from the 8th wave of the survey (EIBIS 2023).

3. Data and trends

3.1. The EIBIS dataset

Since 2016 the EIB has conducted a yearly survey of senior managers or financial directors with responsibility for investment decisions and investments finance for firms with at least five employees in the non-financial sector (Brasili & Harasztosi, 2023). The resulting database, EIBIS, contains firm-level information on investment decisions, financing conditions, characteristics (e.g. size, age, sector of activity), as well as a host of other variables related to performance, innovativeness and strategies related to climate change, digitalisation and trade disruption. Moreover, since the sampling frame for EIBIS is based on Moody's Orbis dataset,[5] it contains anonymised information on the firms' balance sheets. EIBIS covers the 27 Member States, and is representative of four broad economic sectors, each associated with one or more NACE codes. Manufacturing covers NACE C, construction NACE F, services NACE G-I, and infrastructure NACE D-E, H and J (for information on the data sampling, see Brutscher et al., 2020).

For our purposes, EIBIS contains a survey question regarding expectations on total investment for the current financial year, transformed into a dummy variable, which takes a value of 1 if the respondent expects a positive change in the amount of total investment in the current year, and 0 otherwise. Trends and breakdowns for this variable are presented in the Appendix (Figures A.1-A.2). A summary of the descriptive statistics of variables employed in our analysis is also presented in Table A.1.

3.2. Operationalisation of inflation

The main determinant of interest for our analyses is the annual change in inflation at the NACE 2-digit level. The inflation variable was compiled using data from Eurostat. Several price indices were used to operationalise inflation depending on the economic sector of activity. For instance, for manufacturing (NACE C) and part of the infrastructure sector (NACE D, E) we employed producer price indices (PPI). For the remainder of the infrastructure sector (NACE H, J) we relied on service producer price indices (SPPI). Construction producer prices (CPPI) were assigned to NACE F. Finally, in the services sector (NACE G, I) we employed labour cost indices (LCI) due to the lack of SPPI data (see Table 1). This choice was also dictated by the importance of wages to the services sector compared with the others. Wages count for a larger share of production costs in services than in industry, meaning that service prices follow the gradual increase in wages more closely (EIB, 2024). Labour costs in the services sector have also increased much faster compared with the other sectors during 2021-2022, due to the tightening of the labour market in the post-COVID-19 recovery (Figure A.3 in the Appendix; for a case study in Germany see Brunow et al., 2022). Furthermore, it is important to note that, while labour costs represent input costs, producer prices are output prices. We acknowledge these limitations of comparability between the services sector and the other three. Nonetheless, this choice does not seem to impinge on the final results. In none of the models we ran for the analyses (see next section) does the exclusion of the services sector alter the results, suggesting a relatively minor importance of investment to this sector, compared with the other three.[6]

[5] See https://www.bvdinfo.com/en-gb/our-products/data/international/orbis.

[6] These additional analyses excluding the services sector are available upon request.

TABLE 1. INFLATION INDICATORS BY NACE CODE AND SECTOR OF ECONOMIC ACTIVITY

SECTOR	NACE 2-DIGIT CODES	INFLATION INDICATORS	DATA SOURCE
Manufacturing	C10-C33	PPI	Eurostat STS_INPP_Q
Construction	F41-F43	CPPI	Eurostat STS_COPI_Q
Services	G45-G47, I55-I56	LCI	Eurostat LC_LCI_R2_Q
Infrastructure	D35, E36, H49-H53, J58-J63	PPI (D, E) and SPPI (H, J)	Eurostat STS_INPP_Q, Eurostat STS_SEPP_Q

Source: authors' elaboration.

Inflation data were collected at the quarterly level and then lagged by two quarters to be more in line with the sampling period of EIBIS, which takes place halfway through the year. These quarterly data were then averaged at the annual level to match with the time frequency of the EIBIS dataset.[7] To calculate the average inflation by sector, we also employed sector-weighted means using the value added at factor costs that each individual 2-dight NACE code apported to the sector as a whole.[8]

Inflation trends for each sector are shown in Figure 1 below. For the sake of comparison, we included both sector-weighted and unweighted inflation trends.[9] The figure shows that all sectors experienced a sharp increase in inflation at the beginning of 2021, although the increase in the services sector was slightly delayed.[10] However, the extent of this increase varies strongly between sectors – from less than 10% in the services sector to almost 30% in infrastructure. Moreover, while weighted and unweighted values are mostly similar over time, the sharp increase in energy prices affected the infrastructure sector the most, where NACE D35 (Electricity, gas, steam and air conditioning supply) represents a significant proportion of the sector's total value added compared with other economic activities involving water supply and treatment (NACE E), transportation (NACE H), and information and communication (NACE J). Here, the difference between weighted and unweighted values is almost 10 percentage points at its peak in mid-2022. However, it is important to note that the high inflation values (both weighted and unweighted) in the infrastructure sector, while certainly driven by the abnormal energy prices, are also affected by missing values in NACE J. Finally, inflation in all sectors started to decline from Q2 of 2022, though the effect is once again delayed in the services sector.

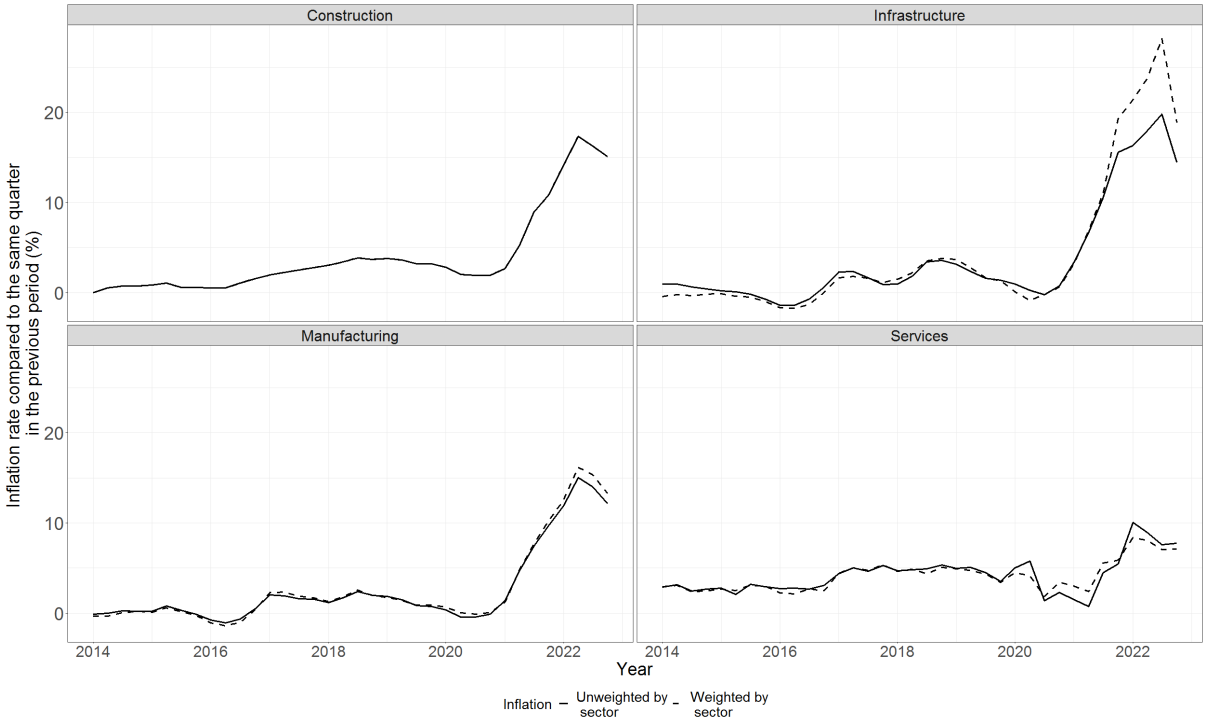
[7] Hence, for instance, for 2021 inflation is based on the values from Q3 and Q4 from 2020 and Q1 and Q2 from 2021.

[8] The value added at factor cost is the gross income from operating activities after adjusting for operating subsidies and indirect taxes, see: https://ec.europa.eu/eurostat/databrowser/view/SBS_NA_SCA_R2__custom_6936431/default/table?lang=en. Unfortunately, the data are limited to 2020. For 2021 and 2022, we used the 2019 values, as a year unaffected by crisis.

[9] Since the construction sector only has one NACE code associated to it (F), weighted and unweighted values are the same.

[10] This is likely due to using LCI instead of PPI/SPPI, whose effect is slightly delayed, since wages tend to be sticky.

FIGURE 1. WEIGHTED AND UNWEIGHTED TRENDS IN INFLATION RATE COMPARED WITH THE SAME QUARTER IN THE PREVIOUS YEAR (%), BY SECTOR, Q1 2014-Q4 2022



Source: Authors' elaboration based on Eurostat data.

Note: producer prices for construction, infrastructure and manufacturing are not directly comparable with labour cost indices employed for services. A comparison of labour costs across all sectors is available in Figure A.3 in the Appendix.

3.3. Operationalisation of the cost pass-through rate

The cost pass-through rate (PTR) captures how increases in input costs are reflected in increases in output prices, and therefore how much of this increase is passed onto consumers. We operationalise this by considering how much of the increase in producer prices (estimated using the PPI, SPPI, CPPI, and LCI) is reflected in the consumer price index (HICP) for each manufactured good or service. It is calculated as:

$$PTR_{ij,t} = \frac{Consumer\ price\ index\ _{ij,t}}{Producer\ price\ index_{ij,t-2}}$$

Where the subscript *i* refers to a given country, *j* represents a NACE sector for a given good or service, and *t* is the time period to which the price index refers. Please note that the producer price is lagged by two quarters to allow firms to enact their price updating strategies.[11]

The cost pass-through rate from producers onto consumers is calculated for a restricted range of sub-sectors and products, presented in Table 2. Each sector refers to a NACE code in which a given good or service is manufactured or provided, while each corresponding product represents the COICOP (Classification of Individual Consumption by Purpose) to which HICP are associated.

[11] As for inflation, producer price indices were collected at the quarterly level to create a lagged variable, and then aggregated at the annual level. HICP is only available at the monthly level, so it was first aggregated quarterly to match PPI, SPPI, CPI, and LCI, and then annually to be merged with the EIBIS dataset.

There is not always a 1-to-1 correspondence between NACE codes for which producer prices are available and goods and services measured in the HICP, which is why some NACE codes could not be included. For instance, NACE C16 (manufacture of wood products) does not have a univocal classification for consumer products, which can span different ranges of products, from furniture (COICOP CP05111) to household utensils (CP054) to sports and recreational goods (CP0932). In other cases, manufacturing products are not sold directly to consumers, but are instead more commonly part of business-to-business transactions (e.g. basic metal and fabricated metal products in NACE C24/C25 are sold to other businesses for them to be transformed into machinery to be sold again either to other businesses or to end-consumers).

NACE codes included in this analysis present the closest alignment between the NACE code and the consumer goods/services category in the HICP. For instance, NACE C14 (manufacture of wearing apparel) is matched with COICOP CP031 (clothing), which excludes footwear (CP032), since the latter is included in NACE C15 (manufacture of leather and related products). Likewise, NACE C17 (manufacture of paper and paper products) is matched with COICOP CP09541 (paper products), thus excluding other stationery, newspapers and book products. The only exception is D35 (electricity, gas, steam and air conditioning supply), which we matched with the COICOP aggregate ELC_GAS (electricity, gas, solid fuels and heat energy), despite D35 not covering solid fuels and heat. However, this matching was retained in light of both the importance of energy price increases in the period under consideration, and of the impossibility of using disaggregated energy HICP without having to calculate consumption weights for each energy source.

There is a further reason behind such a restricted selection of NACE codes, which focuses mostly on manufacturing. Since the producer prices used here are output prices rather than input costs, the PTRs expressed here represent signals of the price adjustment strategies from producer firms, rather than firms that consume these goods and services – and manufacturing firms are most likely to be producers. As such, higher PTRs may be suggestive of more liberal price adjustment strategies, perhaps because of reduced competition in the sector, whereas lower PTRs may be especially indicative of producer firms being locked in fixed-price contracts.

Table 2 also shows the difference between PTR in 2022 and the long-term average. The results suggest that, while in the food industry there was an increased ability to pass costs onto consumers in 2022 compared with the previous years, this was less the case in other manufacturing industries (e.g. paper and computer and electronics), and especially energy.

TABLE 2. CORRESPONDENCE TABLE FOR PRODUCTS AND SERVICES BETWEEN NACE AND COICOP CATEGORIES

PPI/SPPI CODE	NACE DESCRIPTION	COICOP CODE	COICOP DESCRIPTION	AVERAGE PTR (2015-2022)	DIFFERENCE 2022 PTR AND LONG-TERM AVERAGE PTR
C10	Manufacture of food products	CP011	Food	1.028	0.043
C11	Manufacture of beverages	CP012 + CP021	Non-alcoholic beverages + Alcoholic beverages	1.012	0.045
C12	Manufacture of tobacco products	CP022	Tobacco	1.078	0.075

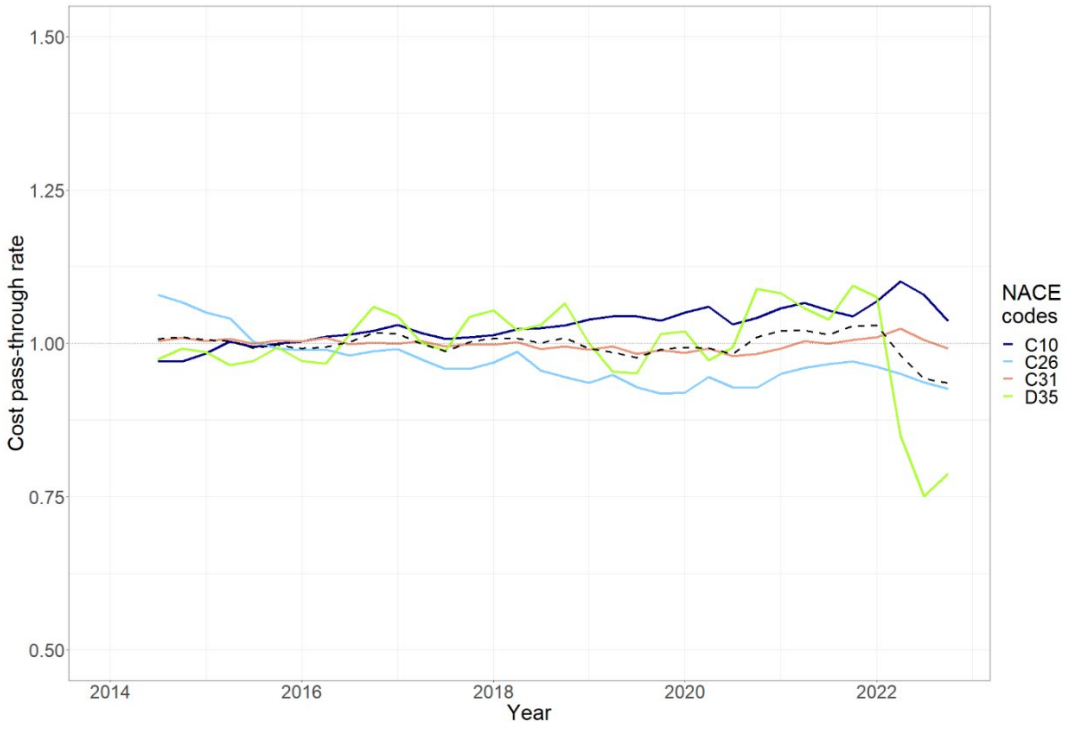
C14	Manufacture of wearing apparel	CP031	Clothing	0.995	0.004
C17	Manufacture of paper and paper products	CP09541	Paper products	0.990	-0.016
C26	Manufacture of computer, electronic and optical products	CP091	Audio-visual, photographic and information processing equipment	0.970	-0.027
C31	Manufacture of furniture	CP0511	Furniture and furnishing	0.998	0.010
D35	Electricity, gas, steam and air conditioning supply	ELC_GAS	Electricity, gas, solid fuels and heat energy	0.996	-0.130

Source: Authors' elaboration.

Note: CP012 and CP021 are averaged.

A graph plotting the trend of PTR for some selected NACE codes in the EU-27 is presented in Figure 2 below. As a reminder, a PTR of 1 entails a full cost pass-through; below 1, the PTR is incomplete, and firms absorb part of the cost shocks; above 1, firms can achieve a profit by adjusting price mark-ups upwards. Producer prices are also lagged by two quarters compared with consumer prices, to allow time for price adjustment strategies to take effect.

FIGURE 2. PTR FOR SELECTED NACE CODES IN THE EU-27, 2015-2022



Source: Authors' elaboration from Eurostat data.

Note: the dashed line is an average of the four NACE codes. Several countries do not have values for these NACE codes. As a result, Eurostat averages information from 21 Member States, excluding Cyprus, Estonia, Latvia, Luxembourg, Malta and Slovakia.

Figure 2 highlights a strong heterogeneity in PTR trends across NACE sectors. For instance, the PTR for food products (C10) has seen a consistent increase over time, with a distinct boost in early 2022 suggesting that firms are profiting from higher food prices despite decreases in global commodity prices (EIU, 2023). This is confirmed by recent studies, which suggest that between 10 and 20 percent of food inflation in Europe can be attributed to the increased profits among firms in this industry (Allianz, 2023b; EIU, 2023; Eurostat, 2023a). The high PTR can be explained by country-specific characteristics, but it is mainly driven by the relatively inelastic demand for food (which is a necessity), which offers food retailers more margins to adjust prices (Walters et al., 2014). On the contrary, the PTR for audio-visual and information-processing equipment (C26) has consistently been below 1, and presents a downwards trend, in line with the idea that advances in digitalisation make equipment cheaper (Charbonneau et al., 2017), although a slight rise in prices (with PTR still below 1) was observed during 2021, likely due to shortages in semi-conductors. PTR trends for energy prices (D35), which are characterised by some seasonality, with spikes during wintertime, when heating needs increase, were the highest in 2020-2021 and 2021-2022, and only relented by 2022 thanks to numerous national and European policy measures aimed at capping gas prices and securing energy supplies (see European Commission, 2022; for a timeline, see European Council, 2023).

4. Methodology and results

3.4. Estimation strategy

Given the binary nature of the dependent variable (expecting more investment in the current financial year versus expecting lower or the same levels of investment), we run a generalised linear model with a logistic link function, such that:

$$y_{ij,t} = \alpha_{ij,t} + \beta X_{ij,t-2} + \gamma \boldsymbol{Z}_{ij,t} + \delta \boldsymbol{C}_{i,t} + \theta \boldsymbol{FE}_{ij,t} + \varepsilon_{ij,t}$$

Where $y_{ij,t}$ represents the probability of a firm in country i and sector j expecting more investment in the current financial year, t; $\beta X_{ij,t-2}$ is the value of inflation rate, lagged by two quarters; $\gamma \boldsymbol{Z}_{ij,t}$ is a vector of firm-specific controls; $\delta \boldsymbol{C}_{i,t}$ is a vector of country-level macroeconomic controls; $\theta \boldsymbol{FE}_{ij,t}$ is a set of country-, year- and sector-specific fixed effects; and $\varepsilon_{ij,t}$ is the error term.

The effect of inflation on investment is tested both across the whole sample (2016-2022) and only for the post-COVID-19 period (2021-2022), where the effect of government support is added as a further control variable.

Inflation is measured both in terms of yearly rates of change – as provided by Eurostat – and as a categorical variable. This latter variable can assume five different values: *No inflation* if the inflation rate is zero or lower; *Low* if it is between zero (excluded) and 5% (included); *Moderate* if it is between 5% and 10%; *High* if it is between 10% and 20%; *Very high* when it is over 20%.

For each model, we include demographic controls for the size and age of the firm, as well as whether the firm is in a high-tech sector or not, since we suspect that investment today is influenced by the EU's agenda on the twin digital and green transition (Muench et al., 2022). We also included two of the major obstacles to investment identified in recent studies – namely the lack of skilled staff (which should incentivise firms to invest, especially in digitalisation, to substitute hard-to-find skilled work, although evidence is mixed, since it is likely that firms most affected by this are the most high-growth and innovative firms that are already investing above average) and the uncertainty about the future of the economy (which should lead firms to postpone investment) (EIB, 2023b; Kolev & Randall, 2023). Moreover, we include information on firms' profitability, as lower profits may affect their ability to finance investment. Since firms are likely to rely on external financing for investment, we include two further variables: firms' expectations on whether external financing will improve, stay the same or deteriorate in the following 12 months; and secondly, a dummy variable on general financing constraints, which assumes a value of 1 when the firm is either dissatisfied with the amount of external finance obtained, saw its request of external financing rejected, decided not to seek any external financing because of excessive costs (e.g. interest rates too high), or decided not to seek any external financing for fear of being rejected (discouraged). We control for the macroeconomic environment by including a measure of aggregate demand with the country's GDP growth rate, and of monetary policy, with the interest rates set by the ECB and non-euro area central banks. Table A.1 in the Appendix offers a list of descriptive statistics for the selected variables.

3.5. Results

3.5.1. The direct effect of inflation on investment

Tables 3 through 6 show the results from the regression models and possible explanations of the results. Table 3 includes five main models: Model 1 uses an untransformed inflation variable, Model 2 employs the categorical operationalisation of inflation as described in the previous section, Models 3 and 4 include subsamples for SMEs and large firms, respectively, while Model 5 re-runs Model 2, limited to period 2021-2022 (i.e. the period of high inflation).

TABLE 3. LOGISTIC REGRESSION MODEL FOR H1: THE EFFECT OF INFLATION ON THE PROBABILITY TO UNDERTAKE MORE INVESTMENT IN THE CURRENT FINANCIAL YEAR

	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
Inflation rate	0.001*				
	(0.000)				
Inflation rate, categorical (ref = Low inflation)					
No inflation		-0.001	0.003	-0.019	-0.007
		(0.005)	(0.006)	(0.013)	(0.012)
Moderate inflation		0.010	0.006	0.028	0.016
		(0.006)	(0.007)	(0.018)	(0.010)
High inflation		0.000	0.003	-0.017	-0.004
		(0.009)	(0.009)	(0.025)	(0.013)
Very high inflation		0.037*	0.042*	0.016	0.042*
		(0.017)	(0.019)	(0.041)	(0.019)
Firm size (ref = Large firm)					
Micro-firm	-0.055***	-0.055***			-0.107***
	(0.006)	(0.006)			(0.012)
Small firm	-0.030***	-0.030***			-0.074***
	(0.006)	(0.006)			(0.011)
Medium-sized firm	-0.013*	-0.013*			-0.033**
	(0.006)	(0.006)			(0.011)
Firm age (ref = More than 20 years)					
Less than 2 years	0.117***	0.116***	0.110**	0.098	0.074
	(0.032)	(0.032)	(0.034)	(0.090)	(0.062)
2-5 years	0.041***	0.041***	0.031**	0.028	0.040+
	(0.010)	(0.010)	(0.011)	(0.038)	(0.021)
5-10 years	0.015*	0.015*	0.008	-0.010	0.020
	(0.007)	(0.007)	(0.007)	(0.025)	(0.013)
10-20 years	0.005	0.006	0.000	0.011	0.018*
	(0.005)	(0.005)	(0.005)	(0.014)	(0.009)
Profitability (ref = Profit)					
Break even	-0.045***	-0.045***	-0.047***	-0.065***	-0.049***

	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
	(0.007)	(0.007)	(0.007)	(0.022)	(0.012)
Loss	-0.053***	-0.053***	-0.052***	-0.064***	-0.065***
	(0.006)	(0.006)	(0.006)	(0.014)	(0.010)
Availability of skilled staff as a major obstacle	0.022***	0.022***	0.021***	0.026***	0.029***
	(0.004)	(0.004)	(0.004)	(0.010)	(0.007)
Uncertainty over the economic future as a major obstacle	-0.042***	-0.042***	-0.044***	-0.034**	-0.038***
	(0.004)	(0.004)	(0.004)	(0.011)	(0.008)
Firm is in high-tech sector	0.006	0.006	0.012+	-0.006	0.017
	(0.006)	(0.006)	(0.007)	(0.013)	(0.011)
Expectations on external financing over the next 12 months (ref = Improve)					
Deteriorate	-0.156***	-0.156***	-0.160***	-0.140***	-0.182***
	(0.006)	(0.006)	(0.007)	(0.017)	(0.012)
Stay the same	-0.143***	-0.143***	-0.150***	-0.110***	-0.166***
	(0.004)	(0.004)	(0.005)	(0.011)	(0.009)
Firm is financially constrained	0.062***	0.062***	0.060***	0.056**	0.051***
	(0.007)	(0.007)	(0.007)	(0.021)	(0.013)
COVID-19 financial support					0.033***
					(0.008)
Real GDP growth (%)	0.001	0.002	0.002+	-0.004	-0.003
	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)
Interest rates	-0.007**	-0.007**	-0.006*	-0.013+	-0.001
	(0.002)	(0.002)	(0.002)	(0.007)	(0.004)
Sector (ref = Manufacturing)					
Construction	-0.064***	-0.063***	-0.066***	-0.098***	-0.080***
	(0.005)	(0.005)	(0.006)	(0.016)	(0.010)
Infrastructure	-0.030***	-0.030***	-0.039***	-0.010	-0.031**
	(0.005)	(0.005)	(0.006)	(0.013)	(0.010)
Services	-0.030***	-0.030***	-0.037***	-0.039**	-0.024*
	(0.005)	(0.005)	(0.006)	(0.013)	(0.010)
Country-fixed effects	X	X	X	X	X
Year-fixed effects	X	X	X	X	X
Num. Obs.	62134	62134	52425	9709	18613
AIC	76181.7	76184.5	63870.2	12363.1	23767.2

	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
BIC	76669.7	76699.6	64349	12750.8	24182.3
Log-likelihood	-38036.9	-38035.2	-31881.1	-6127.5	-11830.6
Pseudo-R2	0.034	0.034	0.033	0.038	0.034

Note: marginal effects presented. Standard errors in parentheses. + p < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001.

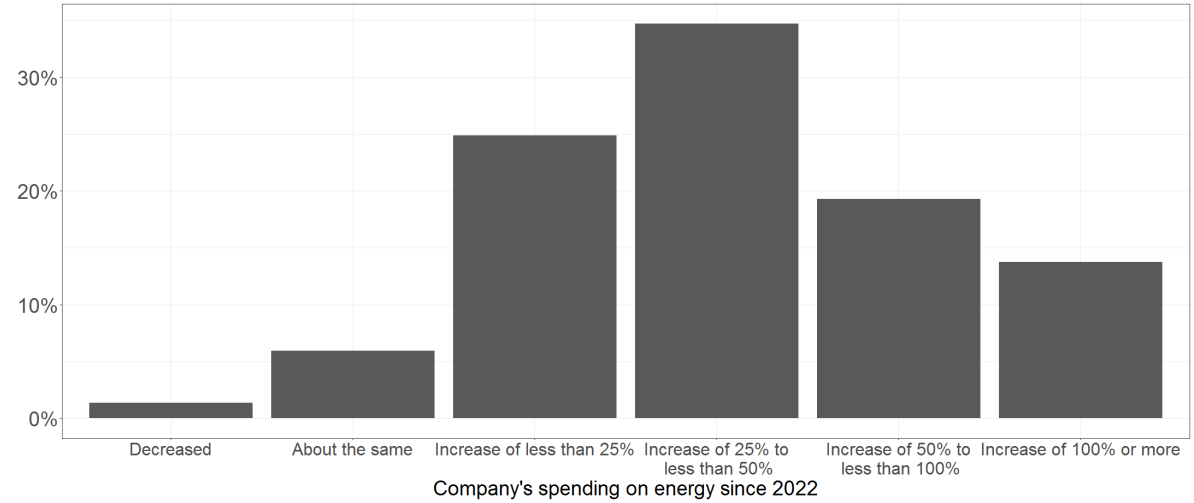
The results show that, in Model 1, inflation has a statistically significant positive association with the probability of a firm undertaking more investment in the current financial year by 0.1 percentage points on average and ranging from 0.056 points in services to 0.062 percentage points in manufacturing, for each percentage point increase in inflation. This effect is however minimal.[12] As Model 2 shows, the effect is significant only for 'very high' values of inflation (>20%), which are associated with an increased probability of the firm undertaking more investment of 3.7 percentage points compared with a situation of 'low' inflation – from around 32.8% to 36.5%. Likewise, Models 3 and 4 suggest that the effect is much stronger among SMEs than large firms: while the probability of SMEs undertaking more investment in a situation of 'very high' inflation increases, compared with a baseline situation of 'low' inflation, from 31.3% to 35.6%, that of large firm only increases from 35.8% to 37.5%, that is by less than half. Additional robustness tests also suggest that these results hold when it comes to the total amount of investment (see Table A.2 in the Appendix).

This effect can be explained by the 'very high' levels of inflation being mostly associated with energy prices, which in around 35% cases entailed companies spending between 25% and 50% more than before on energy (see Figure 3), and therefore affecting the more energy-intensive industries in the manufacturing sector (see Figure A.4 in the Appendix).[13] In such cases, the literature found that increased energy costs can prompt firms to invest in energy efficiency and that energy-intensive firms are more likely to invest in energy efficiency (EIB, 2023b; Eyraud et al., 2013; Kalantzis & Niakaros, 2020; Ley et al., 2016; Triguero et al., 2013). Moreover, investment in greening has been pushed by the Commission's European Green New Deal (European Commission, 2021), which aims to reduce net greenhouse gas emissions by at least 55% by 2030, compared with 1990 levels, with energy efficiency at its core. Indeed, in Model 5, which limits the sample to 2021-2022, the marginal effect of 'very high' levels of inflation remains positive, amounting to 4.2 percentage points higher compared with 'low' inflation (from 36.5% to 40.7%). The marginal effects in Model 5 are also stronger than in Model 2 for each sector, ranging from a minimum of 3.7 percentage points in construction to a maximum of 4.43 percentage points in manufacturing. A recent study based on EIBIS data also suggests that self-perceptions about rising energy costs accounted for an increase in planned investment in energy efficiency by over 5 percentage points, from 52.3% to 57.9% in 2022, with the effect being driven mostly by SMEs rather than large firms (PPMI et al., 2023).

[12] To understand how small of an effect it is, the predicted probability of more investment increases just from 32% to 33.2% for levels of inflation set at 0% and 20%, respectively.

[13] Additional tests, available upon request, also show that the effect is stronger for Eastern European countries, which were more reliant on Russian energy imports.

FIGURE 3. INCREASE IN SPENDING ON ENERGY SINCE 2022



Source: Authors' elaboration based on EIBIS 2023 wave.

Note: All values are weighted by the value added provided by the surveyed firms.

These above findings are supported by further tests showing that inflation is positively associated with the proportion of investment for green efficiency undertaken in the previous financial year, as well as the probability of investing in energy efficiency measures in 2022. Table 4 presents the models for energy efficiency-related investment. Model 1 focuses on energy efficiency investment as a share of total investment in the previous financial year. Models 2 and 3 re-run Model 1 for the SME and large firm subsets. Model 4 employs investment in energy efficiency measures as a way to combat GHG emissions in 2022, while Model 5 adds energy prices as a further control to it.

The analysis finds an increase in the predicted proportion of investment dedicated to energy efficiency by 3.1 percentage points for 'very high' levels of inflation compared with 'low' levels of inflation (from 8.2% to 11.3%), while it is not statistically significant for the other levels of inflation (Table 4, Model 1).[14] Models 2 and 3 in Table 4 also show that the effect is once again bigger for SMEs than large firms, increasing the share of investment for energy efficiency by 3.7 and 2.7 percentage points, respectively, in a situation of 'very high' inflation, compared with a situation of 'low' inflation. Finally, Models 4 and 5 in Table 4 suggest that 'very high' levels of inflation were also associated with a higher probability of investment for energy efficiency measures as a way to combat GHG by 9.2 percentage points, and by 8.9 percentage points when controlling for energy prices as an investment obstacle.[15]

TABLE 4. REGRESSION MODELS WITH PROPORTION OF TOTAL INVESTMENT SPENT FOR ENERGY EFFICIENCY IN THE PREVIOUS FINANCIAL YEAR (MODELS 1-3) AND INVESTMENT IN ENERGY EFFICIENCY MEASURES IN 2022 (MODELS 4-5) AS DEPENDENT VARIABLES

	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
Lagged inflation rate, categorical (ref = Low inflation)					
No inflation	0.005	0.004	0.008		
	(0.003)	(0.004)	(0.007)		

[14] Since the response variable of this model refers to the share of investment dedicated to energy efficiency in the previous financial year, the inflation rate was lagged by four quarters, with GDP growth and interest rates also lagged by a year.

[15] Further analyses (not shown here), suggest instead that inflation is not correlated with investment for innovation activities (e.g. new products or services, new processes, digitalisation, or transformations to the supply chain).

	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
Moderate inflation	0.000	-0.001	0.011		
	(0.003)	(0.003)	(0.009)		
High inflation	0.005	0.005	0.005		
	(0.006)	(0.006)	(0.014)		
Very high inflation	0.032*	0.037*	0.027		
	(0.013)	(0.016)	(0.024)		
Inflation rate, categorical (ref = Low inflation)					
No inflation				-0.027	-0.028
				(0.031)	(0.031)
Moderate inflation				-0.005	-0.011
				(0.014)	(0.014)
High inflation				0.016	0.011
				(0.015)	(0.015)
Very high inflation				0.092***	0.089***
				(0.021)	(0.021)
Firm size (ref = Large firm)					
Micro-firm	-0.035***			-0.134***	-0.132***
	(0.003)			(0.017)	(0.017)
Small firm	-0.019***			-0.272***	-0.268***
	(0.003)			(0.016)	(0.016)
Medium-sized firm	-0.010***			-0.324***	-0.319***
	(0.003)			(0.017)	(0.017)
Firm age (ref = More than 20 years)					
Less than 2 years	0.023	0.015	0.058	-0.024	-0.019
	(0.020)	(0.020)	(0.068)	(0.077)	(0.077)
2-5 years	-0.022***	-0.024***	-0.037*	-0.043	-0.039
	(0.005)	(0.005)	(0.016)	(0.029)	(0.029)
5-10 years	-0.014***	-0.017***	-0.016	-0.051**	-0.047**
	(0.003)	(0.003)	(0.013)	(0.017)	(0.017)
10-20 years	-0.011***	-0.012***	-0.026***	-0.054***	-0.053***
	(0.002)	(0.003)	(0.007)	(0.012)	(0.012)
Profitability (ref = Profit)					
Break even	0.002	0.006	0.014	-0.047**	-0.050**
	(0.004)	(0.004)	(0.012)	(0.017)	(0.017)
Loss	-0.014***	-0.014***	-0.016*	-0.047**	-0.050**
	(0.003)	(0.003)	(0.007)	(0.015)	(0.015)
Availability of skilled staff as a major obstacle	0.003	0.004+	-0.003	0.023*	0.013
	(0.002)	(0.002)	(0.005)	(0.010)	(0.010)

	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
Uncertainty over the economic future as a major obstacle	0.006**	0.004	0.013*	0.019+	0.006
	(0.002)	(0.002)	(0.006)	(0.010)	(0.011)
Firm is in high-tech sector	-0.041***	-0.046***	-0.022***	-0.048**	-0.036*
	(0.003)	(0.003)	(0.006)	(0.016)	(0.016)
Expectations on external financing over the next 12 months (ref = Improve)					
Deteriorate	0.000	-0.001	-0.002	-0.038*	-0.043**
	(0.003)	(0.004)	(0.009)	(0.016)	(0.016)
Stay the same	-0.006*	-0.004	-0.015*	-0.061***	-0.061***
	(0.002)	(0.003)	(0.006)	(0.014)	(0.014)
Firm is financially constrained	-0.010**	-0.012**	0.002	0.030+	0.029+
	(0.004)	(0.004)	(0.011)	(0.017)	(0.017)
Lagged real GDP growth (%)	0.001	0.000	0.001		
	(0.001)	(0.001)	(0.002)		
Real GDP growth (%)				0.000	0.000
				(0.000)	(0.000)
Lagged interest rates	-0.005	-0.004	-0.009		
	(0.004)	(0.004)	(0.009)		
Interest rates				0.000	0.000
				(0.000)	(0.000)
Energy prices as a major obstacle					0.071***
					(0.011)
Sector (ref = Manufacturing)					
Construction	-0.022***	-0.027***	-0.010	-0.134***	-0.123***
	(0.003)	(0.003)	(0.008)	(0.014)	(0.015)
Infrastructure	0.048***	0.046***	0.048***	-0.124***	-0.120***
	(0.004)	(0.005)	(0.008)	(0.015)	(0.015)
Services	-0.022***	-0.027***	-0.013*	-0.063***	-0.058***
	(0.003)	(0.003)	(0.006)	(0.015)	(0.015)
Country-fixed effects	X	X	X	X	X
Year-fixed effects	X	X	X		
Num. Obs.	38818	32738	6080	9356	9335
AIC				11444.6	11375.6
BIC				11794.6	11732.6

	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
Log-likelihood				-5673.3	-5637.8
Pseudo-R2				0.120	0.123
RMSE	0.20	0.20	0.19		

Note: marginal effects presented. Standard errors in parentheses. + p < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001.

Another potential explanation is that in an uncertain economic environment, high inflation may actually incentivise cash-holding firms to invest before their cash reserves are devalued. Table 5 presents the models controlling for cash reserves. Model 1 displays the results for all firms, while Models 2 and 3 re-run Model 1 for the SMEs and large firm subsets.

The analyses show that the average marginal effect of a one percentage-point increase in cash as a share of total assets is to increase the probability of undertaking more investment by 1.4 percentage points, although the effect is not statistically significant. The effect is also far stronger among large firms (18.4 percentage-point increase for one percentage-point increase from the average share of cash reserves) compared with SMEs. While SMEs are overall more likely to hold a higher level of cash reserves, given their low access to external financing sources (19% of total assets for micro firms versus 9% of large firms), the change in liquidity during the COVID-19 crisis in 2020 was significantly higher for large than micro firms (28% versus 19% increase) reflecting a better capacity to adapt among larger firms (Table 5). These results also support recent findings suggesting that, unlike the great financial crises, post-COVID-19 non-financial corporations took on more debt at long maturities and at fixed rates, benefiting from low interest rates, generous fiscal support packages and easy credit conditions. Hence, despite credit tightening due to the high inflation, their debt payments have stayed roughly stable, with the real value of their debt burden even decreasing (Ampudia et al., 2023; EIB, 2024). The key implication is that those firms with such favourable conditions increased their cash reserves – especially large firms. As inflation spiked, these reserves could be put to use for more investment, therefore proving the higher resiliency of investment compared with past crises.

TABLE 5. REGRESSION MODELS TESTING THE EFFECT OF INFLATION ON THE PROBABILITY TO UNDERTAKE MORE INVESTMENT IN THE CURRENT FINANCIAL YEAR WITH ADDITIONAL CONTROL FOR CASH RESERVES

	MODEL 1	MODEL 2	MODEL 3
Inflation rate, categorical (ref = Low inflation)			
No inflation	-0.005	-0.001	-0.020
	(0.006)	(0.007)	(0.013)
Moderate inflation	0.011	0.006	0.043*
	(0.008)	(0.008)	(0.021)
High inflation	0.009	0.009	-0.002
	(0.012)	(0.013)	(0.035)
Very high inflation	0.096**	0.101*	0.068
	(0.037)	(0.040)	(0.090)
Cash reserves	0.014	-0.011	0.184***
	(0.014)	(0.014)	(0.049)
Firm size (ref = Large firm)			
Micro-firm	-0.045***		

	(0.008)		
Small firm	-0.022***		
	(0.007)		
Medium-sized firm	-0.012+		
	(0.006)		
Firm age (ref = More than 20 years)			
Less than 2 years	0.107*	0.122**	-0.028
	(0.043)	(0.047)	(0.107)
2-5 years	0.034**	0.031*	0.008
	(0.012)	(0.013)	(0.042)
5-10 years	0.016*	0.012	0.002
	(0.008)	(0.008)	(0.028)
10-20 years	0.006	0.000	0.022
	(0.005)	(0.006)	(0.016)
Profitability (ref = Profit)			
Break even	-0.037***	-0.034***	-0.089***
	(0.008)	(0.008)	(0.025)
Loss	-0.054***	-0.053***	-0.0610***
	(0.006)	(0.007)	(0.016)
Availability of skilled staff as a major obstacle	0.022***	0.021***	0.028*
	(0.004)	(0.005)	(0.011)
Uncertainty over the economic future as a major obstacle	-0.045***	-0.046***	-0.041***
	(0.005)	(0.005)	(0.012)
Firm is in high-tech sector	0.000	0.006	-0.009
	(0.007)	(0.008)	(0.014)
Expectations on external financing over the next 12 months (ref = Improve)			
Deteriorate	-0.155***	-0.158***	-0.140***
	(0.007)	(0.008)	(0.020)
Stay the same	-0.138***	-0.144***	-0.112***
	(0.005)	(0.005)	(0.012)
Firm is financially constrained	0.060***	0.059***	0.051*
	(0.008)	(0.008)	(0.023)
Real GDP growth (%)	0.001	0.002	-0.002
	(0.001)	(0.001)	(0.004)
Interest rates	-0.002	-0.002	-0.009
	(0.003)	(0.003)	(0.010)
Sector (ref = Manufacturing)			
Construction	-0.071***	-0.071***	-0.104***
	(0.006)	(0.007)	(0.018)
Infrastructure	-0.033***	-0.043***	-0.005

	(0.006)	(0.007)	(0.015)
Services	-0.034***	-0.037***	-0.046**
	(0.006)	(0.007)	(0.015)
Country-fixed effects	X	X	X
Year-fixed effects	X	X	X
Num. Obs.	48272	40291	7981
AIC	59156.8	49078.9	10103.4
BIC	59666.3	49552.2	10487.5
Log-likelihood	-29520.4	-24484.5	-4996.7
Pseudo-R2	0.034	0.033	0.039

Note: marginal effects presented. Standard errors in parentheses. + p < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001.

All models also show similar effects as in recent work by the EIB (2023) regarding the impact of firm-level characteristics. Firms that are large, newer and in manufacturing are most likely to invest, as are profitable firms, in virtue of the availability of internal funding. Moreover, firms facing constraints regarding the availability of skilled staff are those that has a higher probability of investment, whereas the uncertainty about the economic future reduces the probability to invest. In terms of external financing, Model 2 in Table 3 suggests that for firms that expect a deterioration in external financing conditions in the next 12 months, the probability of investing more falls by 16.2 percentage points: from 47.7% to 31.5% in a situation of 'very high inflation' and by 14.8 percentage points – from 47.7% to 32.9% - if they expect external financing to remain the same. This fall is slightly higher compared with a situation of 'low' inflation where deteriorating expectations make the probability of investment to fall by 15.3 percentage points and by 14.3 percentage points if respondents expect external financing to remain the same. The effect is also stronger among SMEs, whose probability of undertaking more investment falls by 17.5 percentage points if they expect external financing conditions to deteriorate (Model 3), compared with 15.3 percentage points for large firms (Model 4).

A similar situation about financing is showcased by the negative marginal effect of interest rates, which reduce the probability of firms undertaking more investment by 0.69 percentage points in a situation of 'very high' inflation compared with a marginal effect of 0.65 in a situation of 'low' inflation. The effect is stronger among large firms (1.5 percentage point decrease) than SMEs (0.66 percentage point decrease), likely due to the higher likelihood of large firms of investing. Given the interest rates set by the ECB in September 2023, 4.50%, this would translate to an additional decreased probability to undertake more investment by around three percentage points.

Finally, being financially constrained is associated with a *higher* probability of more investment from 36.5% to 43.3% in a situation of 'very high' inflation and from 32.6% to 39.1% in a situation of 'low' inflation, with the effect being slightly stronger for SMEs than large firms. This result is in line with earlier findings that high growth firms, which need to invest intensively to grow and which are often likely to be young SMEs, are more likely to be financially constrained (Ferrando et al., 2019).[16]

In sum, inflation does not appear to have a direct effect on investment, except for very high levels of inflation, and in the particular case of the 2021-2022 period, there is a minor positive impact on the probability of firms undertaking more investments. This effect is likely associated with firms' investment in energy efficiency, given that the highest values associated with inflation reflect the sharp increases in energy prices that urges the need of energy efficiency, as well as the desire to invest cash

[16] Robustness analyses show that being financially constrained is negatively associated with the real amount of investment in the previous financial year (Table A.2 in the Appendix).

reserves before they are devalued by increasing inflation, especially among large firms. Moreover, the by-products of inflation (increasing interest rates and financial costs, tightening of external funding conditions) all lead to lower probabilities of firms undertaking more investment.

3.5.2. The role of cost pass-through rates on investment

We also hypothesised that, to maintain the profit margins necessary to invest, firms want to pass costs onto customers. If they fail to do so, they will also present lower probabilities of undertaking more investment. Indeed, the regression results in Tables 3 through 6 all show that failing to be profitable is associated with a lower probability of investment. As such, it is necessary to also explore the mechanisms through which firms manage to maintain their profit margins – namely by passing costs onto customers.

Again, it is important to remember that the producer price index employed for these analyses represents output prices rather than input costs. As such, the PTR variable is most representative for producer firms and their ability to update prices following increases in input costs. Failures to do so most likely result from competitive markets or the presence of fixed-price contracts.

Table 7 presents the results of analysis conducted on a subset of selected NACE codes – covering manufacturing and infrastructure, which are most likely to include producer firms (see Table 2). Hence, due to the low heterogeneity, we do not control for the sector to which the firms belong. Model 1 presents the overall results, while Models 2 and 3, present results for the SME and large firm subsets, respectively.

TABLE 7. LOGISTIC REGRESSION MODEL FOR H2: THE EFFECT OF PTR ON THE PROBABILITY TO UNDERTAKE MORE INVESTMENT IN THE CURRENT FINANCIAL YEAR

	MODEL 1	MODEL 2	MODEL 3
PTR	0.113	0.184	-0.147
	(0.070)	(0.101)	(0.173)
Inflation rate, categorical (ref = Low inflation)			
No inflation	-0.016	-0.014	-0.028
	(0.016)	(0.019)	(0.032)
Moderate inflation	0.035	0.001	0.133*
	(0.026)	(0.029)	(0.056)
High inflation	0.001	0.014	-0.085
	(0.034)	(0.041)	(0.064)
Very high inflation	0.041	0.057	-0.082
	(0.043)	(0.050)	(0.086)
Firm size (ref = Large firm)			
Micro-firm	-0.040+		
	(0.024)		
Small firm	-0.032+		
	(0.018)		
Medium-sized firm	-0.011		
	(0.016)		

	MODEL 1	MODEL 2	MODEL 3
Firm age (ref = More than 20 years)			
Less than 2 years	0.231*	0.227+	0.191
	(0.099)	(0.128)	(0.163)
2-5 years	0.010	-0.007	0.31
	(0.038)	(0.040)	(0.114)
5-10 years	0.001	-0.012	-0.001
	(0.024)	(0.025)	(0.073)
10-20 years	-0.002	-0.011	-0.001
	(0.016)	(0.017)	(0.037)
Profitability (ref = Profit)			
Break even	-0.041+	-0.033	-0.125+
	(0.024)	(0.026)	(0.069)
Loss	-0.046*	-0.048*	-0.052
	(0.018)	(0.021)	(0.037)
Availability of skilled staff as a major obstacle	0.030*	0.023	0.052+
	(0.013)	(0.015)	(0.028)
Uncertainty over the economic future as a major obstacle	-0.031*	-0.033*	-0.034
	(0.013)	(0.015)	(0.028)
Firm is in high-tech sector	0.013	0.012	0.023
	(0.023)	(0.023)	(0.052)
Expectations on external financing over the next 12 months (ref = Improve)			
Deteriorate	-0.126***	-0.145***	-0.064
	(0.023)	(0.027)	(0.046)
Stay the same	-0.136***	-0.148***	-0.097**
	(0.017)	(0.020)	(0.032)
Firm is financially constrained	0.028	0.023	0.045
	(0.021)	(0.023)	(0.052)
Real GDP growth (%)	0.003	0.010*	-0.022*
	(0.004)	(0.005)	(0.009)
Interest rates	-0.014+	-0.006	-0.061*
	(0.008)	(0.009)	(0.026)
Country-fixed effects	X	X	X
Year-fixed effects	X	X	X
Num. Obs.	6260	4621	1607
AIC	8148.1	6028.3	2150.4
BIC	8512.2	6357	2414.2
Log-likelihood	-4020.1	-2963.2	-1026.2
Pseudo-R2	0.032	0.036	0.048

Note: marginal effects presented. Standard errors in parentheses. + p < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001.

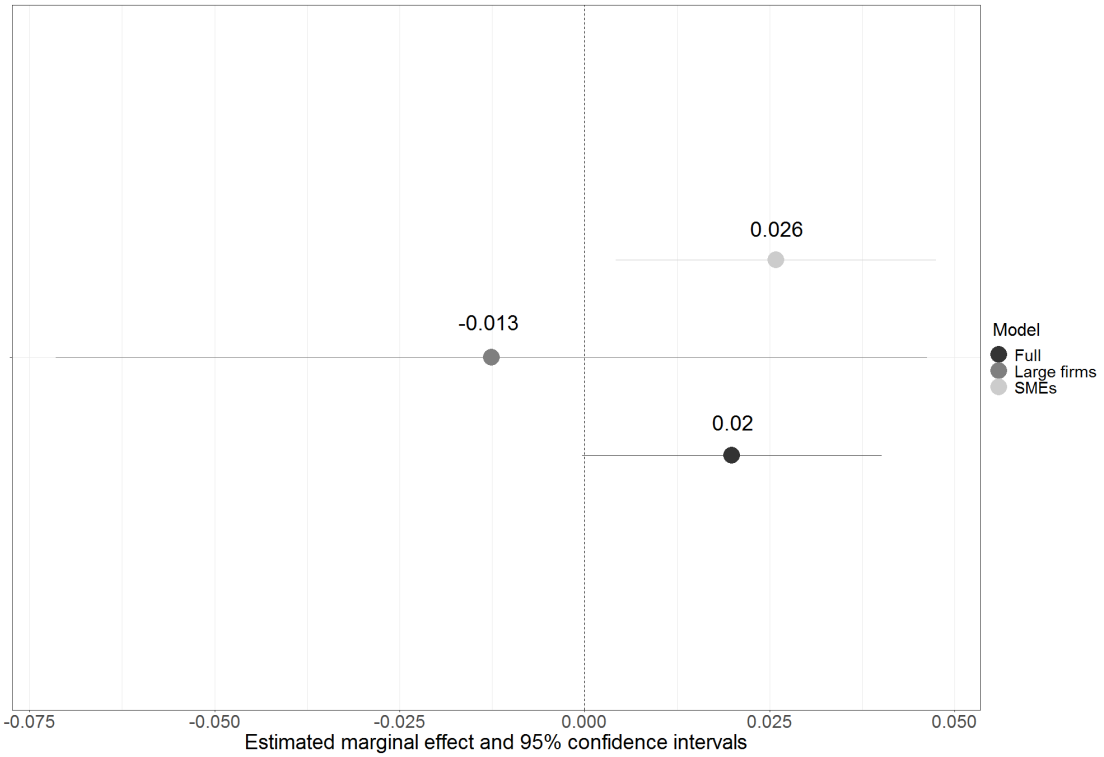
Model 1 shows a positive, albeit non-significant effect of PTR: the average marginal effect is to increase the probability of undertaking more investment in the current financial year by 11.3 percentage points across all firms. Model 2 shows that PTR is also positive for SMEs, being associated with an increase in the probability of more investment by 18.4 percentage points on average, while it is negative for large firms, with the probability of more investment decreasing by 14.7 percentage points (Model 3).[17] For SMEs, the difference in the predicted probability between the lowest recorded level of PTR (0.4) and the highest (1.6) amounts to an increased probability by almost 23 percentage points – from 26.9% to 49.7%. This may suggest that – at least for the selected NACE sectors – SMEs are more susceptible to the necessity to pass costs onto customers than large firms for investment purposes. This is in line with the finding mentioned earlier suggesting that SMEs, unlike large firms, lack the necessary cash reserves to use as internal funding for investment. However, the non-significance of the marginal effects and the restricted sectoral coverage on which the association was tested warrant caution when making any strong inferences from these results.

We further deepen our analyses by looking at the 8th EIBIS wave from 2023. This newer wave provides supporting evidence to the above, while also expanding the scope of analysis beyond the few NACE codes analysed here. Additional regression analyses suggest that passing energy costs onto customers is more important to investment decisions for SMEs than large firms. While the passing of energy costs onto customers presents a statistically significant association with an increased probability of undertaking more investment by 2.6 percentage points for SMEs, the effect is negative and statistically insignificant for large firms (Figure 4; see also Table A.3 in the Appendix). As such, these results appear to confirm that there is a higher degree of reliance on the generation of continuous revenues for investment purposes for SMEs compared with large firms.[18]

[17] For SMEs, the average marginal effect is just outside the standard threshold for statistical significance, with the p-value ≈ 0.12. However, its related log-odds coefficient does result significant at the 10% level, with p-value = 0.068. The discrepancy between the coefficient and its average marginal effect is due to the non-linearity of the partial derivatives. While caution is still warranted in making inferences, the effect is large enough and close enough to statistical significance to be paid attention to.

[18] In particular, while 62% of the surveyed firms see the passing of costs onto customers as the main strategy to deal with the increases in energy prices, the share is larger for medium-sized and large companies (63.6% and 64.3%, respectively) compared with micro- and small firms (52.8% and 59.4%, respectively). The desire to pass costs onto customers may also reflect a company's ability to do so, which is reduced for SMEs, compared with large firms. The survey also suggests that a higher share of firms in manufacturing (71%) aim to use this cost-passing strategy, compared with construction (62%), infrastructure (61%), and services (51%) (see Figure A.5 in the Appendix), which also reflects the larger increase in companies' spending for energy in manufacturing, as shown in Figure A.4.

FIGURE 4. ESTIMATED MARGINAL EFFECT OF COMPANIES' DECISION TO PASS ENERGY COSTS ONTO CUSTOMERS ON THE PROBABILITY OF UNDERTAKING MORE INVESTMENT, 2023



Note: analyses using EIBIS 2023 wave. The model includes having more investment as a binary dependent variable and deciding to pass energy costs onto customers as a binary independent variable. The model also controls for size, age, profitability, obstacles to investment (lack of skilled workers and uncertainty about the future), whether the firm is in a high-tech sector, availability of external financing, and financing constraints. N = 9,058 in the full model.

5. Conclusion

The goal of this paper was twofold. First, we aimed to understand the association between higher inflation and firms' investment decisions by investigating both internal and external channels of action.

Our analysis shows that inflation has no direct effect on investment decision until its rate of change reaches very high levels (over 20%). In this case inflation was found to be slightly positively associated with the probability of firms undertaking more investments, with the effect being strongest among SMEs. We argue that this was most likely driven by investment in energy efficiency, which firms see as a necessary action when energy and input prices soar. The Commission's push for the European Green New Deal also appears to have boosted firms' green investments in the period of 2021-2022. Further analyses suggest that cash-holding firms, especially those with strong increase in liquidity during the COVID-19 crisis may want to invest before their cash reserves become devalued due to inflation. This appears to be a strong driver mostly among large firms.

The second goal was to analyse more in detail the effect of inflation on firms' investment through their ability to pass costs onto consumers – which would allow firms to retain high enough profit margins that could be used to invest. We first tested the effect of pass-through rate (PTR) on the probability of undertaking more investment for a few selected NACE codes in manufacturing and infrastructure, and we found a positive association between passing costs onto consumers and the probability of undertaking investment among SMEs, but not large firms. This finding is also supported by further analyses using the 2023 EIBIS wave, which show that SMEs wanting to pass energy costs onto customers were also more likely to undertake further investment in that financial year across all sectors. These results suggest, in turn, a greater reliance of SMEs on the continuous generation of revenue (internal financing sources) in the absence of cash reserves or external financing sources that could be used for investment.

We do, however, acknowledge some methodological limitations to the present work. First, the lack of data on service producer prices prompted us to employ LCI as a proxy for inflation in the services sector. While justifiable from a theoretical standpoint, this measure still lacks direct comparability with the producer price indices employed for the other sectors. Nevertheless, it is encouraging to note that results held when excluding the services sector from the analyses, which suggests a relatively minor importance of investment for this sector. Secondly, the operationalisation of PTR also forced us to focus on a few selected NACE sectors which showed the highest degree of comparability between producer and consumer prices. Here too, it is encouraging to highlight the consistency with the analyses from the 2023 wave of EIBIS, which showed that SMEs wanting to pass energy costs onto customers are also more likely to undertake more investment across all economic sectors. Future research, however, would do well to explore more finetuned methods to improve the comparability of these findings. Finally, our analyses are purely associational in nature and do not test the underlying causal mechanisms behind investment decisions as inflation rises (as do, for instance, Agarwal & Baron, 2024 in the banking sector). As such, future research could better explore these causal mechanisms in order to have more robust and generalisable findings that could explain the inflation-investment nexus beyond the idiosyncrasies of the energy-driven price increases that affected European companies.

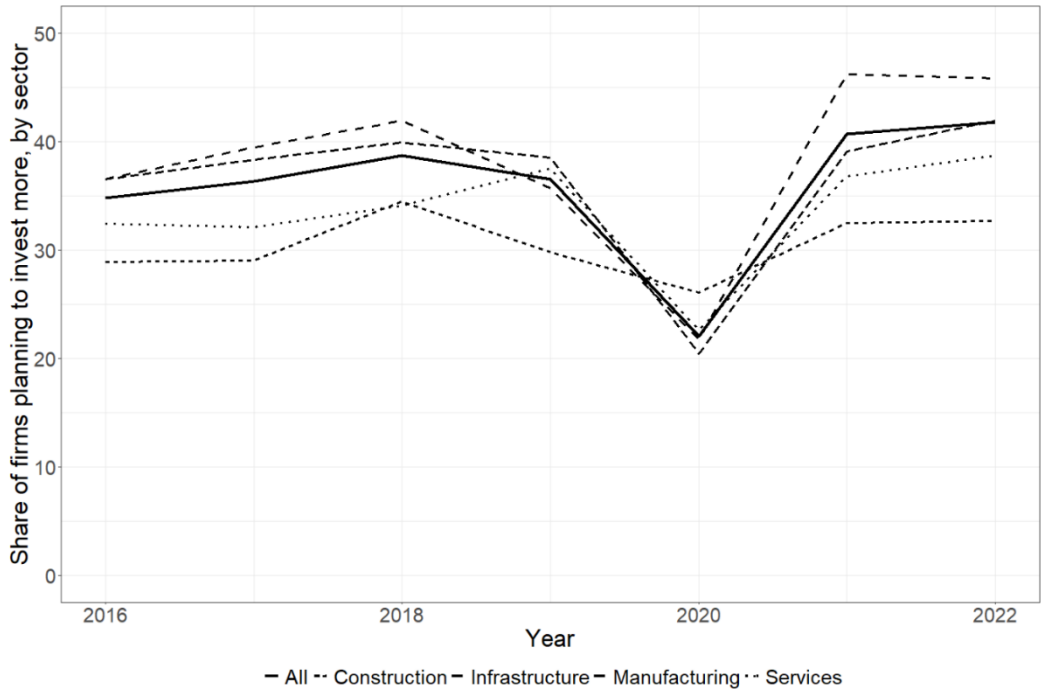
To conclude, there are multiple policy implications of these findings. First, there are signs that the needed digital and green transformation gained an additional boost through the supply shock and price increase. Moreover, there are indications that the various governmental supports (European Green

Deal, COVID-19 policy support, etc) together with accumulated liquidity pre-crisis kept investments on positive trend even in the period of high inflation and policy tightening. This is also captured by the high resiliency in investment even after 2022, which is displayed by firms' enhanced competitiveness on innovation and digitalisation (EIB, 2024). Nevertheless, all the negative by-products of inflation and monetary tightening are also acting in parallel, significantly hindering investments. To counteract those headwinds and keep the transformation process going even in the period of economic deceleration, policymakers should improve the business environment by easing the economic uncertainty and the structurally high level of financing constraints of investing companies, especially for those innovative, small and young firms that are on the track of transformation. This could be addressed by developing and offering alternative financing sources, beside the traditional bank finance, fitting the risk profile of these firms in their longer-term investments for transformation, thus counterbalancing the decelerating effect of cyclical tightening. Moreover, a special focus should be accorded to SMEs operating in a highly competitive market or whose demand is strongly price-elastic, where they are unable to pass-through the higher costs of production compared with firms operating in less-price elastic markets.

6. Appendix

Figure A.1 shows that the share of firms expecting more investment in the current financial year plummeted in 2020 due to COVID-19, but soon bounced back in 2021, almost doubling from around 20% to 39.9%, to around 40% in 2022 (solid black line). Figure A.1 also shows the trends by sector. Overall, firms in construction are those least likely to undertake more investment in any given year (except 2020 due to the pandemic). Firms in manufacturing and construction were those that did not experience significant rises in expected investment between 2021 and 2022. Still, the share of planned investments for manufacturing stays above pre-crisis level. Interestingly, firms in infrastructure and services appear to continue the positive changes in investment in 2022 compared with 2021, while firms in other sectors keep the share of previous year.

FIGURE A.1. SHARE OF FIRMS EXPECTING MORE INVESTMENT IN THE CURRENT FINANCIAL YEAR (%), 2016-2022

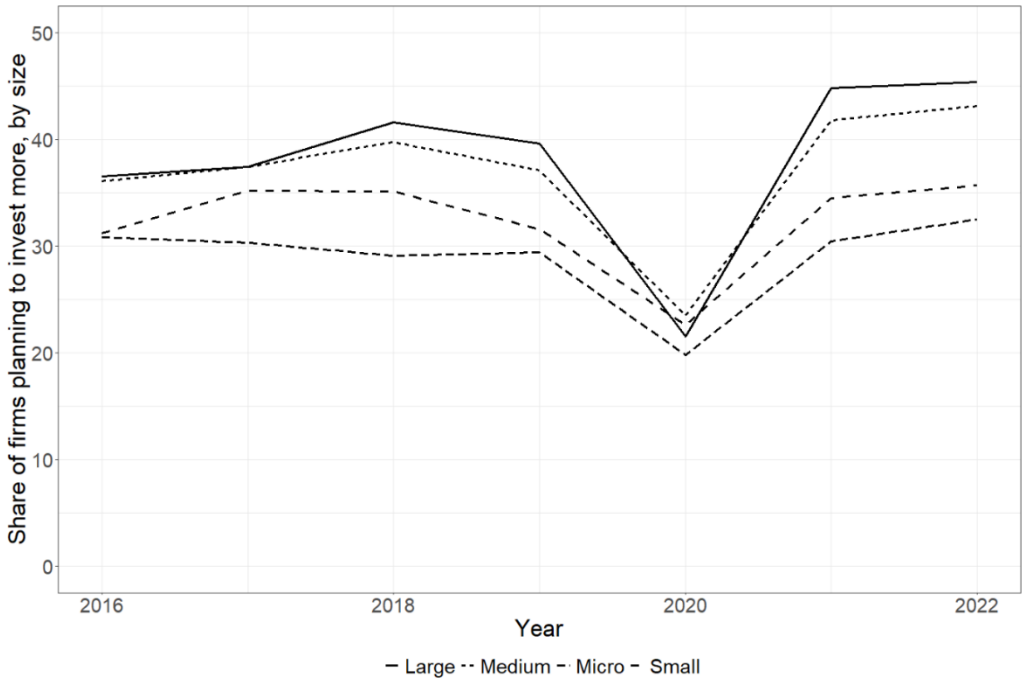


Source: Authors' elaboration based on EIBIS 2022 wave.

Note: All values are weighted by the value added provided by the surveyed firms.

Figure A.2 shows the trends by firm size. While overall medium-sized and large enterprises are those most likely to expect a positive change in investment, firms of all sizes reported expected increases in investment between 2021 and 2022. This positive change was largest among micro-firms and smallest for large firms (from 43.8% to 44.8%). Hence, despite the relative gain in investment for SMEs compared with large firms, the latter are still much more likely to undertake investment in absolute terms.

FIGURE A.2. SHARE OF FRIMS EXPECTING MORE INVESTMENT IN THE CURRENT FINANCIAL YEAR (%), BY FIRM SIZE, 2016-2022

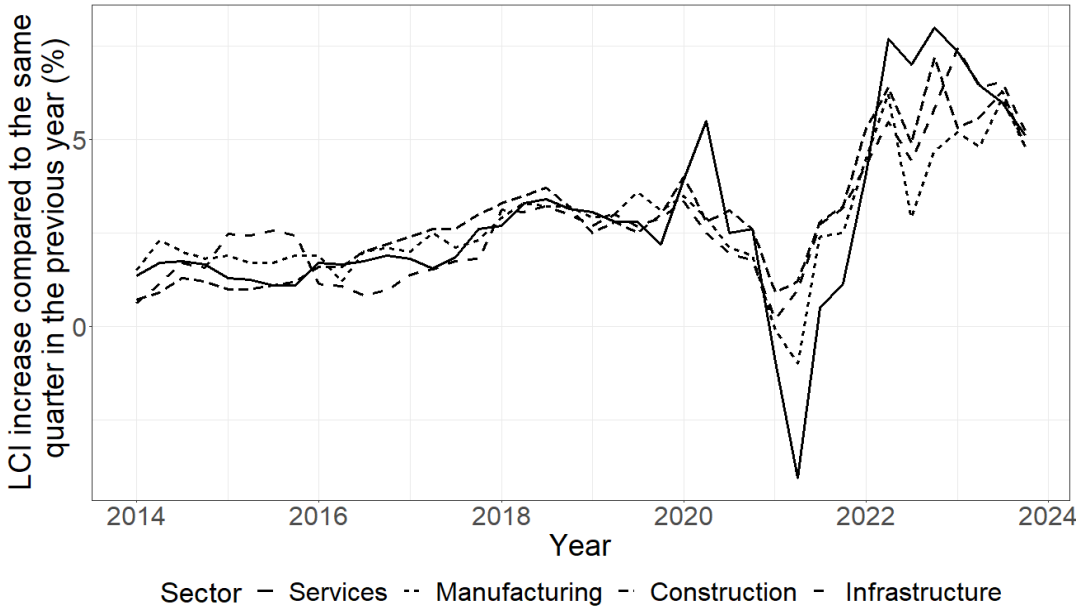


Source: Authors' elaboration based on EIBIS 2022 wave.

Note: All values are weighted by the value added provided by the surveyed firms.

Figure A.3 displays the trend in LCI (seasonally and calendar-adjusted) for all four sectors in the EU-27. The LCI rate was rather stable until 2020, where mass layoff due to the pandemic led to lower labour costs across all sectors, but especially in the services industry. LCI for the services sector increased the fastest as inflation hit, and were highest among all sectors for the entirety of 2022, before decreasing in 2023, as the labour market stabilised.

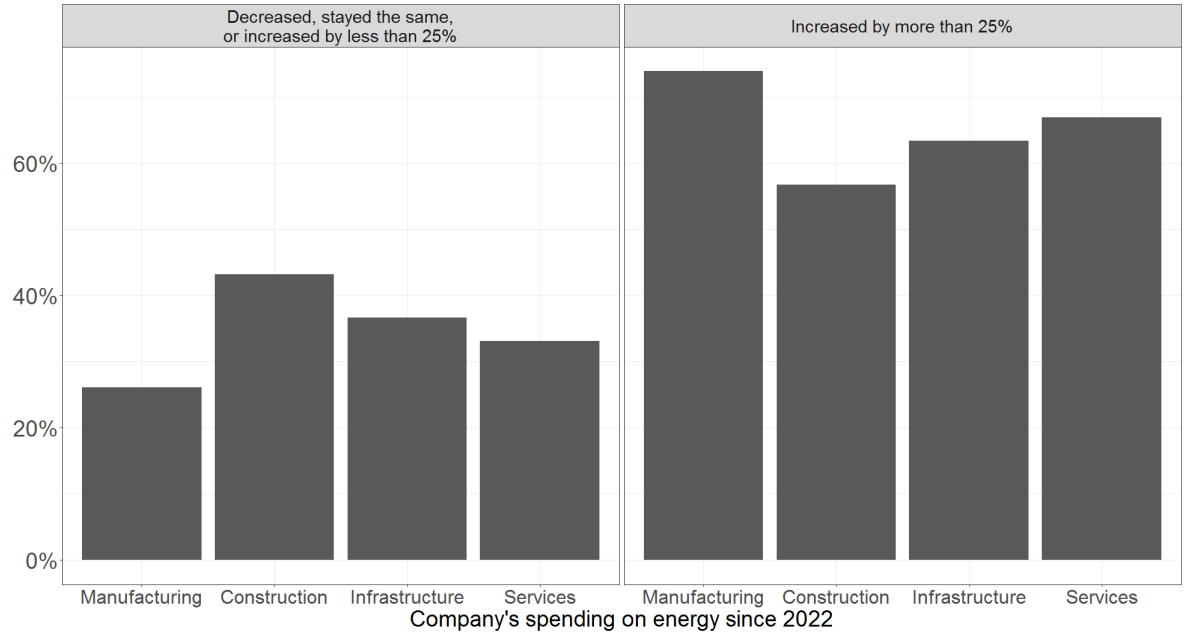
FIGURE A.3. LABOUR COST INDICES FOR THE MAIN ECONOMIC SECTORS IN THE EU-27, 2014-2023



Source: Authors' elaboration based on Eurostat table lc_lci_r2_q.

Figure A.4 below shows how much more companies are spending on energy since 2022 across all sectors – whether more than 25% compared to the previous year, or less than that (including decreased costs). The results suggest that the manufacturing sector was most affected due to the presence of several energy-intensive industries (e.g. chemicals, paper manufacturing, metallurgy, etc.), with 74% of surveyed firm stating that their energy costs increased by at least 25% compared with the previous year. Firms in infrastructure and services were also impacted by the energy price increases, whereas those in construction seems to have been affected the least, with a significantly higher share of firms seeing a *decrease* in energy spending compared with the other sectors.

FIGURE A.4. INCREASES IN COMPANIES' SPENDING ON ENERGY SINCE 2022 FOR ALL SECTORS



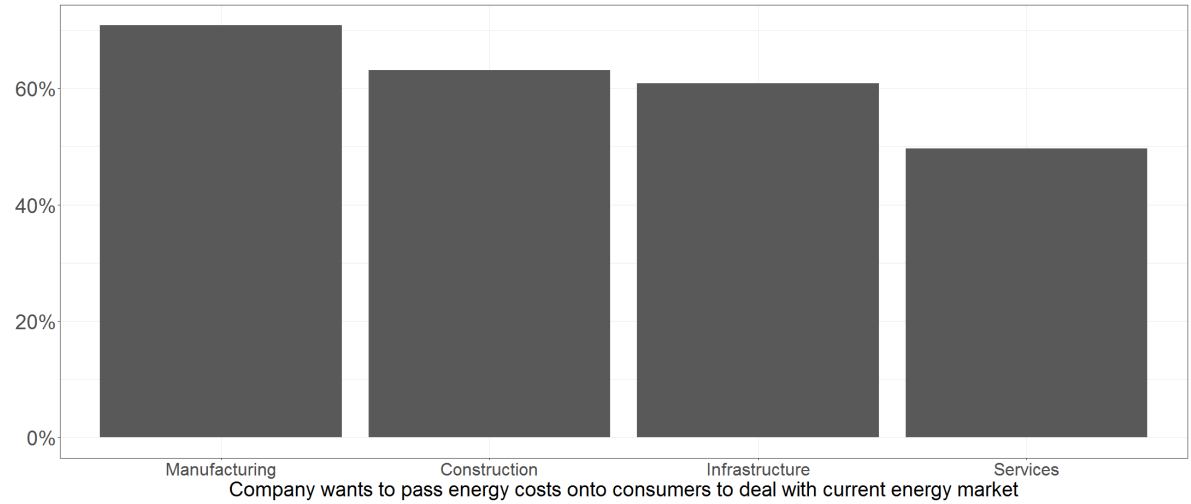
Source: Authors' elaboration based on EIBIS 2023 wave.

Note: All values are weighted by the value added provided by the surveyed firms.

Analyses from the 2023 EIBIS survey also suggest that a higher share of firms in manufacturing (71%) want to pass energy costs onto consumers as a strategy/priority to deal

with the current energy market, compared with other sectors – especially services, where only 51% of surveyed firms stated so (Figure A.5).

FIGURE A.5. SHARE OF COMPANIES WANTING TO PASS ENERGY COSTS ONTO CONSUMERS TO DEAL WITH THE CURRENT ENERGY MARKET, 2023



Source: Authors' elaboration based on EIBIS 2023 wave.

Note: All values are weighted by the value added provided by the surveyed firms.

Table A.1 below shows the descriptive statistics for both EIBIS and non-EIBIS variables.

TABLE A.1. DESCRIPTIVE STATISTICS OF VARIABLES EMPLOYED IN REGRESSION MODELLING

	N	MIN	MAX	MEAN (WEIGHTED)	SD
Non-EIBIS variables					
Inflation rate (%)	73, 168	-38.3	176.57	4.2	7.58
Inflation, categorical					
No inflation				15.14%	
Low inflation (reference)				56.24%	
Moderate inflation				17.1%	
High inflation				8.97%	
Very high inflation				2.54%	
GDP growth rate (%)	82,795	-11.3	13.6	2.54	3.88
Interest rates	82,795	-0.5	13	0.66	1.53

	N	MIN	MAX	MEAN (WEIGHTED)	SD
PTR	6,471	0.39	1.64	1	0.09
EIBIS variables					
Positive investment	82, 795	0	1	0.33 (35.24%)	0.47
Firm size	82,793				
Micro				21.42% (8.96%)	
Small				33.32% (20.88%)	
Medium				30% (21.78%)	
Large				15.28% (48.36%)	
Firm age	82,772				
Less than 2 years				0.42% (0.52%)	
Between 2 and 5 years				3.82% (2.45%)	
Between 5 and 10 years				10.48% (6.12%)	
Between 10 and 20 years				20.48% (16.84%)	
More than 20 years				60.8% (74.07%)	
Firm profit	80,868				
Profitable				78.23% (79.39%)	
Brake even				8.81% (7.66%)	
Loss				12.96% (12.95%)	
Lack of skilled staff a major obstacle	82, 193	0	1	0.48 (48.58%)	0.5
Uncertain economic future a major obstacle	81,355	0	1	0.42 (40.28%)	0.49
Firm is high-tech	82,795	0	1	0.14 (19.98%)	0.34
Expectations on external financing in next 12 months	75,752				
Improve				25.42% (23.96%)	
Stay the same				59.91% (12.45%)	
Deteriorate				14.66% (63.58%)	
Firm is financially constrained	78,410	0	1	0.09 (5.6%)	0.28

	N	MIN	MAX	MEAN (WEIGHTED)	SD
Sector	82,695				
Manufacturing				29.58% (37.93%)	
Construction				21.44% (8.47%)	
Services				25.15% (26.96%)	
Infrastructure				23.83% (26.62%)	

Source: Authors' elaboration from EIBIS 2022 wave and Eurostat data.
Note: EIBIS data in parentheses are weighted by value added.

Table A.2 presents the robustness models using real total investment in EUR (logged) as the dependent variable. Model 1 displays the results for all firms, while Models 2 and 3 re-run Model 1 for the SMEs and large firms' subsets. The findings are discussed in the main text.

TABLE A.2. LINEAR REGRESSION MODEL FOR REAL LOG(INVESTMENT) IN THE PREVIOUS FINANCIAL YEAR AS DEPENDENT VARIABLE

	MODEL 1	MODEL 2	MODEL 3
Lagged inflation rate, categorical (ref = Low inflation)			
No inflation	0.151***	0.140**	0.240***
	(0.037)	(0.046)	(0.069)
Moderate inflation	0.136**	0.112*	0.297**
	(0.047)	(0.055)	(0.104)
High inflation	0.321***	0.282**	0.363+
	(0.085)	(0.100)	(0.207)
Very high inflation	1.203***	1.585***	0.778*
	(0.174)	(0.217)	(0.348)
Firm size (ref = Large firm)			
Micro-firm	-6.065***		
	(0.048)		
Small firm	-4.398***		
	(0.040)		
Medium-sized firm	-2.300***		
	(0.036)		
Firm age (ref = More than 20 years)			
Less than 2 years	-0.276	-0.692**	-1.366+
	(0.251)	(0.272)	(0.805)
2-5 years	0.076	-0.781***	-0.381
	(0.078)	(0.085)	(0.255)
5-10 years	0.043	-0.683***	-0.441**
	(0.049)	(0.054)	(0.161)
10-20 years	-0.024	-0.488***	-0.315***
	(0.035)	(0.040)	(0.086)

	MODEL 1	MODEL 2	MODEL 3
Profitability (ref = Profit)			
Break even	-0.897***	-1.432***	-0.558***
	(0.056)	(0.063)	(0.152)
Loss	-1.125***	-1.271***	-0.537***
	(0.048)	(0.058)	(0.094)
Availability of skilled staff as a major obstacle	0.215***	0.250***	-0.041
	(0.028)	(0.034)	(0.057)
Uncertainty over the economic future as a major obstacle	-0.168***	-0.167***	-0.128*
	(0.031)	(0.030)	(0.061)
Firm is in high-tech sector	0.267***	0.336***	0.263***
	(0.040)	(0.053)	(0.063)
Expectations on external financing over the next 12 months (ref = Improve)			
Deteriorate	-0.184***	-0.350***	-0.200+
	(0.047)	(0.056)	(0.108)
Stay the same	-0.333***	-0.443***	-0.161*
	(0.032)	(0.038)	(0.065)
Firm is financially constrained	0.055	-0.124*	-0.044
	(0.049)	(0.056)	(0.134)
Lagged real GDP growth (%)	0.020**	0.015+	0.026
	(0.007)	(0.008)	(0.018)
Lagged interest rates	-0.145*	-0.111	-0.102
	(0.059)	(0.069)	(0.115)
Sector (ref = Manufacturing)			
Construction	-0.365***	-0.947***	-0.771***
	(0.041)	(0.048)	(0.105)
Infrastructure	0.249***	-0.186***	0.240**
	(0.040)	(0.049)	(0.076)
Services	-0.700***	-1.391***	-0.759***
	(0.041)	(0.049)	(0.079)
Country-fixed effects	X	X	X
Year-fixed effects	X	X	X
Num. Obs.	61864	52199	9665
R2	0.328	0.110	0.111
R2 Within	0.291	0.060	0.038
RMSE	3.33	3.70	2.65

Note: marginal effects presented. Heteroscedasticity-consistent robust errors in parentheses. + p < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001.

Table A.3 presents the results for the regression models used to build Figure 4, based on data from EIBIS 2023.

TABLE A.3. LOGISTIC REGRESSION MODELS FOR THE EFFECT OF PASS-THROUGH RATE OF ENERGY COSTS ON THE LIKELIHOOD OF UNDERTAKING MORE INVESTMENT, 2023 (FIGURE 4)

	MODEL 1	MODEL 2	MODEL 3
PTR energy costs	0.020+	0.026*	-0.013
	(0.010)	(0.011)	(0.030)
Firm size (ref = Micro-firm)			
Small firm	0.021		
	(0.014)		
Medium-sized firm	0.063***		
	(0.015)		
Large firm	0.083***		
	(0.018)		
Firm age (ref = 10-20 years)			
Less than 2 years	-0.035	-0.166	0.636*
	(0.094)	(0.102)	(0.252)
2-5 years	-0.029	-0.043	0.166
	(0.033)	(0.034)	(0.144)
5-10 years	0.019	0.016	0.002
	(0.020)	(0.021)	(0.079)
More than 20 years	-0.008	-0.007	0.052
	(0.013)	(0.013)	(0.042)
Profitability (ref = Loss or break)			
Profit > 10%	0.072***	0.066***	0.108*
	(0.016)	(0.017)	(0.048)
Profit < 10%	0.042**	0.040**	0.078*
	(0.013)	(0.014)	(0.040)
Availability of skilled staff as a major obstacle	0.033**	0.033**	0.011
	(0.011)	(0.011)	(0.030)
Uncertainty over the economic future as a major obstacle	-0.052***	-0.061***	0.002
	(0.011)	(0.012)	(0.031)
Firm is in high-tech sector	-0.009	-0.001	-0.029
	(0.015)	(0.017)	(0.037)
Expectations on external financing over the next 12 months (ref = Improve)			
Deteriorate	-0.175***	-0.185***	-0.123*
	(0.017)	(0.018)	(0.048)

	MODEL 1	MODEL 2	MODEL 3
Stay the same	-0.173***	-0.183***	-0.104**
	(0.014)	(0.015)	(0.039)
Firm is financially constrained	0.033+	0.029	0.058
	(0.018)	(0.019)	(0.061)
Sector (ref = Manufacturing)			
Construction	-0.060***	-0.083***	-0.031
	(0.015)	(0.016)	(0.055)
Infrastructure	0.029*	-0.009	0.169***
	(0.014)	(0.015)	(0.036)
Services	0.004	-0.016	0.034
	(0.014)	(0.015)	(0.040)
Country-fixed effects	X	X	X
Num. Obs.	9058	7765	1293
AIC	11941.6	10140.3	1835.0
BIC	12268.8	10439.5	2057.1
Log-likelihood	-5924.8	-5027.2	-874.5
Pseudo-R2	0.031	0.032	0.042

Note: marginal effects presented. Standard errors in parentheses. + p < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001.

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