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Is Inflation Good for Business?

The Firm-Level Impact of Inflation Shocks in the Baltics, 1997-2021

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ABSTRACT: Using a large panel of firm-level data, this paper provides an analysis of how inflation shocks in the Baltics between 1997 and 2021 affected total factor productivity (TFP), gross profitability, and net fixed investment in nonfinancial sectors. First, we find that inflation and inflation volatility had mixed effects on TFP growth, profitability and net fixed investment in the first year as well as over the medium term, albeit at a dissipating rate. Second, focusing on subsamples, we find that inflation shocks had differential effects on large *versus* small firms. Third, we explore sectoral heterogeneity in how firms responded to inflation shocks and observe significant variation across tradable and non-tradable sectors. Finally, estimates from a state-dependent model suggest that firms' response to inflation shocks varied with the state of the economy. The results suggest that nonfinancial firms in the Baltics have been agile in adjusting to inflation shocks, possibly by either transferring higher production costs to consumers or substituting inputs. Given the differences in the level and nature of the recent inflation shock and the sample period on which our analysis is based, empirical findings presented in this paper might not necessarily apply to the latest bout of inflation in the Baltics.

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WORKING PAPERS

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I. Introduction

The world economy experienced the worst inflation shock since the 1970s due to a plethora of unprecedented developments.[1] Consumer price inflation in the euro area peaked at 19.4 percent in 2022, with significant heterogeneity across countries—5.9 percent in France *versus* an average of 18.5 percent in the Baltics. While inflation in the eurozone is now on the decline, the question arises whether the episode will impact the economy in the longer term. To shed light on this issue, we use a large panel of firm-level data from 1997 to 2021 in Baltic countries and analyze the impact of inflation shocks on total factor productivity (TFP) growth, gross profitability and net fixed investment in nonfinancial sectors of the economy.

We estimate the effects of inflation with standard panel regression techniques, but our main empirical focus is to investigate the dynamic impact of inflation shocks on firm performance and behavior by applying the local projection (LP) method developed by Jordà (2005). Estimating impulse response functions (IRFs) directly from local projections, which accommodates a panel structure and does not constrain the shape of IRFs, we first trace out how TFP growth, gross profitability, and net fixed investment spending responds to inflation shocks to establish a baseline analysis of the full sample of nonfinancial firms in the Baltics. We then study the heterogeneity of these effects across 18 sectors and different types of firms in our sample to obtain a more granular analysis.

Our empirical findings suggest, first, that inflation shocks during the 1997-2021 period had, on average, a marginally positive impact on TFP growth, profitability, and net fixed investment in the first year after the shock as well as over the medium term, albeit at a dissipating rate. Second, we find that inflation shocks have differential effects on large *vs*. small nonfinancial firms. Third, we explore sectoral heterogeneity in how firms respond to inflation shocks and observe significant variation across tradable and non-tradable sectors. Finally, we develop a more granular analysis by estimating a state-dependent model and find that firms' response to inflation shocks vary depending on whether an economy is in expansion or recession.

Overall, the analysis presented in this paper indicates that nonfinancial firms in the Baltics have been agile in making resource reallocations and financial adjustments when faced with relatively moderate inflation shocks, possibly by either transferring higher production costs to consumers or substituting inputs. Higher profitability helped to increase fixed investment spending, which in turn lead to a permanent increase in the efficiency with which productive factors are put to use. These firm-level findings from the Baltics are consistent with recent evidence from the euro area, where profitability increased during a period of rising inflation.

However, these results do not necessarily extend to the recent bout of inflation. The recent inflationary episode brought record-high inflation rates linked to large supply shocks (first related to the pandemic and then to the energy crisis following Russia's war in Ukraine) and large shifts in consumer demand between services and goods. In contrast, the sample period 1997–2021 used in this analysis comprised a disinflationary period following a complex transition to a market economy and low and stable inflation in the runup to European Union (EU) accession in 2004, interrupted by a brief but intensive period of macroeconomic imbalances around to the global financial crisis (GFC) in 2008. This suggests caution in extending the generally benign firm-level effects of inflation shocks found in the analyses presented in this paper to the recent period.

[1] For an overview and analysis of post-pandemic inflation developments, please see Binici *et al*. (2022) and Celasun *et al*. (2022).

II. Literature Review

There is an extensive literature on the determinants of corporate performance and investment dynamics, focusing on the role of firm- and sector-specific factors, such as age, size, profitability, and asset tangibility (Baker and Wurgler, 2002; Booth *et al*., 2001; De Angelo and Roll, 2015; Frank and Goyal, 2009; Graham, Leary, and Roberts, 2015; Gungoraydinoglu and Öztekin, 2011; Harris and Raviv, 1991; Lemmon *et al*., 2008; Myers, 1984; Öztekin, 2015; Titman and Wessels, 1998). Another branch of the literature, consistent with standard models of factor demand, focuses on output and the cost of capital (Hall and Jorgenson, 1967; Auerbach, 1983; King and Fullerton, 1984; Auerbach and Hassett, 1992), and models capital formation as a function of expected future profitability, leverage and financing constraints (Summers, 1981; Hayashi, 1982; Hubbard, 1998; Kalemli-Özcan, Laeven and Moreno, 2019). This paper, however, belongs more to a broader strand of the literature that connects corporate performance to country-specific macroeconomic and institutional developments, along with firm characteristics (Borio, 1990; Rajan and Zingales, 1995; Kayo and Kimura, 2011; Cevik and Miryugin, 2018; Cevik and Miryugin, 2022).

The impact of inflation on growth and productivity has long been a critical issue in macroeconomics. Kormendi and Meguire (1985), Smyth (1992), De Gregorio (1993), Fischer (1993), Barro (1995), and Bullard and Keating (1995) show an unambiguously negative relationship between inflation and economic growth. Analyzing the experience of OECD countries, Andres and Hernando (1997) find that even low or moderate inflation rates have a temporary negative impact on growth rates, leading to significant and permanent reductions in per capita income. Bruno and Easterly (1998), on the other hand, argue that there is no cross-sectional correlation between long-run averages of inflation and growth and that the negative impact of inflation on growth occurs only with extreme inflation observations. In a similar vein, Faria and Carneiro (2001) find that high inflation does not affect real output in the long-run, but has a negative effect on short-run growth dynamics in the case of Brazil. Using high-frequency data covering Canada, Italy, the UK and the US, Mallick and Mohsin (2010) show that inflation, both in the short and long term, negatively affects consumption and investment. With a larger sample of countries, Lopez-Villavicencio and Mignon (2011) and Kremer, Bick, and Nautz (2013) investigate the growth effects of inflation and obtain robust evidence that there is a threshold beyond which inflation exerts a negative impact on economic growth.

The impact of inflation on firms is more nuanced than its macroeconomic effects, but there is still evidence that high and volatile inflation is detrimental to firm performance. Lins and Duncan (1980) document that inflation has varying effects over the short- and long-term on the financial wellbeing of nonfinancial businesses. Benabou (1992), Batini, Jackson, and Nickell (2000), Banerjee, Cockerell, and Russell (2001) show that there is a negative relationship between inflation and the markup, while Wu and Zhang (2001) estimate that inflation reduces the number of firms and each firm's size. Rising costs and greater uncertainty, especially associated with high and volatile inflation, could undermine competitiveness and profitability and reduce firms' appetite for new fixed investment in the long run. Mishkin (2007) finds that high inflation discourages firms to invest in additional facilities and equipment, which is consistent with evidence indicating that macroeconomic instability contributes to business failures (Bhattacharjee *et al*., 2008). In this context, our contribution to the literature is to provide an empirical analysis of how inflation shocks during a period of low and stable inflation affect the performance of nonfinancial firms in a group of countries that have maintained an impressive rate of convergence towards the average EU per capita income over the past three decades.

III. Data Overview

We obtain harmonized firm-level financial data, including balance sheets and income statements on nonfinancial companies in the Baltic countries from the Orbis database compiled by Bureau van Dijk Electronic Publishing. Unlike administrative firm-level databases, Orbis provides a comparable coverage of both public (listed) and private (non-listed) firms including small and medium-sized enterprises. However, similar to any other large-scale micro dataset, the Orbis data require careful management to ensure consistency and comparability across firms and countries and over time. Following the data cleaning principles suggested by Gal (2013), Kalemli-Özcan *et al*. (2015) and Diez, Fan, and Villegas-Sanchez (2021), we drop observations where total assets, tangible fixed assets, employment, operating revenue, sales and short-term loans and long-term debt in any given year are missing or negative, and where total assets are not equal to total liabilities and equity. After these steps, we obtain an unbalanced panel of 107,282 firms with a total of 629,089 firm-year observations from Estonia, Latvia and Lithuania during the period 1997–2021.[2]

Our firm-level dependent variables are (i) productivity (measured by TFP growth, which is estimated according to the Levinsohn-Petrin (2003) approach), (ii) gross profitability (measured by the ratio of profit before taxes to total assets in the preceding period), and (iii) net fixed investment (measured by the difference between tangible assets in the current period and those in the previous period scaled by total assets at the end of the previous year). To capture firm characteristics, we include several key firm characteristics, such as firm size (measured as the logarithm of total assets), leverage (as measured by the sum of short-term loans and long-term debt scaled by total assets) cash flow (measured by the ratio of cash flow to total assets), asset tangibility (measured by tangible fixed assets to total assets), and sales growth (measured by the annual rate of change in sales).

Our main independent variable is inflation shocks. Consumer price inflation is computed on an annual basis as the year-on-year percentage change in the CPI as follows:

$$\pi_{c,t} = \left(\frac{CPI_{c,t}}{CPI_{c,t-12}}\right) * 100$$

where $\pi_{c,t}$ denotes headline inflation in country *c* at time *t*. The time series are drawn from Eurostat. We use the standard deviation of the annual rate of inflation as our measure of inflation shocks.

Our data extends over a lengthy period of transition in the Baltics, containing economic booms and downturns. This coverage of various stages of the business cycle enriches the empirical analysis, but also necessitates the inclusion of country-specific information (real GDP per capita, trade openness measured by the sum of exports and imports in GDP, financial development measured by domestic credit to the private sector as a share of GDP and measures of institutional development) as control variables, which help account for economic and structural convergence since independence. We draw the macroeconomic series from the IMF and the World Bank, and the bureaucratic quality index from the International Country Risk Guide (ICRG) database.

[2] According to the *Nomenclature des Activités Économiques dans la Communauté Européenne* (NACE) classification of economic activities, most of the nonfinancial firms operate in the wholesale and retail trade sector, accounting for over 22.9 percent of our sample, followed by construction with 11.2 percent and manufacturing with 10.9 percent. These three sectors cover about 60 percent of employment in three Baltic countries.

Descriptive statistics of all variables for the entire sample are presented in Table 1. There are large variations in firm performance, as measured by TFP growth, gross profitability, and net fixed investment, and key firm characteristics used in the empirical analysis across sectors and type of firms, as well as in macroeconomic, financial and institutional conditions across countries and sectors and over time. It is therefore essential to analyze the time-series properties of the data to avoid spurious results by conducting panel unit root tests. We check the stationarity of all variables by applying the Im-Pesaran-Shin (2003) procedure, which is widely used in the empirical literature to conduct a panel unit root test. The results, available upon request, indicate that the variables used in the analysis are stationary after logarithmic transformation or upon first differencing.

Table 1. Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Inflation:					
Inflation	518,795	2.26	2.45	-1.22	15.25
Inflation Volatility	518,795	2.16	1.14	0.01	7.52
Firm-level dependent variables:					
Total Factor Productivity Growth	463,815	0.00	0.31	-4.62	4.21
Gross Profitability	518,786	17.27	132.75	-9675.28	20786.14
Net Fixed Investment	518,795	3.61	25.13	-99.55	197.48
Firm-level control variables:					
Total Assets*	518,795	12.03	2.12	2.03	21.72
Leverage	518,795	52.69	641.94	0.00	190878.30
Sales Growth	517,290	0.58	20.19	-1.00	5669.33
Macroeconomic control variables:					
Real GDP growth	518,795	3.12	3.80	-14.84	11.97
Real GDP per capita	518,795	9.50	0.17	8.54	9.81
Trade Openness	518,795	129.86	15.42	79.87	170.76
Bureaucratic Quality	518,483	2.53	0.11	2.00	3.00
Corruption Index	518,483	3.00	0.59	2.00	5.00

* Variable is in logarithmic form.
Source: Authors' calculations.

IV. Econometric Strategy

The objective of this paper is to analyze how inflation shocks affect TFP growth, profitability, and net fixed investment in a large panel of more than 107,282 nonfinancial firms in three Baltic countries during the period 1997-2021. To do this, we resort to panel regressions using (i) panel fixed effects estimations to estimate the impact of inflation and inflation volatility and (ii) the semi-parametric LP technique to estimate the dynamic effects of inflation shocks over the short and long term. First, the panel fixed effects estimation tries to identify the impact of both contemporaneous and lagged inflation rate and inflation volatility on firm performance, controlling for firm fixed effects, time fixed effects, firm characteristics, and macroeconomic conditions. The baseline specification is as follow:

$$y_{f,s,c,t} = \beta_1 \pi_{c,t-1} + \beta_2 \pi_{c,t} + \theta firm_{f,s,c,t-1} + \omega macro_{c,t-1} + \eta_f + \eta_{s,t} + \eta_{c,s} + \varepsilon_{f,s,c,t} \quad (1)$$

in which the subscripts *f, s*, *c*, and *t* denote firm, sector, country, and time, respectively. The dependent variable, y, is the dependent variable of interest (TFP growth, profitability, and net fixed investment). $\pi_{c,t}$ denotes the level or volatility of inflation. The term $firm_{f,s,c,t}$ is a set a of firm-level control variables, including size, leverage, asset tangibility, cash flow, and sales growth, while the term $macro$ denotes a set of macroeconomic control variables including real GDP per capita, trade openness, and an index of bureaucracy quality. The η_f coefficient denotes the firm-specific fixed effects capturing time-invariant unobservable factors. The $\eta_{s,t}$ coefficient denotes the set of sector-year fixed effects capturing unobserved time-invariant heterogeneity among firms across sectors, and common shocks to firms belonging to the same sector in a given year. This helps control for aggregate and sectoral demand or policy-induced shocks, as well as cross-sectional dependence among firms in our sample. Furthermore, including sector-year fixed effects allows us to interpret the coefficient on, for example, the leverage ratio as the effect of higher indebtedness relative to a firm's sector peers at time *t*. This is an important consideration since some sectors are more highly leveraged than others, with differing investment patterns. The $\eta_{c,s}$ coefficient does the same for country-sector groups. As a result, without sector-country and sector-year fixed effects, the results would only reflect average investment patterns in more leveraged sectors. Finally, $\varepsilon_{f,s,c,t}$ is an idiosyncratic error term. Robust standard errors are clustered at the country-industry-level to account for the fact that observations pertaining to firms within an industry in a specific country are correlated and thus do not contain as much information as unclustered errors.

Second, we apply the LP method, which is less sensitive to misspecification compared to conventional vector autoregressive (VAR) models (Auerbach and Gorodnichenko, 2013; Jordà and Taylor, 2016; Ramey and Zubairy, 2018; Romer and Romer, 2019). Accordingly, we use the following baseline specification in a panel setting:

$$y_{f,s,c,t+k} - y_{f,s,c,t-1} = \alpha_f + \gamma_s + \delta_c + \mu_t + \beta_k is_{c,t} + \theta firm_{f,s,c,t} + \varepsilon_{c,t} \quad (2)$$

in which y is the dependent variable of interest as described above. β_k denotes the (cumulative) response of the firm-level variable in each *k* year after an inflation shock. The α_f, γ_s, δ_c and μ_t coefficients denote the time-invariant firm-, sector-, and country-specific effects and global developments that are common across all countries in a given year, respectively. $is_{c,t}$ denotes a measure of inflation shocks as defined above. $firm_{c,t}$ is a set a of firm-level control variables, including size, leverage, asset tangibility, cash flow, and sales growth. In estimating the impact on net fixed investment, we also include TFP growth and profitability along with other firm-level variables. As an alternative specification—and to obtain a more detailed information on country-

specific features—we replace country fixed-effects with macroeconomic and institutional variables, including real GDP per capita, trade openness, financial development, and a measure of institutional quality, which account for economic and structural convergence since independence. $\varepsilon_{i,t}$ is the idiosyncratic error term. As suggested by Teulings and Zubanov (2014), we also include leads of the inflation variable in the model to control for inflation shocks that occur in the horizon of the local projection. IRFs are then obtained by plotting the estimated β_k for *k*= 0,1,..4 with 90 percent confidence bands computed using the respective standard errors.[3] To account for possible heteroskedasticities, the equation is estimated using Ordinary Least Squares (OLS) with Spatial Correlation Consistent (SCC) standard errors as proposed by Driscoll and Kraay (1998).

We also explore whether the state of the economy at the time of the inflation shock influences the firm-level impact of the shock. The LP estimation of nonlinear effects is similar to the smooth transition autoregressive (STAR) model proposed by Granger and Terasvirta (1993).[4] Accordingly, the augmented LP model takes the following form:

$$y_{i,t+k} - y_{i,t-1} = \alpha_f + \gamma_s + \delta_c + \mu_t + \beta_k^K F(z_{i,t}) is_{i,t} + \beta_k^L [1 - F(z_{i,t})] is_{i,t} + \theta firm_{i,t} + \varepsilon_{i,t} \quad (3)$$

$$\text{with } F(z_{i,t}) = \frac{\exp(-\gamma z_{i,t})}{1+\exp(-\gamma z_{i,t})}, \gamma > 0$$

in which $z_{i,t}$ denotes the state of the economy as measured by the output gap estimate that is normalized to have zero mean and unit variance.[5] The coefficients β_h^K and β_h^L capture the impact of inflation shocks on corporate performance at each horizon h in case of recessions ($F(z_{i,t}) \approx 1$ when z goes to minus infinity) and expansions ($[1 - F(z_{i,t})] \approx 1$ when z goes to plus infinity), respectively. This allows us to capture state-dependent nonlinear effects of inflation shocks according to the cyclical position of the economy.

V. Empirical Results

Our panel regressions results, presented in Table 2, indicate that while contemporaneous inflation has virtually no effect on TFP growth, lagged inflation has a small negative effect on TFP growth, with a 1 percentage point increase in the level of inflation is, on average, associated with a 0.004 percentage point decrease in TFP growth in the Baltics. However, higher levels of inflation are associated with higher profitability and net fixed investment among nonfinancial firms—a 1 percentage point increase in inflation leading to an increase of 0.6 and 0.4 percentage points in profitability and net fixed investment, respectively. We also investigate the impact of inflation volatility, measured by the standard deviation of headline inflation, on firm performance. As presented in Table 3, we find that contemporaneous inflation volatility tends to have very small negative but insignificant impact on firms' TFP growth at 0.01 percent while the impact on profitability is larger at 1.2 percent. But lagged inflation volatility has positive and statistically significant impact on TFP growth and

[3] Another advantage of the LP method compared to vector autoregression (autoregressive distributed lag) specifications is that the computation of confidence bands does not require Monte Carlo simulations or asymptotic approximations. One limitation, however, is that confidence bands at longer horizons tend to be wider than those estimated in vector autoregression specifications.

[4] Using such a STAR function in such empirical setups is not new. Auerbach and Gorodnichenko (2013) and Abiad, Furceri, and Topalova (2016) employ a similar approach to look at nonlinear effects of monetary and fiscal shocks.

[5] The weights assigned to each regime vary between 0 and 1 according to the weighting function F(.), so that $F(z_{i,t})$ can be interpreted as the probability of being in a given economic state—boom or bust.

profitability, suggesting firms' ability to adjust to the inflation shocks in a relatively short time when hit by inflation shocks.

Our findings indicate that higher inflation is associated with an acceleration in net investment growth. This shift in corporate behavior, in our view, suggests that companies tend to transition from relatively more labor-intensive to more capital-intensive production methods, as a strategy to mitigate the likely elevated cost of labor due to higher inflation. Furthermore, it is worth noting that firm profitability tends to improve during periods of high inflation, which may be attributed to the market power held by these firms, enabling them to pass on the increased costs to consumers through additional markups. Conversely, higher inflation appears to correlate with marginally lower productivity, which may reflect the increase in input expenses and the substitution of input factors, potentially resulting in a less efficient input matrix.

After presenting panel regressions, our main empirical focus is on the dynamic impact of inflation shocks on firm performance using the LP method. In Figure 1, we present the baseline IRFs of three measures of corporate performance—productivity, profitability, and net fixed investment—to an inflation shock measured by standard deviation changes in headline inflation, together with 90 percent confidence bands. First, we find that the average impact of inflation shocks is positive and statistically significant on the performance of nonfinancial firms in the Baltics. A one standard deviation shock to inflation is typically associated with an increase of 0.003 percentage points in TFP growth, and negligible impact on profitability and net fixed investment in the first year after the shock. The impact from inflation shock on all performance measures peak in the second year since the initial shock—0.008, 1.5 and 0.75 percentage points on TFP growth, profitability, and net fixed investment respectively. Second, we find that the effects on TFP growth and net fixed investment remain persistent over the long run, resulting in a cumulative increase of 0.03 percentage points in productivity, 1.7 percentage points in net fixed investment spending during the five-year period after the inflation shock hits. Third, the pattern of responses to inflation shocks in our sample varies over time:

- The cumulative response of TFP growth peaks at about 0.008 percentage points in the second year after the shock. Although it dissipates over the long run, the overall impact remains positive. This reflects a complex process through which firms make capital and labor adjustments to strengthen productivity against inflation shocks in order to maintain financial performance.
  The cumulative response of profitability peaks at about 1.5 percentage points in the second year after the shock and subsequently dissipates over the long run. This is in part an indication of higher productivity translating into higher profitability. It also suggests that firms can likely transfer the high costs, with lags, to consumers and even increase the markup to increase their profitability in the short run, but in longer terms, inflation shock has overall zero effect on the average profitability of nonfinancial firms in general.
- The cumulative response of fixed investment peaks at about 0.75 percentage points in the second year after the shock and fluctuate around that level over the medium term. This indicates a long-lasting impact on fixed investment, which in turn has a positive effect on TFP growth.

Altogether, these findings suggest that nonfinancial firms in Baltic countries are agile in making adjustments to inflation shocks, possibly by either transferring the costs to consumers and/or substituting factors of production. The consequential higher profitability induces higher fixed investment spending, which in term leads to a permanent increase in the efficiency with which productive factors are put to use.

Table 2. Firm-Level Impact of Inflation

Variables	TFP	Profitability	Net Fixed Investment
Inflation	0.001	0.604***	0.357***
	(0.001)	(0.221)	(0.056)
Lagged Inflation	-0.005***	-0.425*	0.0389
	(0.001)	(0.219)	(0.056)
Total Assets	0.096***	54.61***	24.80***
	(0.001)	(0.423)	(0.108)
Leverage	0.000***	0.006***	0.001***
	(0.000)	(0.000)	(0.000)
Sales Growth	0.000***	0.190***	0.001
	(0.000)	(0.018)	(0.005)
Trade Openness	0.000*	-0.129*	-0.007
	(0.000)	(0.071)	(0.018)
Real GDP per capita	0.363***	56.36***	30.79***
	(0.061)	(19.72)	(5.021)
Bureaucratic Quality	0.019**	10.05***	-1.508**
	(0.008)	(2.638)	(0.672)
Observations	379,502	379,502	379,502
R-squared	0.024	0.074	0.217
Number of firms	81,797	81,797	81,797

Standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

We conduct several robustness checks to verify our baseline findings and obtain a more nuanced picture of how inflation shocks affect the performance of nonfinancial firms. First, we estimate the model for subsamples of small and large firms.[6] Second, we estimate the model for different sectors with a focus on tradable and non-tradable industries to explore the heterogenous impact of inflation shocks on TFP growth, profitability, and net fixed investment.

We exploit firm-level heterogeneity and find that smaller firms react more than larger firms to inflation shocks in profitability and net fixed investments. As presented in Figure 2, both the patterns and magnitude of impulse responses show variation across firm sizes. First, the impact of inflation shocks on TFP growth is around zero throughout the medium term, but it is positive and statistically significant for larger firms within the first four years after the initial inflation shock. Second, when inflation volatility is higher than normal times, the average profitability of nonfinancial firms tends to increase marginally, but this effect is more pronounced for larger firms

[9] Small and large firms are defined as those whose total assets are below 25th percentile or above 75th percentile threshold, respectively.

Table 3. Firm-Level Impact of Inflation Volatility

Variables	TFP	Profitability	Net Fixed Investment
Inflation Volatility	0.007***	1.192***	-0.003
	(0.0012)	(0.356)	(0.101)
Lagged Inflation Volatility	0.004***	0.850**	0.233**
	(0.001)	(0.344)	(0.098)
Total Assets	0.100***	52.92***	25.78***
	(0.002)	(0.451)	(0.128)
Leverage	0.000***	0.020***	0.001***
	(0.000)	(0.000)	(0.000)
Sales Growth	0.000***	0.105***	0.011**
	(0.000)	(0.019)	(0.005)
Trade Openness	0.000	-0.145*	-0.033
	(0.000)	(0.074)	(0.021)
Real GDP per capita	0.217***	49.96**	33.48***
	(0.069)	(20.35)	(5.779)
Bureaucratic Quality	0.0141	7.727***	-0.342
	(0.009)	(2.604)	(0.739)
Observations	284,430	284,430	284,430
R-squared	0.026	0.095	0.223
Number of firms	64,325	64,325	64,325

Note: Standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

in the second and the third year after the shock, with the impact diminishes to virtually zero over the medium term among firms of all sizes. Third, interestingly, both small and large firms' net fixed investments fluctuate around zero in the first four years after the shock, but small firms net fixed investment picks up by the end of the projection period.

We also focus on sectoral differences in the way nonfinancial firms respond to inflation shocks by estimating the model separately for tradable and non-tradable industries.[7] As presented in Figure 3, firms in the tradable sector respond positively to inflation shocks in all three performance measures, whereas firms in the non-tradable sector only show significant responses in TFP growth and profitability in the second-year post-inflation-shock. After a year of the initial inflation shock, tradable firms show higher level of profits, which in turn lead to higher net investments, which eventually result in higher productivity—similar to the average patterns found

[7] In addition to our main analyses, we performed the same study focusing on more specific subsectors. For brevity's sake, we do not present the estimation results for 18 nonfinancial subsectors, which are broadly similar to the baseline results.

among all firms. In the non-tradeable sector, on the other hand, firms do not exhibit significant response to inflation shocks, with marginal impacts on TFP growth and profitability in the second year and miniscule increases over the medium term.

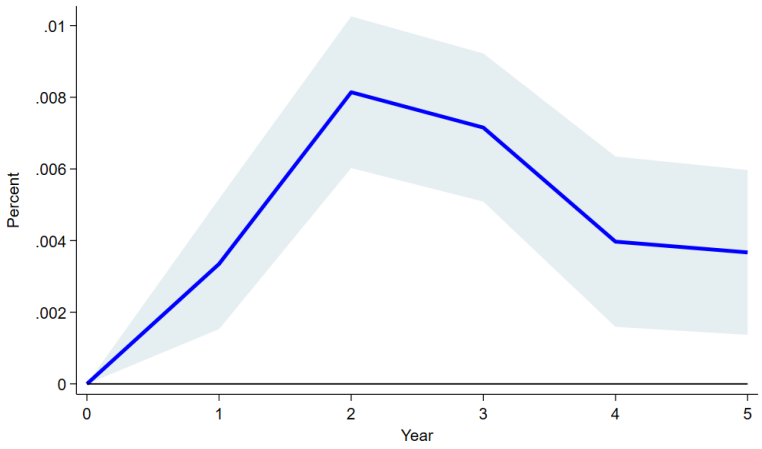
We also explore whether firms' response to inflation shocks varies with the state of the economy at the time of the shock (i.e., during periods of expansion vs. recession). These estimations, presented in Figure 4, show that nonfinancial firms respond to inflation shocks differently depending on state of the economy—defined in this paper as "good" and "bad" according to the output gap. During "bad" times, firms do not respond immediately to an inflation shock, given the statistically insignificant impulse response in the first year. After that, however, we observe that profitability is negatively impacted by the inflation shocks, followed by a return to positive terrain in the third year. This increase in profitability is likely driven by the positive impulse response of TFP growth three years after the initial inflation shock. In our view, this reflects a number of factors. First, a higher-than-expected inflation during recession could further reduce the profitability of firms. Second, the "purging effect" of inflation shocks is likely to be pronounced during recessions and force firms with lower profitability to go out of business in the first two years after the shock. In other words, unproductive firms would leave the market when an inflation shock hits during "bad" times, leaving behind firms with higher productivity and profitability and TFP growth, which are more likely to invest as they gain larger market share.

This sectoral heterogeneity in how firms respond to inflation shocks supports the hypothesis that Baltic countries are converging towards the average level of productivity in the EU, with support from higher productivity growth in the tradable sector. The heterogeneous responses of firms across sectors are related to firms' ability in input substitution in response to the inflation shocks and the cause of inflation shocks. First, if the inflation shock is domestic or demand driven, the differences in profitability growth across sectors could be driven by firms' ability in input substitution as well as their need to stay competitive by investing. Relative to non-tradable sectors, firms in the tradable sector are less labor intensive, and thus more flexible in their choice of inputs when high inflation hits. Second, if the inflation shock is driven by imports, such as commodity price shock, the higher world price level could potentially increase the profit margin for exporters in the Baltics. In any case, when an inflation shock arrives, the higher production costs potentially make the tradable firms less competitive in the international market. The worsened competitiveness incentivizes tradable firms to invest more to increase TFP growth and profitability.

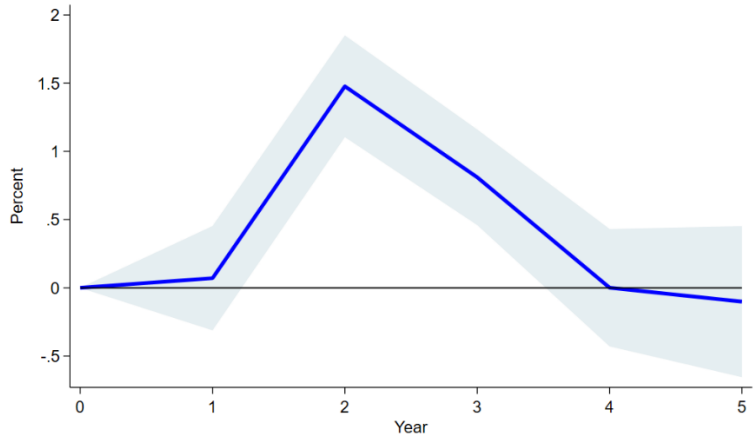
In contrast to the somewhat positive longer-term consequences from the inflation shock in a "bad" states, the response of firms to an inflation shock during "good" times show an optimistic picture in the short run but a more pessimistic picture in the medium run. Firms show immediate positive response in profitability and TFP growth, followed by net fixed investment. However, three years after the initial shock, all the initial positive impact nullified if not become negative, as shown in Figure 4. In our view, the initial positive effects are likely to reflect the high demand and firms' ability to transfer the high costs to consumers. The increased profitability initially results in higher fixed investment. Over time, however, as input costs continue to rise and more firms enter the market, attracted by the high profits, the firms begin to lose their market power. This shift leads to a decrease in profitability, followed by reductions in net investment and productivity. Therefore, inflation shocks during a "good" time seem contribute to worse nonfinancial firm performance in the Baltics over the medium term.

Figure 1. Inflation Shocks and Corporate Performance: Small vs. Large Firms

Total Factor Productivity



Profitability



Net Fixed Investment

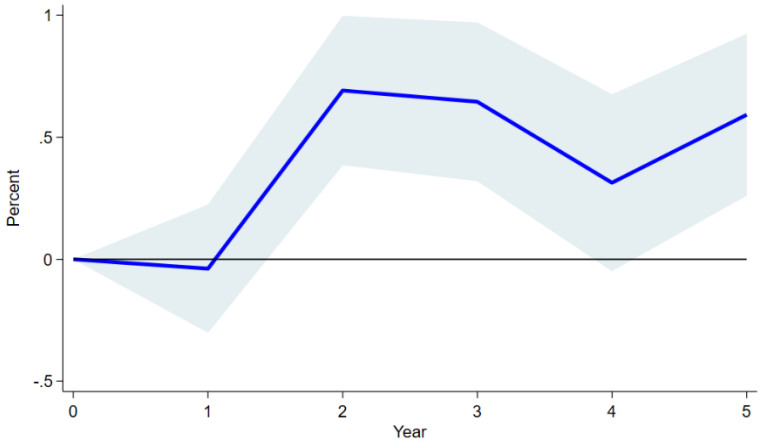
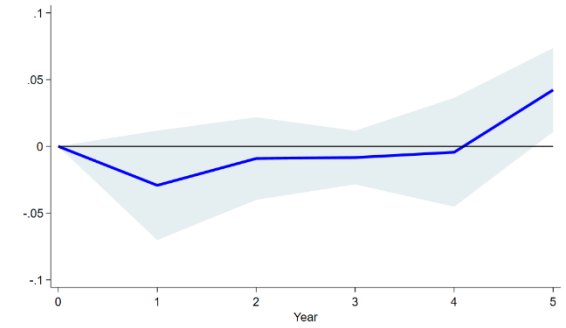
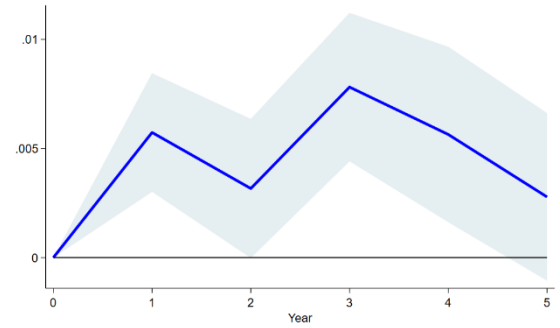


Figure 2. Inflation Shocks and Corporate Performance: Small vs. Large Firms

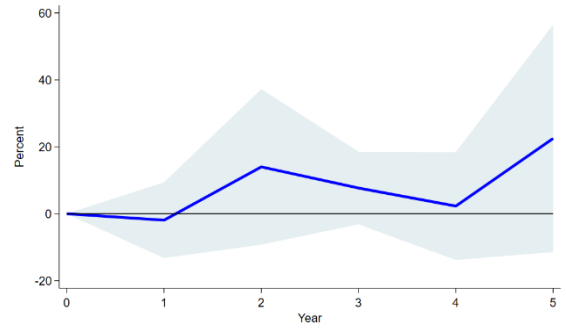
Total Factor Productivity – Small firms



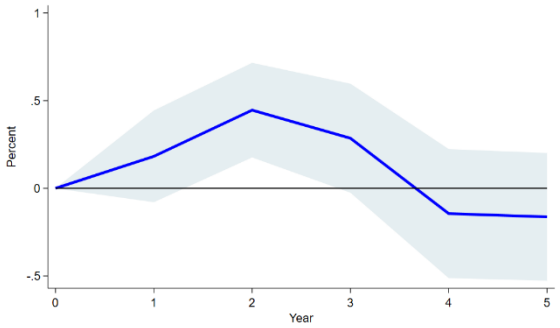
Total Factor Productivity – Large firms



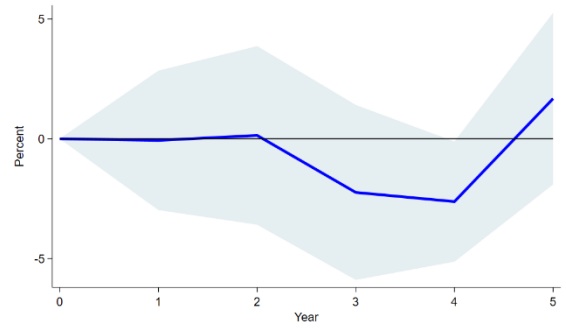
Profitability – Small firms



Profitability – Large firms



Net fixed Investment – Small firms



Net fixed Investment – Large firms

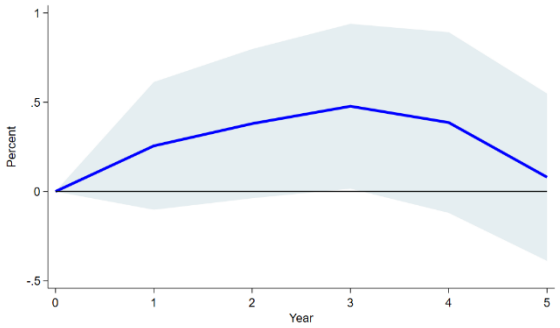
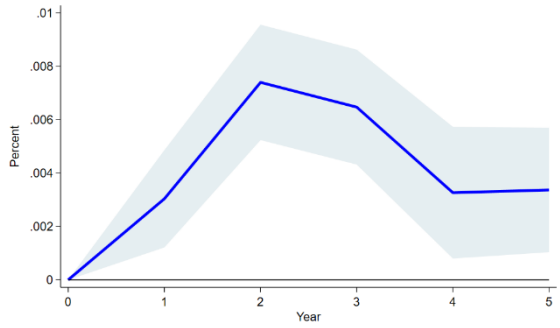
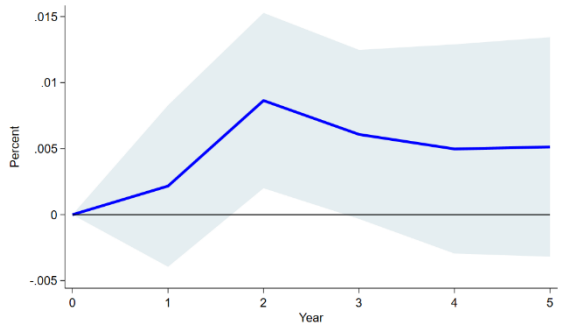


Figure 3. Inflation Shocks and Corporate Performance: Tradable vs. Non-Tradable Sectors

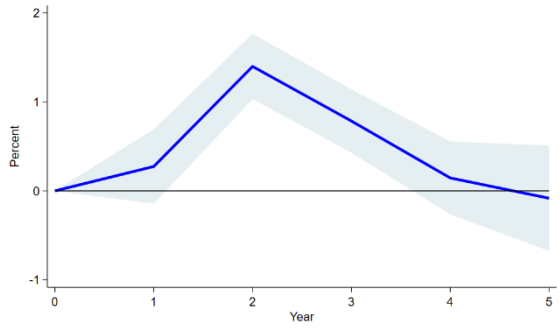
Total Factor Productivity – Tradable



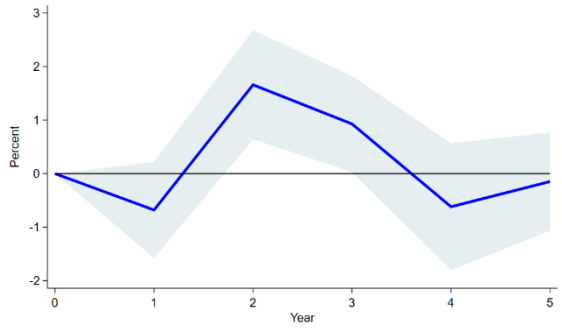
Total Factor Productivity – Non-Tradable



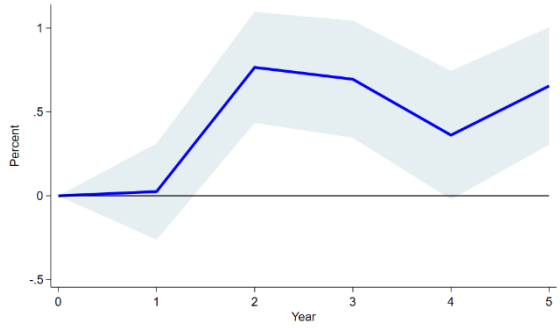
Profitability – Tradable



Profitability – Non-Tradable



Net Fixed Investment – Tradable



Net Fixed Investment – Non-Tradable

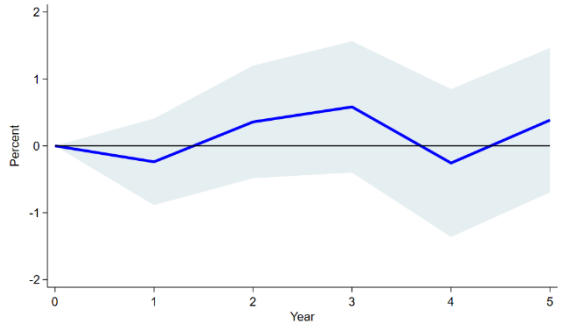
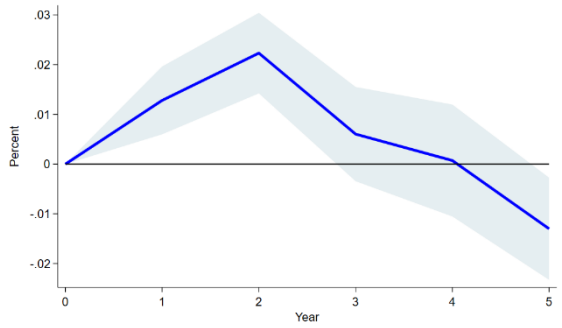
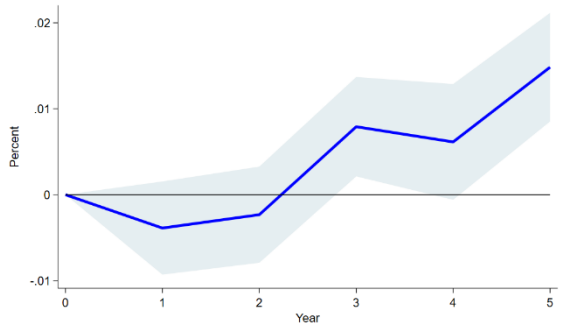


Figure 4. Inflation Shocks and Corporate Performance: State-Dependent Estimations

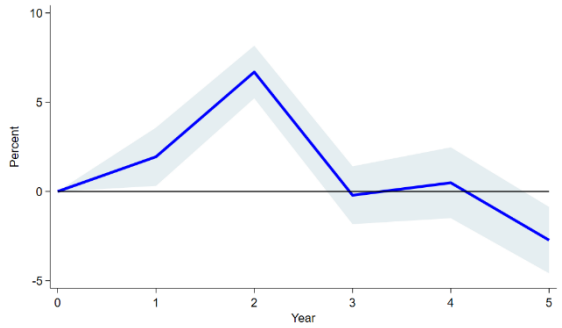
Total Factor Productivity – Good State



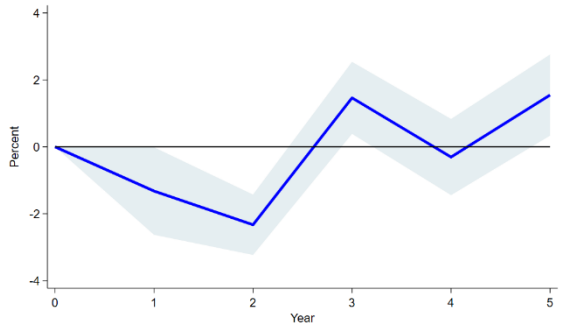
Total Factor Productivity – Bad State



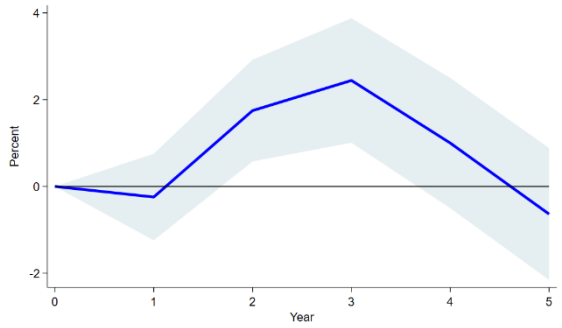
Profitability – Good State



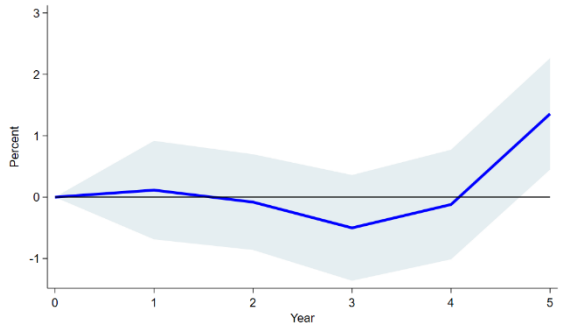
Profitability – Bad State



Net Fixed Investment – Good State



Net Fixed Investment – Bad State



On the whole, the analysis presented in this paper indicates that nonfinancial firms in the Baltics are agile in making resource reallocations and financial adjustments against inflation shocks, possibly by either transferring higher production costs to consumers or substituting inputs. The consequential higher profitability induces higher fixed investment spending, which in term leads to a permanent increase in the efficiency with which productive factors are put to use. It is important to draw attention to the fact that the period 1997–2021 was defined by (i) disinflation following difficult transition to market economy and (ii) low and stable inflation after joining the EU, except for the brief period of macroeconomic imbalances prior to the GFC in 2008. As a result, inflation dynamics over the sample period analyzed in this paper do not appear to have the detrimental consequences for nonfinancial firms the literature tends to find in countries with high and volatile inflation. These firm-level findings from the Baltics are consistent with recent evidence from the euro area, where profitability increased during a period of rising inflation (Hansen, Toscani, and Zhou, 2023). This relationship,

however, should not be expected to hold the recent burst of inflation—reaching as high as 25 percent in Baltic countries—turns into a persistent phenomenon and undermines macro-financial stability.[8]

VI. Conclusion

In this paper, using a large panel of firm-level data over the period 1997-2021, we provide a granular analysis of how inflation shocks in the Baltics affect TFP growth, profitability and net fixed investment spending in nonfinancial sectors. The estimation results reveal a coherent picture of how nonfinancial firms respond to large inflation shocks. First, we find that inflation shocks have, on average, a marginally positive impact on TFP growth, profitability and net fixed investment in the first year after the shock as well as over the medium term, albeit at a dissipating rate. Second, we find that inflation shocks have differential effects on large vs. small nonfinancial firms. Third, we explore sectoral heterogeneity in how firms respond to inflation shocks and observe significant variation across tradable and non-tradable sectors. Finally, we develop a more granular analysis by estimating a state-dependent model and find that firms' response to inflation shocks vary with the state of the economy (i.e., during periods of expansion *versus* recession).

On the whole, the analysis presented in this paper indicates that nonfinancial firms in the Baltics are agile in making resource reallocations and financial adjustments against inflation shocks, possibly by either transferring higher production costs to consumers or substituting inputs. The consequential higher profitability induces higher fixed investment spending, which in term leads to a permanent increase in the efficiency with which productive factors are put to use. It is important to draw attention to the fact that the period 1997–2021 was defined by (i) disinflation following difficult transition to market economy and (ii) low and stable inflation after joining the EU, except for the brief period of macroeconomic imbalances prior to the GFC in 2008. As a result, inflation dynamics over the sample period analyzed in this paper do not appear to have the detrimental consequences for nonfinancial firms the literature tends to find in countries with high and volatile inflation. These firm-level findings from the Baltics are consistent with recent evidence from the euro area, where profitability increased during a period of rising inflation. This relationship, however, should not be expected to hold during the recent burst of inflation—reaching as high as 25 percent in 2022 across the Baltics.

[8] Analyzing nonfinancial firms in Lithuania, Foda, Shi, and Vaziri (2022) find that financial constraints cause firms to lower fixed investment and consequently suffer a loss of productivity.

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