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# Households' inflation expectations in Lithuania: A First look and overview

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# Households' inflation expectations in Lithuania: A First look and overview*

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* The views expressed in this paper are those of the authors and do not necessary reflect those of the Bank of Lithuania.

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## ABSTRACT

We document a number of novel stylised facts about Lithuanian households' inflation expectations. Inflation expectations of Lithuanian households are significantly above the recent observation of actual inflation. On average, year-on-year inflation was around 4 percent from 2004 to 2023. However, one-year-ahead inflation expectations of households over the same period were on average 16.9 percent. Although we observe a clear upward bias in inflation expectations, there is significant co-movement between actual inflation and inflation expectations of households. Additionally, we find that over the economic boom, inflation expectations are higher than inflation perceptions, a finding that reverses over the economic downturn. We build a VAR model to analyse whether and how inflation, households' inflation expectations/perceptions and unemployment are linked. We show that structural shocks to inflation expectations play a minor role in overall inflation and unemployment dynamics.

*Keywords:* Households' inflation perceptions, inflation expectations.

*JEL Classification:* C83, D12, E21, E31.

# 1 Introduction

Inflation expectations play a key role in almost all mainstream economic models. Macroeconomic theory posits that the primary mechanism whereby inflation expectations affect households' decisions is their perceived real interest rate, which depends not just on the nominal interest rates faced by households, but also on their expectations of future inflation. Similarly, firms' expectations of inflation should affect their pricing and wage-setting decisions, as well as their investment and hiring decisions, because of the existing relationship between inflation and real economic activity.

Since the middle of the twentieth century, the Full Information Rational Expectations (FIRE) paradigm has dominated mainstream macroeconomics. In this model, it is assumed that every agent in the economy forms their expectations having a full information set and does so fully rationally. In such a case, the different agents' expectations should be interchangeable. However, a growing body of empirical evidence suggests that the process underpinning households' and firms' inflation expectations is not entirely in line with the FIRE model. Research starting with Jonung (1981) and including EU analysis by Arioli et al. (2017) shows that households hold various opinions of inflation depending on their income, age, education and gender. In most cases, households provide estimates substantially above actual inflation, but there is still a high level of co-movement between measured and perceived/expected inflation. Thus, for several decades, mounting empirical evidence has indicated that the inflation expectations of households do not comply with the FIRE model. Empirical findings at odds with FIRE have spurred alternative theories on the formation of inflation expectations. Some of these findings can be explained using models of information rigidities. These models have garnered significant attention over the past few decades, beginning with the pioneering work of Mankiw & Reis (2002) on *sticky expectations*, Sims (2003) on *rational inattention* and Woodford (2001) on *noisy information*. Coibion & Gorodnichenko (2012) and Coibion & Gorodnichenko (2015*b*) provide convincing evidence that most findings about households' and firms' inflation expectations are consistent with the predictions of models of information rigidities.

Lithuania is witnessing a rise in media attention regarding households' inflation expectations. However, to the best of my knowledge, this paper represents the first academic attempt to delve deeply into the topic. In this paper, we document a number of novel stylised facts about Lithuanian households' inflation expectations[1] using various available data.

We show that inflation expectations of Lithuanian households are significantly above recent observations of actual inflation and forecasts of institutions. On average, year-on-year inflation was around 4 percent from 2004 to 2023. However, one-year-ahead inflation expectations of households over the same period were on average 16.9 percent. Households' inflation expectations can be linked to their socio-economic characteristics (older, less educated people on average expect higher inflation). However, this relation is not statistically significant. Although we observe a clear upward bias in inflation expectations, there is significant co-movement between actual inflation and the inflation expectations of households.

Additionally, we use two methods to analyse the possible impact of households' inflation expectations on the broader economy. First, using a micro-level survey, we explore whether there is a link between intentions to make major purchases and households' beliefs about future inflation. We do not find strong evidence for this link in Lithuania. Second, as we have inflation expectations data from 2004, we build a VAR model to analyse *whether* and *how* inflation, households' inflation expectations/perceptions and unemployment are linked. We show that structural shocks to inflation expectations play a minor role in overall inflation dynamics.

The rest of the paper is organised as follows. Section 2 places our contribution in the context of the existing literature. Section 3 presents the survey we use and discusses various stylised facts. In Section 4, we try to link households' expectations with the real economy. Section 5 concludes the paper.

[1] The main focus of this paper is households' inflation expectations. Nevertheless, we provide some stylised facts on inflation expectations of firms in Lithuania in annex B.

## 2 Literature review

In 1961, Muth (1961) introduced the Full Information Rational Expectations (FIRE) theory, which assumes that individuals base their decisions on human rationality, information available to them, and their past experiences. Individual agents' expectations may be wrong, but they are correct on average over time. Despite the dominance of the FIRE model in macroeconomics since the mid-twentieth century, empirical evidence from the past decades indicates that the process underpinning households' and firms' inflation expectations is not completely in line with this theory. In this section, we briefly review the literature on households' inflation expectations that is at odds with the Rational Expectations theory.

**There is considerable heterogeneity in inflation expectations across various population subgroups.** Research starting with Jonung (1981) and including EU analysis by Arioli et al. (2017) and Bańnkowska et al. (2021) shows that households hold different opinions of inflation depending on their income, age, education and gender. Arioli et al. (2017) and Bańnkowska et al. (2021) show that on average, women consistently report higher rates for inflation perceptions and expectations. D'Acunto et al. (2021) and Bruin et al. (2011) suggest that this finding might be explained by women's greater exposure to changes in the price of goods due to their prevalent role of shopper in a household. Additionally, Bruin et al. (2011) show that households with low financial literacy have higher inflation expectations over both the short and the medium term, as well as higher uncertainty in their inflation expectations. Bańnkowska et al. (2021) documents that inflation uncertainty decreases with the level of trust in the ECB, highlighting that public trust might help to reduce inflation uncertainty. Bańnkowska et al. (2021) and Bruin et al. (2011) demonstrate that older consumers have higher short and medium-term inflation expectations.

**Households generally perceive inflation to be higher than actual inflation.** In most cases, households provide estimates substantially above actual inflation, but there still is a high level of co-movement between measured and perceived/expected inflation. D'Acunto et al. (2021) shows that consumers rely on the price changes of goods in their grocery bundles when forming expectations about aggregate inflation. Binder (2018) shows that consumer inflation expectations are positively correlated with gas prices.

**Households do not use full information when forming their inflation expectations.** A portion of the empirical findings can be explained using models of information rigidities. These models have received significant attention over the past few decades, ever since the pioneering work of Mankiw & Reis (2002) on sticky expectations, Sims (2003) on rational inattention and Woodford (2001) on noisy information.Coibion & Gorodnichenko (2012) and Coibion & Gorodnichenko (2015*b*) provide convincing evidence that the findings about households' and firms' inflation expectations are largely consistent with the predictions of models of information rigidities.

However, some researchers challenge the aforementioned findings on the consistency of households' and firms' inflation expectations with information rigidity model predictions. For example, Zhao (2019) shows that updates to consumer inflation expectations exhibit negative serial correlation. Additionally, these expectations cannot be explained by recent changes in the actual inflation rate. This implies that households' inflation expectations are noisy and there is limited information in changes in inflation expectations.

**Inflation expectations affect household decisions.** In macroeconomic models, inflation expectations should affect households' decisions. In such models, inflation expectations determine the real interest rate that is relevant to consumption and savings decisions. For example, an expected increase in inflation will lower real interest rates, which in turn can boost consumption and reduce incentives to save. This also should affect borrowing and investment decisions. However, the empirical question remains open as to whether this is borne out by the data. The majority of the literature examines the relationship between quantitative inflation expectations and answers to qualitative questions on "readiness to spend". Havranek et al. (2015) provides a meta-analysis and collects all published estimates of the elasticity of intertemporal substitution. The estimates vary substantially from country to country, even after controlling for 30 aspects of study design. Many authors find that survey results regarding readiness to spend are positively correlated with households' inflation expectations.

Ichiue & Nishiguchi (2015) find evidence that survey respondents in Japan with higher Inflation expectations tend to indicate that their household has increased real spending compared with one

year ago. Drager & Nghiem (2021) also find that consumers in Germany are more likely to increase current spending if they expect higher inflation. While these results are from surveys, literature has started to emerge which links actual decisions and household's expectations. For example, Vellekoop & Wiederholt (2019) link survey data on quantitative inflation expectations to administrative data on income and wealth. They show that households with higher inflation expectations save less. Estimating panel data models with year and household fixed effects, we find that a one percent increase in a household's inflation expectation over time is associated with a 250 to 400-euro reduction in the household's change in net worth per year on average. They also show that households with higher inflation expectations are more likely to acquire a car, and acquire higher-value cars.

However, a number of authors (especially in the US) have found the opposite results. Bachmann et al. (2015) finds that the impact of higher inflation expectations on the reported readiness to spend on durables is generally small or even negative. Burke & Ozdagli (2013), using survey panel data for the period from April 2009 to November 2012, investigate the relationship between a household's inflation expectations and its current spending, taking into account other factors such as the household's wage growth expectations, uncertainty surrounding its inflation expectations, macroeconomic conditions, and unobserved heterogeneity at the household level. Examining spending behaviour for large consumer durables as well as for nondurable goods, they find no evidence that consumers increase their spending on large home appliances and electronics in response to an increase in their inflation expectations.

The different results may arise from the fact that households might associate higher inflation with lower income (i.e., supply shocks). Coibion et al. (2019) provide evidence of causal effects, showing that elevated inflation expectations have a sharp negative effect on durable spending in the Netherlands. They suggest that this is likely driven by the fact that Dutch households seem to become more pessimistic about their real income as well as aggregate spending when they increase their inflation expectations. Also, Duca-Radu et al. (2021) show that it is crucial to account for individuals' inflation perceptions. Duca-Radu et al. (2021) provide evidence that the deviation of expected inflation from the currently perceived inflation rate helps control for unobserved heterogeneity in inflation perceptions. They show that across the euro area, changes in perceived inflation are associated with higher intention to buy durables.

**There is extensive evidence that using households' inflation expectations might help us understand various aggregate phenomena.** For example, Coibion & Gorodnichenko (2015*c*) show that use of household inflation forecasts as the measure of the Phillips curve can account for the missing disinflation over 2009-2011. Household inflation expectations went up sharply at the time, potentially preventing a downward adjustment of prices. Forsells & Kenny (2004) suggest that consumers' inflation expectations in the euro area are not fully rational, although they may still contain important information about future price developments.

**News shocks and shocks to households' inflation expectations.** From a macro-level perspective, there is a discussion of how and whether news shocks or shocks to expectations affect the economy. For example, Barsky & Sims (2011), using the VAR model, try to identify news shocks. The news shock is identified as the shock orthogonal to the innovation in current utilization-adjusted TFP that best explains variation in future TFP. On impact, a favourable news shock leads to an increase in consumption and decreases in output, hours, and investment. Though news shocks account for a significant fraction of output fluctuations at medium frequencies, they contribute little to the understanding of recessions. Surprisingly, few papers specifically analyse shocks to households' inflation expectations[2]. One exception is Barrett & Adams (2022). Using the VAR model and data for the United States, they find that a positive inflation expectation shock is deflationary and contractionary: inflation, output, and interest rates all fall. These results

[2]The paper by Bandera et al. (2023) analyses whether and how monetary policy shocks affects households' (one-year ahead) inflation expectations with the VAR model. The model contains several macroeconomic and financial variables for the United Kingdom, including the Consumer Price Index (CPI), a survey-based measure of household one-year-ahead expectations by Barclays, and a time series of monetary policy surprises based on forecasts of the Bank of England's Bank Rate. Monetary policy shocks are identified with a narrative-sign restriction strategy; this allows us to disentangle anticipated monetary policy shocks (those that generate changes in expected Bank Rate around specific events) from unanticipated ones. The SVAR estimates also suggest that monetary policy does not directly affect household expectations. They show that household expectations initially increase following a tightening, that is, a positive shock to Bank Rate, and do not react to an anticipated monetary policy shock.

are inconsistent with the standard New Keynesian model, which predicts inflation and interest rate hikes.

# 3 Review of the data

## 3.1 Data sources

The information on inflation expectations used in this paper is extracted from two main data sources: (i) the European Commission EU Consumer Survey; and (ii) two surveys of households and firms conducted by the Bank of Lithuania. The EU Consumer survey data are collected under the framework of the Joint Harmonised EU Programme of Business and Consumer Surveys. The programme is administered by the European Commission. This consumer survey, covering the 28 European Union member states, is conducted on a monthly basis.

The main survey questions that we use in our empirical analysis are provided below. Survey participants are not given any other information (e.g., most recent reading of inflation, ECB inflation target, inflation forecasts etc.). Thus, the design of the survey does not interfere with survey participants' initial priors.

- Q5: How do you think that consumer prices have developed over the last 12 months? Survey respondents can answer:
    1. risen a lot;
    2. risen moderately;
    3. risen slightly;
    4. stayed about the same;
    5. fallen;
    6. don't know.
- Q6: By comparison with the past 12 months, how do you expect that consumer prices will develop over the next 12 months?Survey respondents can answer:
    1. increase more rapidly;
    2. increase at the same rate;
    3. increase at a slower rate;
    4. stay about the same;
    5. fall;
    6. don't know.
- Q51: By how many per cent do you think that consumer prices have gone up/down over the past 12 months? Consumer prices have increased by xx,xx % / decreased by xx,xx %.
- Q61: By how many per cent do you expect consumer prices to go up/down in the next 12 months? Consumer prices will increase by xx,xx%/ decrease by xx,xx %.
- Q8: In view of the general economic situation, do you think that now it is the right moment for people to make major purchases such as furniture, electrical/electronic devices, etc.? Survey respondents can answer:
    1. yes, it is the right moment now;
    2. it is neither the right moment nor the wrong moment;
    3. no, it is not the right moment now;
    4. don't know.

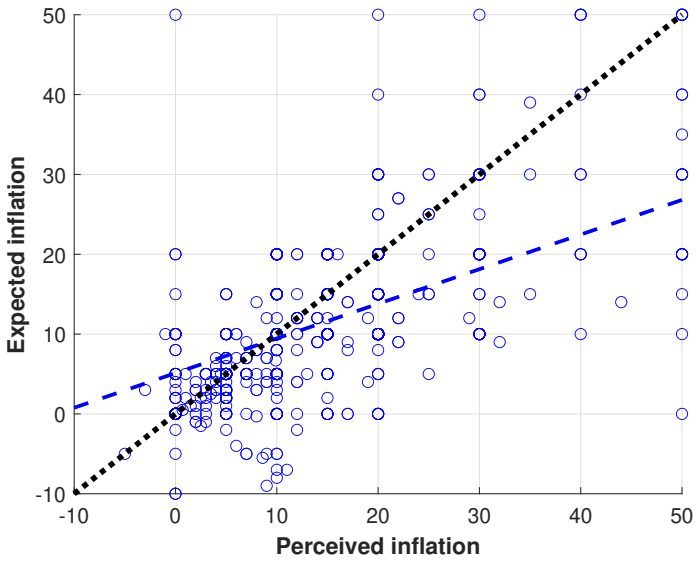



**Figure 1:** Households' inflation expectations and Households' inflation perceptions

Source: Survey of households conducted by the Bank of Lithuania
Note: Data are from a survey conducted in August 2020

While not all the micro-data is available, we have Lithuanian monthly averages on answers to Q51 and Q61. This provides us with times series on households' inflation expectations and households' inflation perceptions in Lithuania. Our sample started in January 2004.

In addition, as of 2020, the questions on inflation expectations were added to the traditional surveys of households and firms conducted by the Bank of Lithuania. Households and firms are now asked to provide quantitative estimates of expected consumer price change over the next 12 months. The questions we added to the survey mirrored the questions of the EU consumer survey (Q51 and Q62). The Survey of Households is a representative[3] survey which is stratified via most socioeconomic characteristics (e.g., age, gender, education, district of residence, etc.). The Survey of Households was conducted over June 2020.

Those two data sources complement each other, as the EU consumer survey provides a time dimension and the survey conducted by the Bank of Lithuania provides a cross sectional dimension. We provide some results on firms' inflation expectation in Annex B.

## 3.2 Cross-sectional dimension of households' inflation expectations

Inflation expectations of Lithuanian households are significantly above the recent observation of inflation and forecasts of institutions (European Commission, Bank of Lithuania, commercial banks, etc.). A survey of households conducted by the Bank of Lithuania shows that in June 2020, households on average expected that prices would increase by 11.86 percent (median – 10%). It is worth noting that expectations across households vary a great deal, as there is a (small) number of extreme outliers. (The standard deviation of the whole sample was 14.39.)

Additionally, the survey shows (see Table 1) that Lithuanian households hold various opinions about inflation depending on their age, education and gender. Even though we observe this in the data from a rather small data sample, in the literature (see Jonung 1981) it is a well-established fact that socioeconomic factors matter.

Another feature which becomes evident (see Table 2) is that most quantitative responses of households are multiples of 5/10 (as noted by Binder 2017) and between 1-10, there are also peaks at round numbers, such as 1, 2, 3, etc. This feature is not unique to Lithuania as it has been observed in the US (see Binder 2017) and the EU (see Arioli et al. 2017).

[3]Sample size consists of 1000 households.

| Response | Obs | % Share | NA | Mean | Median | Std. dev |
|---|---|---|---|---|---|---|
| **Financial situation*:** | | | | | | |
| *Poor* | 204 | 20.4 | 41 (20.1) | 15.4 | 10 | 18.3 |
| *Average* | 367 | 36.7 | 81 (22.1) | 12.0 | 10 | 13.6 |
| *Good* | 332 | 33.2 | 68 (20.5) | 10.2 | 10 | 11.8 |
| *N/A* | 97 | 9.7 | 39 (40.2) | 8.7 | 7 | 14.3 |
| **Living in:** | | | | | | |
| *Large cities* | 506 | 50.6 | 91 (18.0) | 10.0 | 10 | 12.2 |
| *Other cities* | 215 | 21.5 | 66 (30.7) | 15.2 | 10 | 18.6 |
| *Villages* | 279 | 27.9 | 72 (25.8) | 13.1 | 10 | 14.4 |
| **Education:** | | | | | | |
| *University* | 448 | 44.8 | 80 (17.9) | 10.6 | 10 | 12.4 |
| *Upper-secondary* | 397 | 39.7 | 97 (24.4) | 13.1 | 10 | 15.5 |
| *Lower-secondary* | 102 | 10.2 | 26 (25.5) | 14.5 | 10 | 19.3 |
| *N/A* | 53 | 5.3 | 26 (49.1) | 8.2 | 7 | 7.7 |
| **Age:** | | | | | | |
| *18-29* | 114 | 11.4 | 16 (14.0) | 10.1 | 10 | 14.1 |
| *30-49* | 448 | 44.8 | 112 (25) | 11.2 | 10 | 13.2 |
| *50+* | 438 | 43.8 | 101 (23.1) | 13.0 | 10 | 15.5 |
| **Gender:** | | | | | | |
| *Male* | 455 | 45.5 | 103 (22.7) | 9.86 | 9 | 12.4 |
| *Female* | 545 | 54.5 | 126 (23.1) | 13.6 | 10 | 15.7 |
| Full sample | 1000 | 100 | 229 | 11.86 | 10 | 14.39 |

**Table 1:** Households' Inflation expectations: sample composition and statistics by selected characteristics

Note: The survey was conducted on behalf of the Bank of Lithuania by a public opinion and market research company. It was carried out in June 2020. In total, 1,000 households were surveyed.

Also, it is interesting to note that inflation perceptions and inflation expectations can differ considerably on an individual level. Fig. 1 shows that there is significant dispersion between inflation perceptions and expectations. If all individuals had equal inflation expectation and inflation perceptions, all the dots would be on the diagonal line (black dotted line). However, the data shows that this is not the case. Duca-Radu et al. (2021) argue that changes in expected inflation could help to locally approximate the traditional Euler equation. Thus, households' decisions should depend not only on inflation expectations but also on changes in expected inflation.

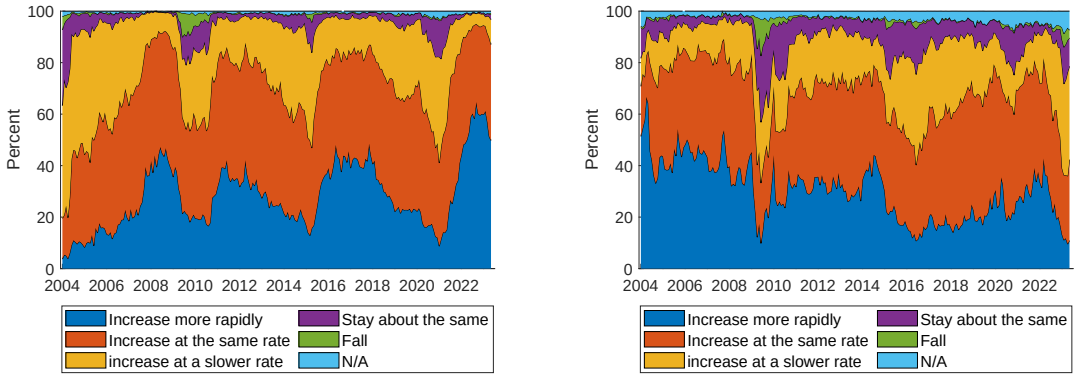
| | Inflation expectations | | Inflation perceptions | |
|---|---|---|---|---|
| Response | Obs. | % Share | Obs. | % Share |
| 0 | 90 | 9 | 8.7 | 8.7 |
| 10 | 196 | 19.6 | 161 | 16.1 |
| 5 | 90 | 9 | 89 | 8.9 |
| 15 | 63 | 6.3 | 72 | 7.2 |
| -10 | 3 | 0.3 | 0 | 0 |
| 20 | 97 | 9.7 | 139 | 13.9 |
| -5 | 7 | 0.7 | 1 | 0.1 |
| 3 | 21 | 2.1 | 11 | 1.1 |
| 2 | 17 | 1.7 | 7 | 0.7 |
| Other | 207 | 20.7 | 253 | 25.3 |
| NA | 229 | 22.9 | 186 | 18.6 |
| Positive | 651 | 65.1 | 716 | 71.6 |
| Negative | 30 | 3 | 11 | 1.1 |
| 0 | 90 | 9 | 87 | 8.7 |
| NA | 229 | 22.9 | 186 | 18.6 |
| Full sample | 1000 | 100 | 1000 | 100 |
| Median | 10 | | 10 | |
| Average | 11.86 | | 15.12 | |

**Table 2:** Households' inflation expectations

Source: Survey of households conducted by the Bank of Lithuania
Note: Data are from a survey conducted in August 2020. Annex D provides histograms of inflation expectations and inflation perceptions.

## 3.3 Quantitative vs Qualitative inflation expectations

Fig. 2 shows the distribution of the various response categories for the two qualitative questions in the EC survey in Lithuania since 2004. We can see that most sample households expect that prices will increase over the next 12 months (Fig. 2b) and have increased over the past 12 months (Fig. 2a). Only during the 2009 economic crisis did some households indicate that prices had not increased, and expect that prices would fall.




**(a)** Inflation perceptions **(b)** Inflation expectations

**Figure 2:** Households' qualitative opinions on inflation developments

Source: European Commission
Note: Data from January 2004 to May 2023

Fig. 3 plots the balance statistics on the two qualitative price questions for Lithuania. Following Arioli et al. (2017) an aggregate measure of consumers' opinions – the "balance statistic" – is calculated as the difference between the relative frequencies of responses falling in different categories. Answers are weighted using a scheme that attributes to the answers [1] and [5] twice the weight of the moderate responses [2] and [4]; the middle response [3] and the "don't know" response [6] are attributed zero weights. The balance statistic is thus computed as:

$$Index_{it} = P[1] + \frac{1}{2} \cdot P[2] - \frac{1}{2} \cdot P[4] - P[5], \tag{1}$$

where $P[x]$ is the frequency of response $[x]$ $(x = 1, 2, \ldots, 6)$, so $Index_{it} \in [-100; 100]$.

As per the qualitative nature of the questions, the series only provides information on the directional change in prices over the past and next 12 months, but does not provide an explicit indication of the magnitude of the perceived and expected rate of inflation. If we compare qualitative (Q5 and Q6) and quantitative measures (Q51 and Q61), we see some similarities, as those measures co-move. However, there are differences, as quantitative measures also let households provide the magnitude of price changes. As mentioned by Arioli et al. (2017), the interpretation of the quantitative survey questions may vary across individuals and over time, making the aggregation of individual responses potentially problematic.

## 3.4 Time dimension of households' inflation expectations

Fig. 4 provides the data for Lithuanian inflation, average households' inflation perceptions and average households' inflation expectations over 2004-2023[4]. We can see that households' inflation expectations and households' inflation perceptions were consistently above the actual inflation rate (on average by 12.2% and 13.4% respectively). Nonetheless, there is significant co-movement

[4]The information on households' inflation expectations used in this note is extracted from the European Commission EU Consumer Survey. The EU Consumer Survey data are collected under the framework of the Joint Harmonised EU Programme of Business and Consumer Surveys. The programme is administered by the European Commission. This consumer survey covers the 27 European Union member states and is conducted on a monthly basis.

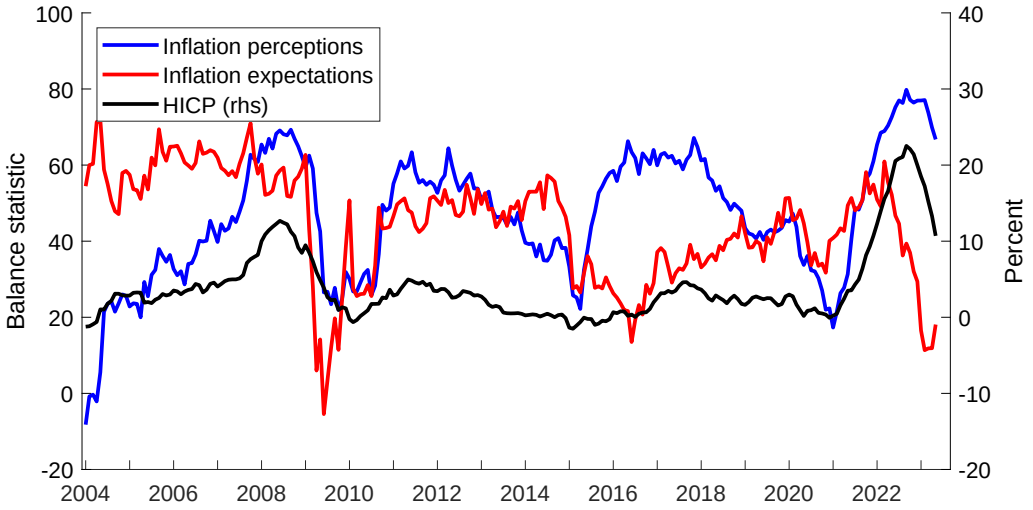



**Figure 3:** Perceived and expected price trends over the past and next 12 months in Lithuania

Source: European Commission and Statistics Lithuania
Note: Data from January 2004 to May 2023

between actual inflation and inflation expectations/perceptions. From Fig. 4 we can identify 6 distinct periods:

1. **Economic boom (2004-2008)**
2. **Financial crisis (2009)**
3. **Economic recovery (2010-2015)**
4. **Adoption of the euro (2015-2018)**
5. **Covid-19 (2020)**
6. **Post-Covid-19 rise in inflation (2021 - ...)**

We discuss these periods in greater detail below.

**1. Economic boom (2004-2008).** We have data from the start of 2004. Fig. 4 shows that from 2004 to 2008, inflation, households' inflation expectations and households' inflation perceptions had been rising. Over this period, inflation increased from -1.2% (in January of 2004) to around 12% (it peaked in June of 2008 at 12.6%). Inflation expectations and inflation perceptions increased from 12.4% and 5% to 31.9% and 30.3%, respectively. There were three main factors behind rising inflation at the time. First, over this period the Lithuanian economy experienced unprecedented growth which in part was the result of economic convergence. The gross domestic product (GDP) grew on average by almost 8 per cent. Second, over this period Lithuania experienced a domestic credit-fuelled housing bubble, which added to internal demand and thus inflation. See, for example, Kuodis & Ramanauskas (2009) for a review of the boom-bust cycle. Third, in addition to those internal developments, this period was also marked by an unprecedented rise in oil prices (especially in 2007-2008). Interestingly, during this period, inflation expectations were on average 2.7 pp higher than inflation perceptions. This might indicate that households were also anticipating the acceleration of an increase in prices.

**2. Financial crisis (2009-2010).** At the end of 2008, internal imbalances unravelled and Lithuania had one of the highest declines of GDP in the world. In 2009, GDP contracted by 15%. This had an impact on inflation as it had declined from around 10% to around 1%. Inflation expectations and inflation perceptions shrank to 13% and 13.9%, respectively. It is interesting that during this period inflation expectations were on average 1.8 pp lower than inflation perceptions.

**3. Economic recovery (2011-2015).** The period from 2011 to 2015 was a period of economic recovery. We had no inflationary pressures as the economy at that time was growing sustainably.

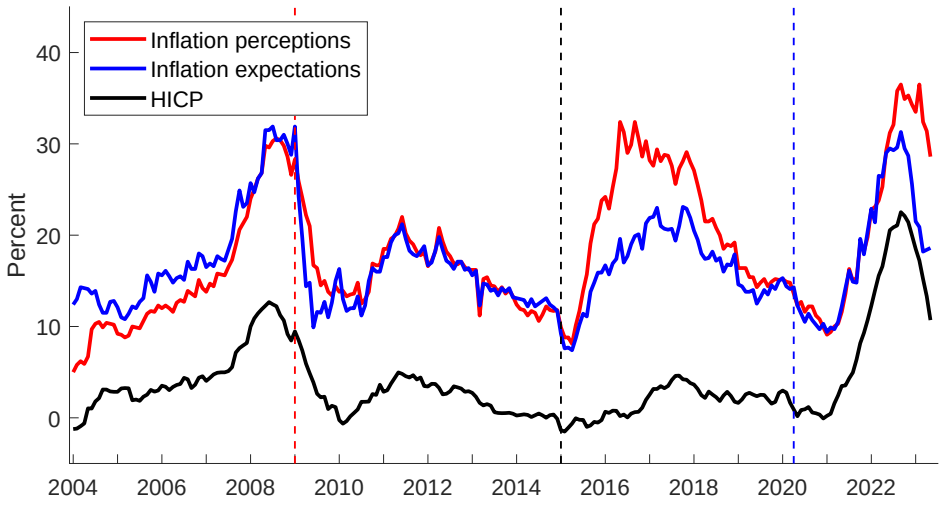



**Figure 4:** Lithuanian consumers' quantitative estimation of inflation perceptions and inflation expectations

Source: Statistics Lithuania.
Note: Data from January 2004 to May 2023

In this period on average households' inflation expectations were equal to households' inflation perceptions. From the first three periods we have discussed, it seems that households are able to distinguish between periods of economic boom and periods of economic contraction. During periods of economic boom, households expect that inflation will increase; during contractionary periods, they expect the opposite.

**4. Adoption of the euro (2015-2018)**. As of 1 January 2015, Lithuania officially became the $19^{th}$ member of the euro area. This means that the national currency (litas) was converted to euros. At the time, various surveys showed that the majority of Lithuanian households seemed to be convinced that price pressure after the introduction of the euro would be strong. While at the time of the euro introduction inflation perceptions and inflation expectations were relatively low, they started increasing rapidly in the second half of 2016. In September 2016, average households' inflation perceptions had reached an all-time high of 32.4%, while inflation expectations peaked at around 20%. Over this period, on average, inflation expectations were 6pp lower than inflation perceptions (14.3pp lower in June of 2016). We do not see a high increase of aggregate inflation around the time of the euro introduction. Also, the euro changeover did not lead to a significant change in the overall inflation rate in Lithuania between 2015 and 2019 (see Jouvanceau (2021) for discussion). However, some inflationary effects emerge in the sub-categories. One explanation concerns the notion of "self-fulfilling prophecy". Thus, as many households were expecting an increase in prices before the introduction of the euro, they started looking for increases in prices and attributed these increases to the changeover. At the time, there was exceptionally high media attention paid to the price increases of specific goods (e.g., a cup of coffee). So, as those topics were discussed in the media, households started thinking that inflation was increasing, although in fact inflation was not significantly higher. Inflation perceptions at the time were even higher than in 2008 despite the fact that actual inflation was almost 6 times lower. Similar tendencies were observed in other countries after the introduction of the euro (see Arioli et al. (2017)).

**5. Covid-19 (2020)**. The Covid-2019 pandemic induced higher volatility in inflation. At the start of the pandemic, we experienced an oil price collapse, which put downward pressure on inflation, inflation perceptions and inflation expectations. Over the pandemic period, inflation expectations and perceptions followed the trends of actual inflation. We do not see a significant difference between inflation expectations and inflation perceptions. It is interesting that qualitatively the same tendencies were seen in the US (see Annex C).

**6. Post-Covid-19 rise in inflation (2021 - ...)**. Since mid-2021 we have seen a global rise in

aggregate demand, recovery in oil prices, and many supply bottlenecks. These factors contributed to a sharp rise in inflation, which in Lithuania reached 20 percent in June 2021. This coincided with a comparable increase in inflation perceptions and inflation expectations (by 25.8pp and 20.1pp respectively). From mid-2022, we see that inflation perceptions were high compared to inflation expectations. The difference in October 2022 reached 5.4pp. This might indicate that households were anticipating a deceleration of price growth.

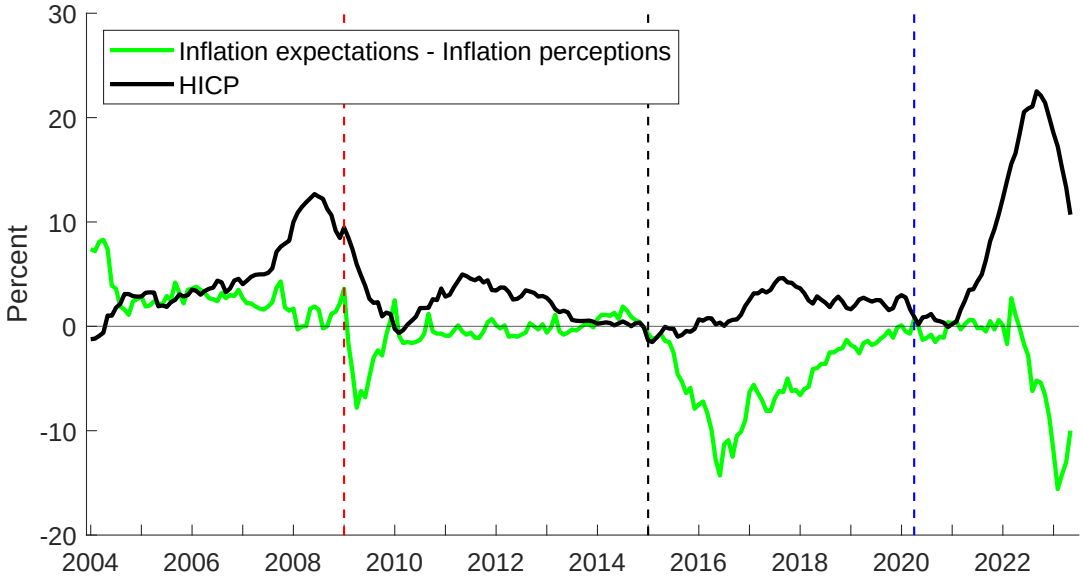



**Figure 5:** Changes in households' expected inflation and actual inflation

Source: Statistics Lithuania.
Note: Data from January 2004 to May 2023

Over the whole period we also can observe the tendency that if there are no significant shocks, the difference between inflation expectations and perceptions tends to converge to zero. See Fig. 5.

If inflation expectations are in line with the Full Information Rational Expectations theory, they should exhibit *two* fundamental characteristics. First, they should be *unbiased* - that is, agents should forecast inflation correctly on average ($\alpha = 0$ and $\beta = 1$ in eq. 2). Second, forecasts should be *efficient* - that is, agents should employ all relevant information for which the marginal benefit of gathering and utilizing the information exceeds the marginal cost ($\delta = 0$ and $\phi = 0$ in eq. 4).

$$\pi_t = \alpha + \beta \cdot \mathbb{E}_{t-1}\{\pi_t\} + \varepsilon_t \tag{2}$$

$$\pi_t - \mathbb{E}_{t-1}\{\pi_t\} = \delta + \phi \cdot I_{t-1} + \nu_t \tag{3}$$

| | $\pi_t$ | $\mathbb{E}_t\{\pi_t\}$ |
|---|---|---|
| $\mathbb{E}_{t-12}\{\pi_t\}$ | 0.1387*** | 0.322*** |
| $\alpha$ | 1.8858* | 13.35*** |
| $R^2$ | 0.02 | 0.05 |
| Obs. | 221 | 221 |

**Table 3:** Test of rationality (2004m1-2023m5)

$$\pi_t - \mathbb{E}_{t-1}\{\pi_t\} = \delta + \phi \cdot I_{t-1} + \nu_t \tag{4}$$

| | $\pi_t - \mathbb{E}_{t-12}\{\pi_t\}$ | $\pi_t - \mathbb{E}_{t-12}\{\pi_t\}$ |
|---|---|---|
| $\pi_{t-1} - \mathbb{E}_{t-13}\{\pi_{t-1}\}$ | 0.9624*** | |
| $\pi_{t-12} - \mathbb{E}_{t-24}\{\pi_{t-12}\}$ | | 0.1673** |
| $\delta$ | -0.4991** | -10.22*** |
| $R^2$ | 0.92 | 0.02 |
| Obs. | 220 | 209 |

**Table 4:** Test of information utilisation (2004m1-2023m5)

We can easily prove that average households' inflation expectations in Lithuania are not in line with FIRE. Table 3 shows that inflation expectations are biased as $\alpha > 0$ and $\beta < 1$. It is also worth noting that inflation expectations are not rational even if we compare them with inflation perception instead of actual inflation. We can also easily show that inflation expectations are not *efficient*, as forecasting errors are autocorrelated (see Table 4).

## 3.5 Cross-country comparison of inflation expectations

As discussed in in Section 3, the EU consumer survey covers all European Union countries. While we do not have direct access to these data, Arioli et al. (2017) provide 2004-2015 averages of households' inflation expectations and households' inflation expectations across EU countries. Fig. 6 provides this data linked with the actual average inflation rate. The dots in Fig. 6 on the y-axis represent specific EU countries' average households' inflation expectations (blue dots) and average households' inflation perceptions (red dots) and corresponding inflation over the same period on the x-axis. This shows that countries which had higher inflation also had higher inflation perceptions and expectations.

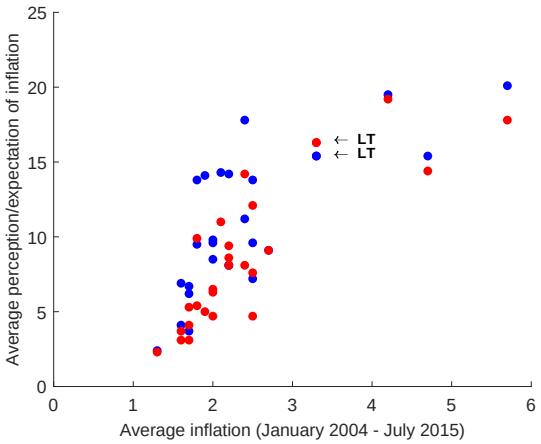



**Figure 6:** Inflation expectations/perceptions and Inflation across countries

| | $\mathbb{P}_i\{\pi_t\}$ | $\mathbb{E}_i\{\pi_{t+12}\}$ |
|---|---|---|
| $\pi_i$ | 2.899*** | 3.0325*** |
| Constant | 3.8505* | 1,5051* |
| $R^2$ | 0.4619 | 0.5259 |
| Obs. | 26 | 26 |

**Table 5:** Linking actual inflation with Inflation expectations/perceptions

Note: Every dot on the y-axis represents a specific EU country's average households' inflation expectations (blue dots) and average households' inflation perceptions (red dots) and corresponding inflation over the same period on the x-axis. Data are obtained from Arioli et al. (2017)

Table 5 shows results of simple regressions which link average inflation perceptions and inflation expectations in 2004-2015 to the average inflation rate. This shows that 1pp higher inflation is associated with about 3pp higher inflation expectations and inflation perceptions.

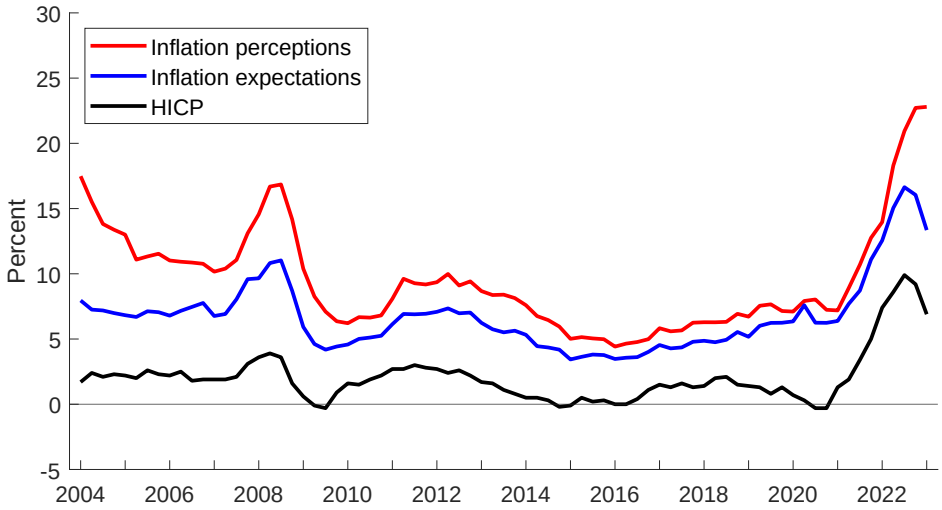



**Figure 7:** EA consumers' quantitative estimation of inflation perceptions and inflation expectations

Source: European Commission.
Note: Data for Euro area are quarterly.

## 3.6 Comparing households' inflation expectations in euro area and Lithuania

Fig. 7 provides the data for euro area inflation, average households' inflation expectations, and average households' inflation expectations over 2004-2023. We can see that there are some similarities. In the euro area, households' inflation expectations and households' inflation perceptions were consistently above the actual inflation rate. Inflation perceptions on average were 9.8%, inflation expectations were 6.7% and actual inflation was 2.1%. In Lithuania, we had an even wider gap (18.1%, 16.9% and 4%). Also, as in Lithuania, in the euro area inflation tends to co-move with inflation expectations and perceptions. However, one difference emerges: over the whole period, in the euro area inflation expectations were below inflation perceptions.

To sum up, Lithuanian households' inflation expectations exhibit many characteristics which are present in other countries (see Arioli et al. (2017), Coibion & Gorodnichenko (2015*a*)). First, households provide rounded numbers and especially like to provide numbers which are multiples of 5/10. Second, there is significant co-movement between inflation expectations and actual inflation. Third, households' inflation expectations are significantly above the actual inflation rate. Lithuanian households provide numbers which are unusually high. For example, in the US or New Zealand, households' inflation expectations are almost twice higher than actual inflation, while in Lithuania they are three to four times higher. There could be a few reasons why this is the case:

- Actual inflation in Lithuania was somewhat higher and more volatile than in other countries. In Section 3.5, we show that higher actual inflation rates are associated with exponentially higher household inflation expectations. One pp higher inflation is associated with 3pp higher households' inflation expectations.
- From 1992 to 1994, Lithuania experienced a period of hyper-inflation, as inflation peaked at 1000%. Studies show that hyperinflation episodes leave an enduring effect on households' inflation expectations. Households which have experienced hyperinflation predict higher inflation even decades after the experience.
- Media attention in Lithuania has been focused on the country's inflation, which might incline households to think that inflation is higher.

The aforementioned factors may help to explain higher inflation expectations. However, further research is required to identify the main drivers of this phenomenon.

# 4 Linking households' expectations with real economy

In this section, we examine whether households' inflation expectations really matter. In Subsection 4.1, using micro data from the Bank of Lithuania June-July 2020 Survey of Households, we examine the relationship between inflation expectations and households' readiness to spend. In Subsection 4.2, we take a macro perspective and build a VAR model with which we analyse how structural shocks to inflation expectations affect inflation and unemployment. There we use the mean values from the EC survey.

## 4.1 Do consumers expect to spend more if they expect higher inflation?

As we discussed in Section 2, the standard economic model shows that an increase in expected inflation *ceteris paribus* should boost current consumption and lower consumers' incentives to save. We will examine whether this is the case in Lithuania. Empirically, we will closely follow Duca-Radu et al. (2021) and investigate whether higher inflation expectations are associated with an increase in the probability that a given consumer will make major purchases. The literature provides mixed evidence on this relation (see Section 2 for a literature review).

Our empirical strategy is data-driven. As our dependent variable is an ordered variable, we employ an ordered logit specification (Aitchison & Silvey 1958) to model the relationship between the inflation expectations and the individual consumer's readiness to spend. In this way, we exploit the natural ordering in our dependent variable, namely, consumer readiness to spend. The answer to the question on readiness to spend (see Q8 in Section 3) can be ordered into being more or less ready to spend, consumers responding that *it is not the right moment* being the least ready to spend and consumers responding *it is the right moment* being the most ready.

As in the binary dependent variable model, we can model the observed response by considering a latent variable $y_i^*$ (some continuous measure of the readiness to spend) that depends linearly on the explanatory variables $x_i$ (inflation expectations):

$$y_i^* = \beta x_i + \epsilon_i \tag{5}$$

where is $\epsilon_i$ are independent and identically distributed random variables. The observed $y_i$ is determined from $y_i^*$ using the rule:

$$y_i = \begin{cases} 1 & \text{if } y_i^* < \alpha_1 \\ 2 & \text{if } \alpha_1 < y_i^* < \alpha_2 \\ 3 & \text{if } y_i^* > \alpha_2 \end{cases} \tag{6}$$

See Aitchison & Silvey (1958) for an explanation of the estimation algorithm.

In Table 6, we report all our empirical findings related to the estimation of the ordered logit model given by Equation 5. We also provide additional estimates of binary logit model and simple OLS regression. The logit model is estimated using just two answers - *it is not the right moment* and *it is the right moment*.

We find that there is no statistically significant effect of inflation expectations or changes in subjective inflation on the probability of being ready to spend. However, using the binary logit model, we find a statistically significant effect of inflation perceptions on the probability of being ready to spend. There is no difference in the results if we control for socio-economic characteristics.

**Discussion.** Our results differ from Duca-Radu et al. (2021), who find a statistically significant relationship across major EU countries. However, we use small data samples which were collected during the COVID-19 crisis. Also, on a more conceptual level, higher inflation expectation stimulates consumption via lower real interest rates, according to the Euler equation (inter-temporal substitution effect) $r = i - \mathbb{E}_t\{\pi_{t+1}\}$. However, this also might lead to other effects, for which we are not controlling in our regression. Higher inflation expectation *ceteris paribus* would lower real

| | OLS | | | Logit | | | Ordered Logit | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| $\mathbb{E}_t\{\pi_{t+12}\} - \mathbb{P}_t\{\pi_t\}$ | -0.0011 | | | -0.006 | | | -0.0034 | | |
| $\mathbb{E}_t\{\pi_{t+12}\}$ | | 0.0015 | | | 0.0115 | | | 0.0041 | |
| $\mathbb{P}_t\{\pi_t\}$ | | | 0.0028* | | | 0.0176* | | | 0.0078 |
| N | 937 | 937 | 937 | 403 | 403 | 403 | 937 | 937 | 937 |
| $R^{2*}$ | 0.0003 | 0.0011 | 0.0015 | 0.0002 | 0.0032 | 0.0057 | 0.0018 | 0.0005 | 0.0013 |

**Table 6:** Linking the readiness to spend and expectations/perceptions of future inflation.

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. $R^2$ we provide McFadden R-squared for estimates of Logit models, and Pseudo R-squared for Ordered Logit.

wages and would affect spending negatively via the income effect. $\mathbb{E}_t\{\pi_{t+1}\} \Uparrow \rightarrow \frac{\mathbb{E}_t\{W_{t+1}\}}{\mathbb{E}_t\{\pi_{t+1}\}} \Downarrow$. Also, new research (Coibion et al. 2019) shows that households tend to associate inflation with lower economic growth.[5] In addition, higher inflation expectations may lead to higher uncertainty and hence reduce consumption (precautionary savings). Thus, the negative effects of various channels might outweigh the positive effects from lower real interest rates. In general, our results should be seen as preliminary, as we use one Bank of Lithuania survey wave.

## 4.2 VAR

In this section, we take a macro perspective. We can see striking co-movement between actual inflation and households' inflation expectations/perceptions (see Section 3.4). It is natural that those variables affect each other: higher inflation may lead to higher inflation expectations, but also higher inflation expectations affect actual inflation. In this section, we use a VAR model and explore how structural shocks to inflation expectations and inflation perceptions affect inflation and unemployment.

VAR models proposed by Sims (1980) constitute a relatively agnostic class of models that allow the "data to speak", as no tight cross-equation restrictions are imposed. We base our analysis on the VAR framework, which is a standard tool to estimate how various macroeconomic variables are affected by exogenous shocks such as monetary policy shocks (see, e.g., Stock & Watson (1999)) or fiscal policy shocks (see, e.g., Caldara & Kamps (2008)). First, we estimate a reduced-form VAR model, in which each dependent variable is regressed on its own lags and on the lags of other variables. We then impose specific restrictions on the errors of the reduced-form VAR to recover structural shocks and thus develop a structural VAR model. There are a number of different approaches to recovering structural shocks, such as imposing zero, long-run and sign restrictions or combinations of those. In this section we use the simplest one, namely, zero restrictions.

We estimate a reduced-form VAR model, where each dependent variable is regressed on its own lags and on the lags of the other variables. In a vector notation, this can be expressed as follows:

$$y_t = c + \sum_{i=1}^{p} A_i y_{t-p} + \sum_{i=1}^{p} B_i x_t + u_t \tag{7}$$

where $y_t$ is a $N \cdot 1$ vector containing all $N$ endogenous variables, $c$ is a $N \cdot 1$ vector of constants, $A_i$ (for $i = 1, \ldots, P$) are $N \cdot N$ parameter matrices, and $u_t$ is the $N \cdot 1$ one-step ahead prediction error with $u_t \sim N(0, \sigma)$, where $\sigma$ is the $N \cdot N$ variance-covariance matrix. The vector of $y_t$ contains the endogenous variables[6]. The vector $x_t$ contains exogenous variables.

**Data.** A model comprises four endogenous variables – inflation (calculated from harmonised index consumer prices (HICP)), households' inflation perceptions, households' inflation expectations and unemployment. With the exception of the unemployment variable, the variables are expressed as year-on-year growth rates. Unemployment is expressed in levels. The baseline specification also includes two exogenous variables: the Eonia interest rate (as a proxy for policy rate) and oil price. As Lithuania is a small open economy, it is natural to assume that those variables are not affected by the shocks in Lithuania. The model was estimated using four lags that were selected using

[5] See Cukierman & Wachtel (1979), who note that higher inflation can be perceived as a sign of a less certain economic environment and thus may increase household saving.

[6] The selection of variables is in line with the literature. However, as the others mostly use quarterly data, the use of GDP instead of unemployment is more common.

standard optimal lag selection criteria. To estimate our model, we use monthly data for Lithuania spanning from January 2004 to May 2021. We estimate the VAR model with Bayesian techniques using the Minnesota priors (see Litterman 1985).

**Identification**: zero-restrictions. The most common restrictions to recover structural shocks are the so-called zero restrictions (following Sims 1980). A commonly used identification scheme is the Cholesky decomposition, which utilises a recursive contemporaneous ordering of variables, based on the assumption that it is possible to determine the variables that are not affected by contemporaneous changes in other variables and only respond to those changes with a lag. Yet, economic theory is frequently silent about specific zero restrictions in SVAR models, and for some applications the assumption of the causal ordering (i.e., which variable affects which) is problematic, since in reality variables can be jointly determined. Nevertheless, this method is often applied in practice to identify various shocks.

Our identification strategy follows the logic that there is a sort of "causal chain" of shocks. The ordering of variables is: inflation, inflation perception, inflation expectations, unemployment. The shock to the inflation equation can affect all variables contemporaneously, and the shock to unemployment does not affect other variables contemporaneously. Shocks to inflation perceptions can affect inflation contemporaneously but not other variables. Shocks to inflation expectations can affect inflation and inflation perceptions contemporaneously, but not unemployment.[7] As a robustness check, we provide the alternative shocks identification in Annex A.

**Results** Impulse response function (IRF) to (one standard deviation) shocks are provided in Figure 8.

*Shocks to inflation.* The first column in Figure 8 provides the IRF of the inflation shock which leads to a temporary increase in inflation and later transmits to inflation perceptions. The effect on inflation perception peaks after about 20 months, and fades away after another 20 months. The effect on inflation expectations is less pronounced. The effect on unemployment emerges over time, increasing unemployment by 0.2 pp, peaking after 2.5 years (30 months). As the shock to the inflation equation moves inflation and unemployment in the same direction, it has the flavour of an aggregate supply shock. Interestingly, if we use only pre-2015 data, we obtain somewhat different results (see the red dashed line). Namely, we obtain more similar profiles in the effects on inflation perception and inflation expectations. This could be explained by the fact that post-2015, we had two episodes in which the co-movement of inflation expectations and inflation perceptions were less present compared to the period of 2004 to 2015.

*Shocks to inflation perceptions.* Shocks to inflation perceptions move inflation down. On impact, the shock to inflation perception of 1.2 percent lowers inflation by almost 0.3 pp after 22 months. Inflation expectations move up, and the effect on unemployment is limited. One possible explanation of this finding is that if households *ceteris paribus* perceive inflation to be higher, they lower their consumption. Additionally, there can be information effects which could affect price setters. If *ceteris paribus* households' inflation perception increased, this could lead to negative media attention to the price setters, which in turn could limit their ability to increase prices.[8] It is also interesting to note that if we limit the data sample, the effect on inflation expectations changes substantially.

*Shocks to inflation expectations.* Shocks to inflation expectations had a very limited effect on

[7] Interestingly, there are few attempts at including households' inflation expectations in VAR models. Also in our case we use not just inflation expectations, but also inflation perceptions. Such (especially quantitative) data are rarely collected for long periods of time. Also, EU-wide data or quantitative expectations are not publicly available, so such models are rare. Gábriel (2010) uses an index constructed from a balance of qualitative answers in a VAR model with sign and zero restrictions. He provides empirical evidence for Czech Republic, Hungary, and the United Kingdom, that changes in expectations influence prices and wages considerably. Goyal & Parab (2021), using a VAR model with recursive identification, show that inflation expectations are relevant for monetary policy, and in the longer term are determined by demand shocks. Ueda (2010) imposes short-term non-recursive restrictions in VAR, taking into account simultaneous co-dependency between realized and expected inflation. He finds that responding to changes in exogenous prices and to monetary policy shocks, inflation expectations adjust more quickly than does realized inflation. However, in all the examples above, identification of shocks differs, so there is no universally established way of identifying those shocks. In this paper we use the simplest approach.

[8] Rational inattention models would suggest that it would be too costly for consumers to follow the small movements in various prices and even the price level. However, the shock to the inflation perception could be interpreted as an increase in households' awareness of inflation.

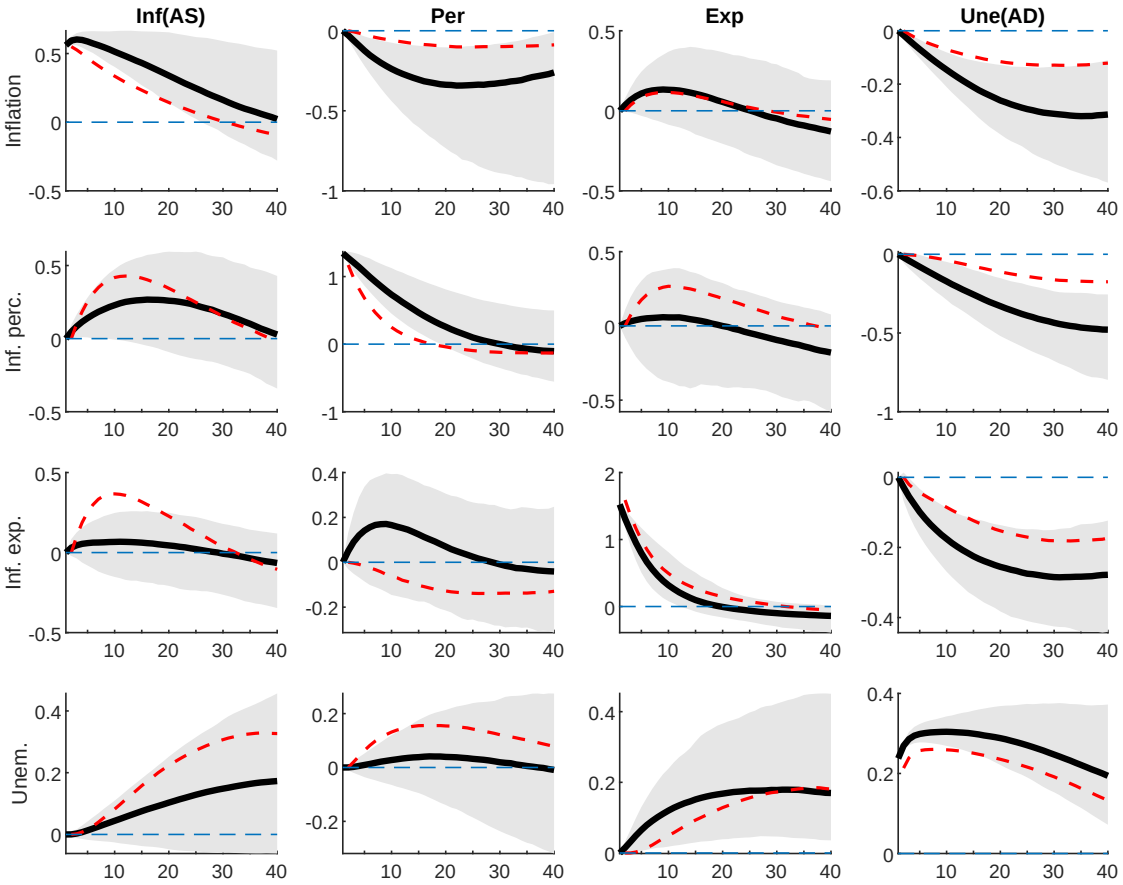



**Figure 8:** Impulse Response Functions to Estimated Structural Shocks

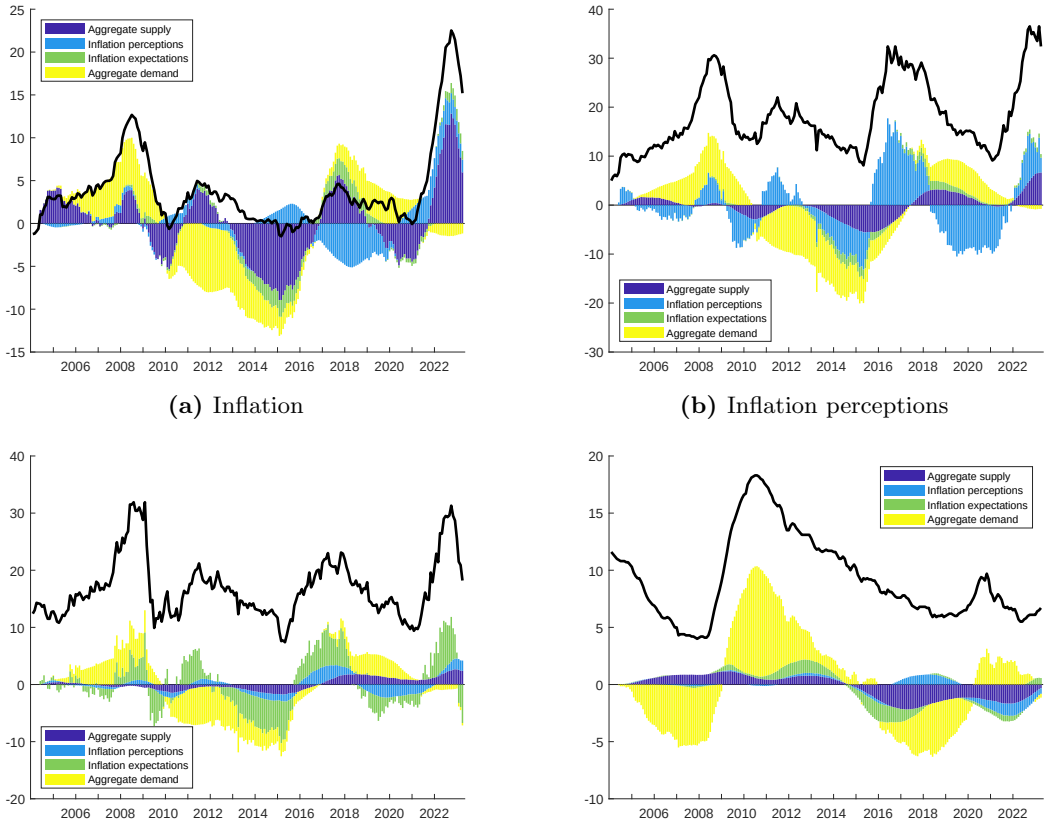
Note: The black line is the median estimate from the SVAR. Shaded area represents 90 percent credibility intervals for the Minnesota prior. Units are in percentage points. Red dashed line is the median estimates using data up to 2015.

all other variables. Interestingly, if we look at the estimates of IRF using only pre-2015 data, we see that shocks to inflation expectations had a more pronounced effect on inflation perceptions. This is not the case, however, if we use the model estimated using whole data sample.

*Shocks to unemployment.* Shocks to unemployment move inflation and employment in opposite directions, while movements in inflation expectations and inflation perceptions mirror the movements in inflation. As the shocks to unemployment push inflation and unemployment in opposite directions, these shocks have the "flavour" of aggregate demand.

We also provide the estimates of IRF using data up to 2015. Note the red dashed line in Figure 8. As we exclude the period of high inflation perception induced by the introduction of the euro and also the post-Covid rise in inflation, we can check the robustness of our results. We show that shocks to inflation and unemployment do not change. However, there are some small but interesting changes in the other two shocks. Using data up to 2015, we see that shocks to inflation expectations had a more pronounced spillover effect on inflation perceptions. Those two shocks also had a more pronounced effect on unemployment. This implies that the post-Euro-introduction dynamic in inflation perceptions differed from the dynamics of inflation perceptions in other periods.

The VAR model allows us to discern the cumulative impact of specific shocks and other factors




**(a)** Inflation

**(b)** Inflation perceptions

**(c)** Inflation expectations

**(d)** Unemployment

**Figure 9:** Historical decomposition

Note: Black line denotes actual variable. Coloured bars provide contributions of different shocks.
Note: Data from January 2004 to May 2023

on the dynamics of the model's endogenous variables (see Fig. 9)[9]. Shocks to inflation and unemployment (which we interpret as shocks of aggregate demand and aggregate supply) explain most of the variation in inflation and unemployment. The results are intuitive. For example, the 2022-2023 rise in inflation is mostly explained by aggregate supply shocks, which is widely agreed upon by experts.

Shocks to inflation expectations and inflation perceptions explain a relatively small part of the variation in inflation and unemployment. Inflation perception and inflation expectations contributed 0.7 pp (at peak) during the 2007-2008 rise in inflation. In 2016-2018 negative shocks to inflation perceptions contributed to lower inflation. Shocks to inflation expectations contributed to lower inflation in 2020. It is also interesting that shocks to inflation perception explain most of the variation in actual inflation perception while (to a lesser extent) shocks to inflation expectations explain most of the variation in inflation expectations. This implies that households' inflation expectations and inflation perception are relatively unimportant in explaining broader economic trends, and move "on their own". Recent periods of post-Covid increase in inflation are driven mostly by aggregate supply shocks. Shocks to inflation expectations contributed at peak 0.6 pp. to inflation.

[9]With VAR models, it is possible to establish the contribution of each structural shock to the historical dynamics of the data series. Specifically, for every period of the sample, one may want to decompose the value of each variable into its components, each component being due to one structural shock of the model. This identifies the historical contribution of each shock to the observed data sample. In our case, the contribution of each shock is calculated as the median of the posterior distribution, and we also consider the total shock contributions, defined as the sum of the individual contributions. For a more technical explanation, see Dieppe et al. (2016).

# 5 Conclusions

Economic theory suggests that inflation expectations should play an important role in economic agents' decision making and, thus, have an effect on economic dynamics. Macroeconomic theory posits that the primary mechanism whereby inflation expectations affect households' decisions is through their perceived real interest rate, which depends not just on the nominal interest rates faced by households, but also on their expectations of future inflation. In this paper, we take a closer look at all available quantitative data for Lithuanian households' inflation expectations. We document a number of novel stylised facts about Lithuanian households' inflation expectations and show that, in many ways, inflation expectations exhibit similar characteristics as in other countries. However, we also indicate some potential differences and provide a hypothesis to explain those differences. Lithuania has witnessed a great deal of media attention about inflation, but to the best of my knowledge this is the first paper analysing quantitative Lithuanian households' inflation expectations. However, as we base our paper on limited data, all the findings should be approached with caution.

In many ways, households' inflation expectations in Lithuania behave similarly to those in other countries . Inflation expectations of Lithuanian households have been significantly higher than recently observed actual inflation rates and forecasts by institutions. On average, year-on-year inflation was around 4 percent from 2004 to 2023. However, average one-year-ahead inflation expectations of households over the same period were 16.9 percent. While it is well established in the literature that households' inflation expectations usually are high compared to actual inflation, in Lithuania this is especially evident. At least part of this can be explained by the fact that inflation in Lithuania was somewhat higher than in other countries. Although we observe the clear upward bias in inflation expectations, there is significant co-movement between actual inflation and inflation expectations of households.

We also show that while inflation perceptions and inflation expectations can differ for a period of time, they tend to converge. During economic booms inflation expectations were higher compared to inflation perceptions. During the economic crisis of 2009, inflation expectations were lower than inflation perceptions. This show that households may indicate the low/high inflation regimes, even if they consistently over-predict inflation. For example, in the post-Covid period inflation, perceptions are almost twice as large as inflation expectations. This suggests that households expect that the current surge in inflation is temporary.

We show that there is considerable heterogeneity in inflation expectations across various population subgroups and even within those subgroups. Households' inflation expectations can be linked to their socio-economic characteristics (older, less educated people on average expect higher inflation). This is in line with the findings of others (Bańnkowska et al. (2021), Arioli et al. (2017)). Nevertheless, we did not find this result to be statistically significant.

We use two methods to analyse how and whether inflation expectations of households affect the broader economy. First, using a micro level survey, we explore whether the spending response of consumers is linked to their beliefs about future inflation. We show that changes in perceived inflation or inflation expectations cannot fully explain variations in consumers' readiness to spend. While in general the literature finds these variables to be linked, this is not universal as in some countries it is not the case. Second, we build a VAR model and analyse the possible effects of households' inflation expectations/perceptions on unemployment and actual inflation. We show that structural shocks to inflation expectations and inflation perceptions play a minor role in overall inflation and unemployment dynamics.

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# A VAR robustness check and additional results

## A.1 Responses of endogenous variables to the shocks to exogenous variable

This section provides the responses of endogenous variables to the shocks to exogenous variable from the main model described in Section 4.2.

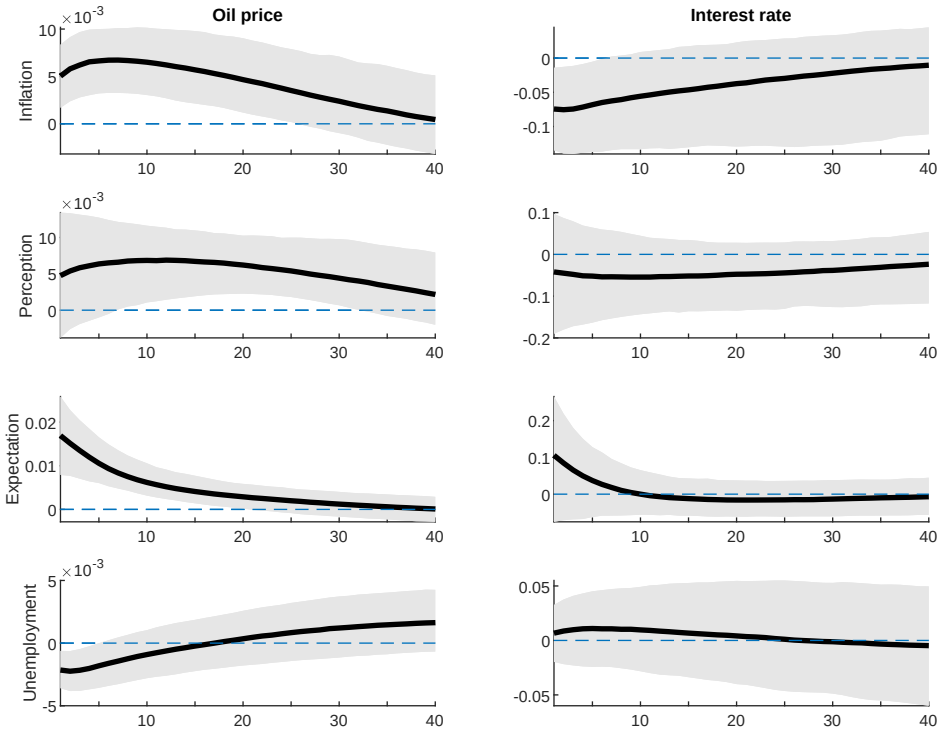



**Figure A.10:** Response of endogenous variables to shocks to exogenous variable

Note: The black line is the median estimate from the SVAR. Shaded area represents 90 percent credibility intervals for the Minnesota prior. Units are in percentage points.

## A.2 Some results from the alternative specification of the VAR model

In this section, we provide various alternative specifications of the VAR model presented in Section 4.2:

1. The model as it is described in Section 4.2 but excluding the inflation perceptions.
2. The model without exogenous variables (oil price and ECB policy rates).
3. The model with changes in unemployment instead of levels in unemployment rate.

### A.2.1 3-variable VAR model

This model specification includes 3 endogenous variables: inflation, inflation expectations and unemployment; and two exogenous variables: oil price and ECB policy rate.

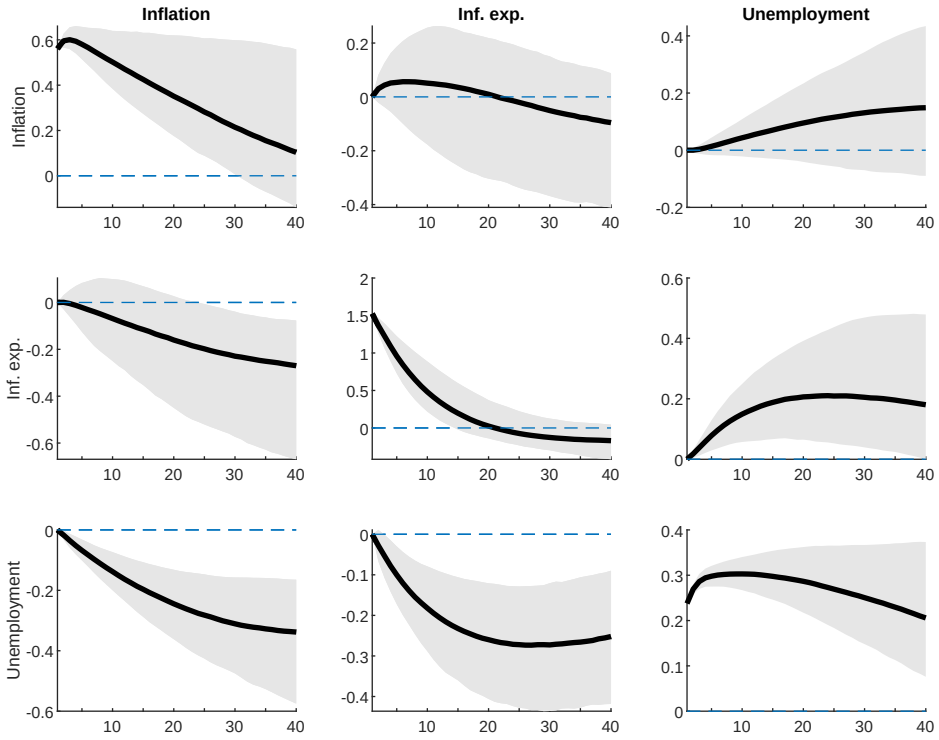



**Figure A.11:** Impulse Response Functions to Estimated Structural Shocks

Note: The black line is the median estimate from the SVAR. Shaded area represents 90 percent credibility intervals for the Minnesota prior. Units are in percentage points.

### A.2.2 4-variable VAR model without exogenous variables

This model specification includes 4 endogenous variables: inflation, inflation perceptions, inflation expectations and unemployment.

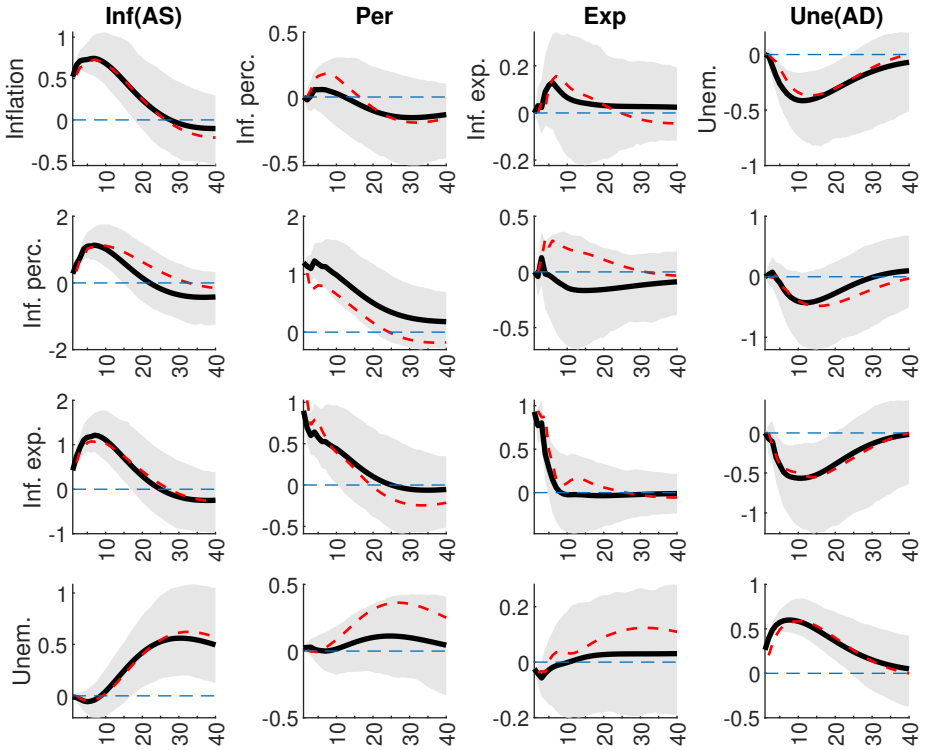



**Figure A.12:** Impulse Response Functions to Estimated Structural Shocks

Note: Note: The black line is the median estimate from the SVAR. Shaded area represents 90 percent credibility intervals for the Minnesota prior. Units are in percentage points. Red dashed line is the median estimates using data up to 2015.

### A.2.3 4-variable VAR model with changes in unemployment

This model specification includes 4 endogenous variables: inflation, inflation perceptions and inflation expectations and unemployment; and two exogenous variables: oil price and ECB policy rate.

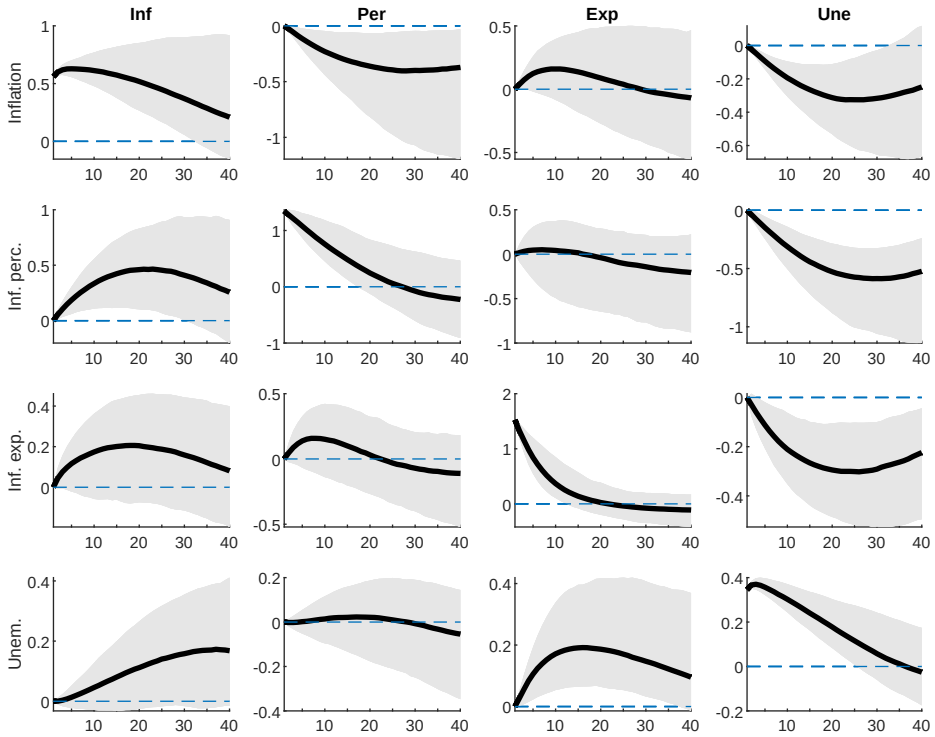



**Figure A.13:** Impulse Response Functions to Estimated Structural Shocks

Note: The black line is the median estimate from the SVAR. Shaded area represents 90 percent credibility intervals for the Minnesota prior. Units are in percentage points.

## A.3 Different shock identification

In the main text, we use the most common restrictions to recover structural shocks: the Cholesky decomposition. This identification scheme utilises a recursive contemporaneous ordering of variables, based on the assumption that it is possible to determine the variables that are not affected by contemporaneous changes in other variables and only respond to those changes with a lag. Our identification strategy follows the logic that there is a sort of "causal chain" of shocks. The ordering of variables is: inflation, inflation perception, inflation expectations, unemployment. However, there no universally established practice to identify expectation shocks. As a robustness check, we also show the results with two alternative specifications:

1. **"Expectations-first" specification.** The variable order is: inflation perception, inflation expectations, inflation, unemployment.
2. **"Variables-first" specification.** The variable order is: unemployment, inflation, inflation perception, inflation expectations.

### A.3.1 "Expectations-first" specification

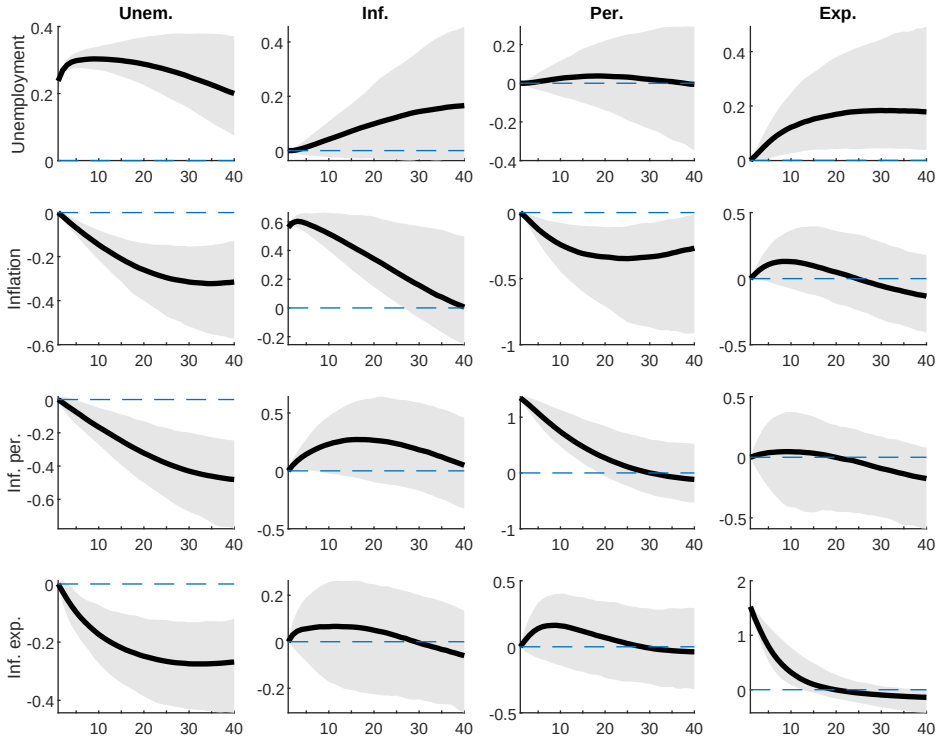



**Figure A.14:** Impulse Response Functions to Estimated Structural Shocks

Note: The black line is the median estimate from the SVAR. Shaded area represents 90 percent credibility intervals for the Minnesota prior. Units are in percentage points.

### A.3.2 "Variables-first" specification.

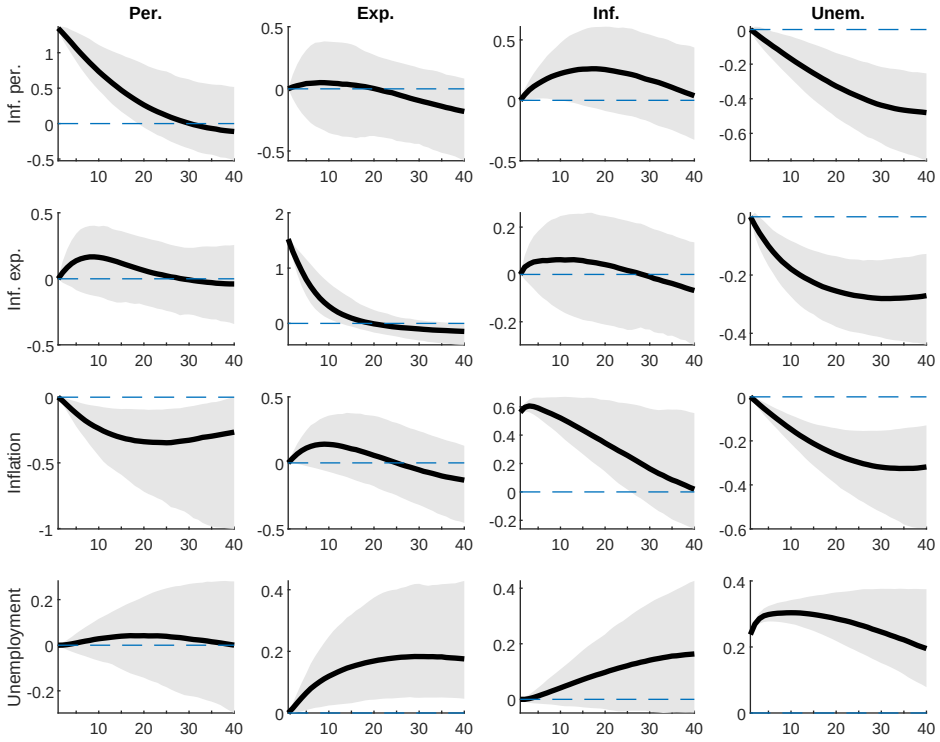



**Figure A.15:** Impulse Response Functions to Estimated Structural Shocks

Note: The black line is the median estimate from the SVAR. Shaded area represents 90 percent credibility intervals for the Minnesota prior. Units are in percentage points.

# B Firms' inflation expectations in Lithuania

In this section, we present the results from a survey of firms conducted by the Bank of Lithuania. As mentioned previously, a quantitative question about one-year-ahead inflation rate has been added to the 2020 wave of this survey. The survey of firms is stratified by sector of economic activity, geographic area and number of employees. To some extent, the survey sample overrepresents larger firms, but, in general, the sample represents a wide variety of firms (see. Fig. B.16 and Table 8). There were three waves to this survey (2020, 2021 and 2022).

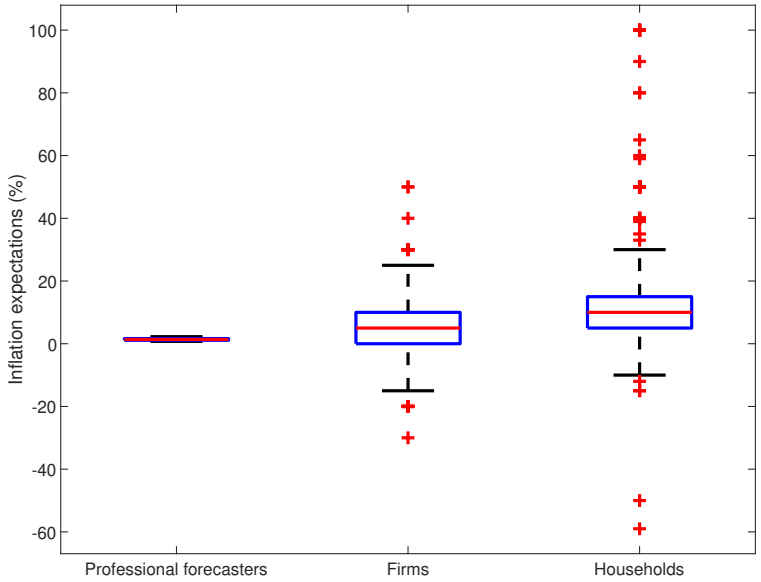



**Figure B.16:** Inflation expectations across agents (2020)

Note: We use the publicly available data of institutions which forecast inflation for Lithuania: The Ministry of Finance, European Commission, the Bank of Lithuania and two commercial banks (Swedbank and SEB). On each box, the central mark indicates the median, and the bottom and top edges of the box indicate the 25th and 75th percentiles, respectively. The whiskers extend to the most extreme data points not considered outliers, and the outliers are plotted individually using the '+' symbol.

| Agents | Mean | Median | Std. dev. | Sample size |
|---|---|---|---|---|
| Professional forecasters | | | | |
| *2020* | 0.82 | 0.8 | 0.18 | 5 |
| *2021* | 2.12 | 2.2 | 0.95 | 5 |
| Firms | 4.82 | 5 | 9.6 | 437 (501) |
| Households | 11.86 | 10 | 14.39 | 771 (1000) |

**Table 7:** Inflation expectations

Note: We use the publicly available data of institutions which forecast inflation for Lithuania: The Ministry of Finance, European Commission, the Bank of Lithuania and two commercial banks (Swedbank and SEB).

Inflation expectations of Lithuanian firms were significantly above the recent observation of inflation and forecasts of institutions (European Commission, the Bank of Lithuania, commercial banks, etc.). However, they were lower than households' inflation expectations. Firms on average expected that prices would increase by 4.82 percent (median – 5%). At the same time households on average expected that prices would increase by 11.86 percent (median – 10%). Also, it is worth noting that firms' expectations varied less compared to households; however there were a number of extreme outliers as in the households' survey (see Fig. B.16 and Table 7). This is largely in line with other research (see for example Dovern et al. (2020)).

| Response | Obs | % Share in survey | % Share in population |
|---|---|---|---|
| **Number of employees:** | | | |
| *1-9* | 167 | 33 | 82.28 |
| *10-49* | 167 | 33 | 13.55 |
| *50+* | 167 | 33 | 4.17 |
| **Main activity** | | | |
| *Industry (BCDE)* | 113 | 22.6 | 20.17 |
| *Construction (F)* | 90 | 18 | 8.09 |
| *Wholesale and Retail trade (G)* | 114 | 22.8 | 17.49 |
| *Services (HIJLMNPQRS)* | 184 | 36.7 | 54.24 |
| Full sample | 501 | 100 | |

**Table 8:** Survey sample vs population

Note: Population shares are calculated using data from Statistics Lithuania

| Response | Obs | % Share | N/A | Mean | Median | Std. dev |
|---|---|---|---|---|---|---|
| **Number of employees:** | | | | | | |
| *1-9* | 167 | 33 | 21 | 6.24 | 5 | 10.8 |
| *10-49* | 167 | 33 | 26 | 3.9 | 4 | 9.4 |
| *50+* | 167 | 33 | 17 | 4.31 | 5 | 8.4 |
| **Main activity** | | | | | | |
| *Industry (BCDE)* | 113 | 22.6 | 14 | 4.21 | 3 | 11.1 |
| *Construction (F)* | 90 | 18 | 11 | 4.78 | 5 | 9.5 |
| *Wholesale and Retail trade (G)* | 114 | 22.8 | 11 | 4.99 | 5 | 8.5 |
| *Services (HIJLMNPQRS)* | 184 | 36.7 | 28 | 5.12 | 3.5 | 9.3 |
| **Exporter** | | | | | | |
| *Yes* | 211 | 42.1 | 23 | 4.62 | 5 | 9.3 |
| *No* | 290 | 57.9 | 41 | 4.97 | 5 | 9.8 |
| Full sample | 501 | 100 | 64 | 4.82 | 5 | 9.6 |

**Table 9:** Firms' Inflation expectations: sample composition and statistics by selected characteristics

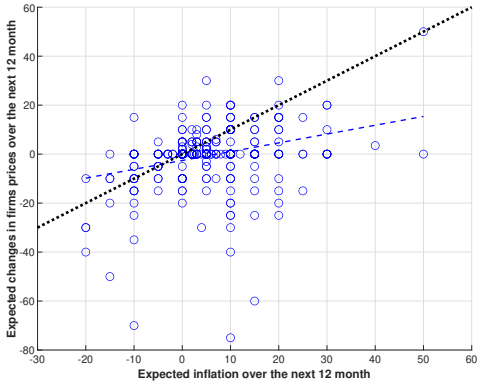
Note: Survey of firms was conducted in July 2020.

Firms' characteristics are relatively insignificant relative to their inflation expectations, as can be seen in Table 9. For example, firms working in different industries hold somewhat similar inflation expectations. Most quantitative responses of firms' inflation expectations (see Table 11) are multiples of 5/10 and between 1-10 there are also peaks at round numbers, such as 1, 2, 3, etc. This feature is similar to the households' survey.

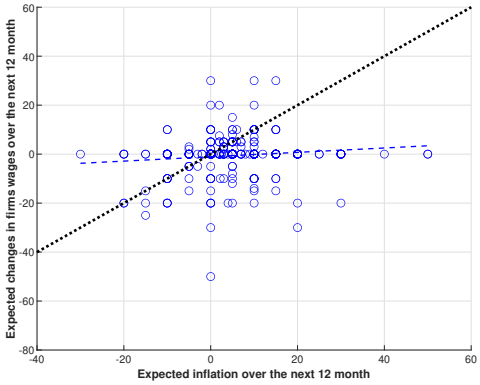
One could argue that if a specific firm expects higher inflation in the future, it should increase its prices now to account for a possible increase in future costs. Fig. B.17a shows that firms' expected price change and expected inflation are positively correlated, while firms' inflation expectations are not correlated with expected changes in firms' wages.

In Table 10, we provide evidence that firms' inflation expectations matter in their price setting decisions, as firms which expect that inflation will be higher also expect to increase their product prices more. This holds true even if we control for expected demand, past price changes and other factors. Thus, a 1 percentage point rise in firms' inflation expectations is associated with 0.35-0.40 percent rise in expected changes in prices.

**Following the significant rise in inflation in the second half of 2021, firms' inflation expectations began to move upwards, albeit to a lesser degree compared to households.** Fig. B.18 provides the data for firms' inflation expectations. In 2020, firms on average were expecting inflation of 4.22 percent (the median firm, however, was expecting 2 percent inflation). This increased significantly in 2021 and 2022, reaching more than 10 percent. Inflation expectations




**(a)** Inflation expectations and expected changes in firms' prices




**(b)** Inflation expectations and expected changes in firm level wages

**Figure B.17:** Linking firms' inflation expectations to other variables.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Intercept | -2.6*** | -2.27*** | -3.92 | -4.93*** | -1.47** | -4.53 |
| Inflation (next 12-months) | 0.36*** | 0.35*** | 0.35*** | 0.35*** | 0.38*** | 0.40*** |
| Firm-level wages (next 12-months) | | | 0.25*** | 0.25*** | 0.25*** | |
| Prices (last 6-months) | | | | 0.10 | 0.45*** | 0.15*** |
| Demand (next 12-months) | | YES | YES | YES | NO | YES |
| Demand (last 6-months) | | NO | NO | NO | NO | YES |
| Observations | 377 | 377 | 345 | 345 | 345 | 340 |
| $R^2$ | 0.090 | 0.145 | 0.182 | 0.182 | 0.145 | 0.236 |

**Table 10:** Price setting equation

Note: The actual sample size used for estimation is 501. The lower sample for some specifications reflects the fact that we also draw on other questions and the response rate can vary from question to question.

| Response | Obs. | % Share |
|---|---|---|
| 0 | 123 | 24.6 |
| 10 | 79 | 15.8 |
| 5 | 65 | 13 |
| 15 | 30 | 6 |
| -10 | 24 | 4.8 |
| 20 | 22 | 4.4 |
| -5 | 18 | 3.6 |
| 3 | 14 | 2.8 |
| 2 | 10 | 2 |
| Other | 53 | 10.4 |
| NA | 63 | 12.6 |
| Positive | 253 | 50.5 |
| Negative | 61 | 12.2 |
| 0 | 123 | 24.6 |
| NA | 64 | 12.8 |
| Full sample | 501 | 100 |

**Table 11:** Firms' inflation expectations

of the median firm in 2022 reached 15 percent. Notably, a significant portion of firms (20-40%) expect no price increase. This leads to a bimodal distribution of firms' expectations, especially

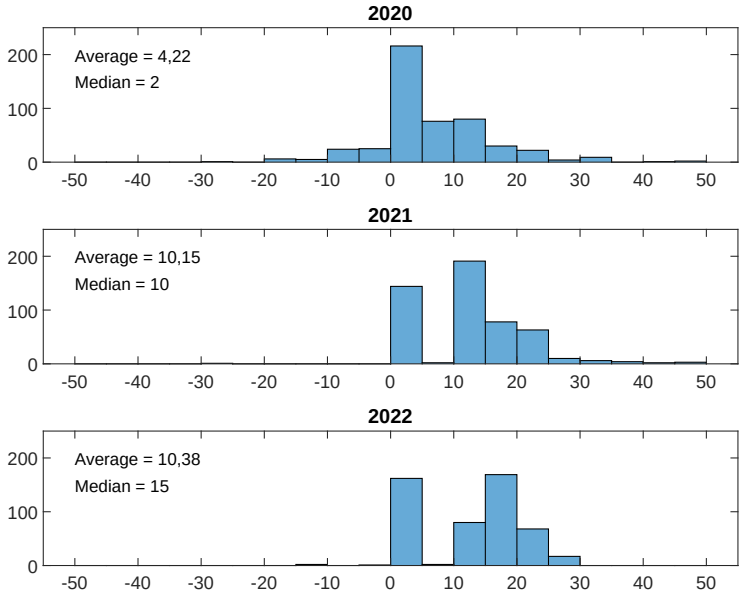



**Figure B.18:** Histogram of firms' inflation expectations

Source: Bank of Lithuania.

Note: In 2022 survey was conducted in July-August, in 2021 it was conducted in June-July, in 2020 it was conducted in May-June.

evident in 2022.

**Firms' wage growth expectations are relatively modest compared to their inflation expectations.** In the survey, the respondents are asked about their wage growth expectations. There are two questions. The first focuses on wage growth expectations in the whole country over the next 12 months. The second focuses on the wage growth expectations in the specific firm over the next 12 months. Fig. B.19 and Fig. B.20 provide results. We can see that in mid-2020, respondents were expecting wage decreases in the country (on average -4.82%), while most of the firms did not expect any wage decrease in their firm. In 2022, the firms were expecting a wage increase of 6.3 percent in Lithuania. When asked about their own firm, most respondents thought that wages would not change. However in 2021-2022 more firms were expecting significant wage increases in their firm.

**There is only a small positive correlation between firms' wages growth expectations and firms' inflation expectations.** See Fig. B.21 and B.22.

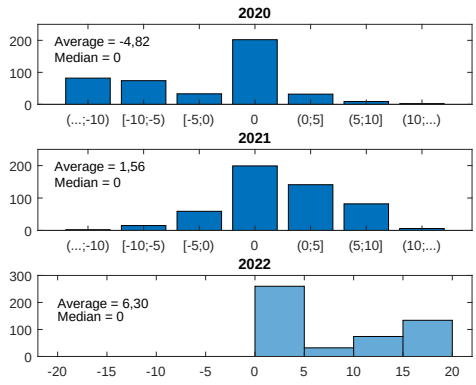



**Figure B.19:** Histogram of firms' wage growth expectations (country level)

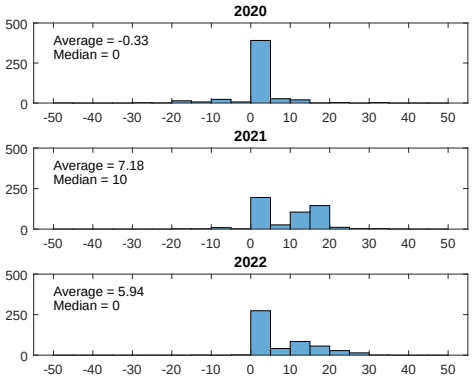



**Figure B.20:** Histogram of firms' wage growth expectations (firm level)

Source: Bank of Lithuania.

Note: In 2020 and 2021, the question on firms' wage growth expectations in Lithuania was formulated as a categorical question, providing 7 choices for the respondents. In 2022, this question was adjusted and respondents could provide any numerical value.

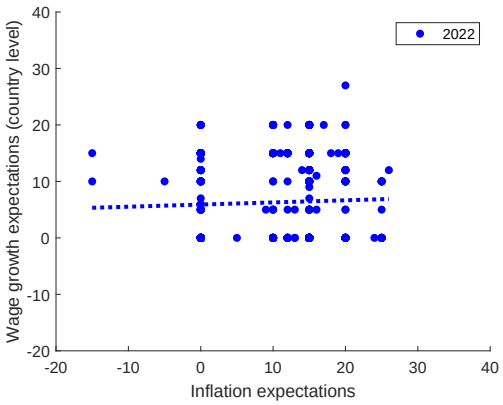



**Figure B.21:** Country-level wage growth

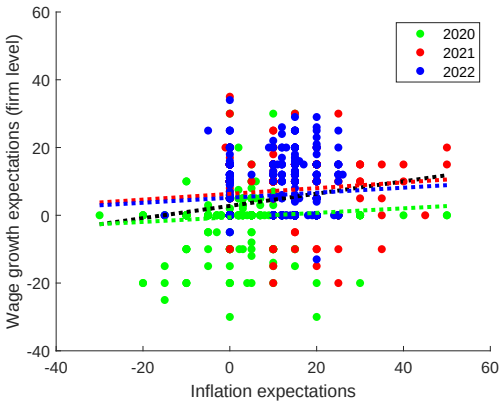


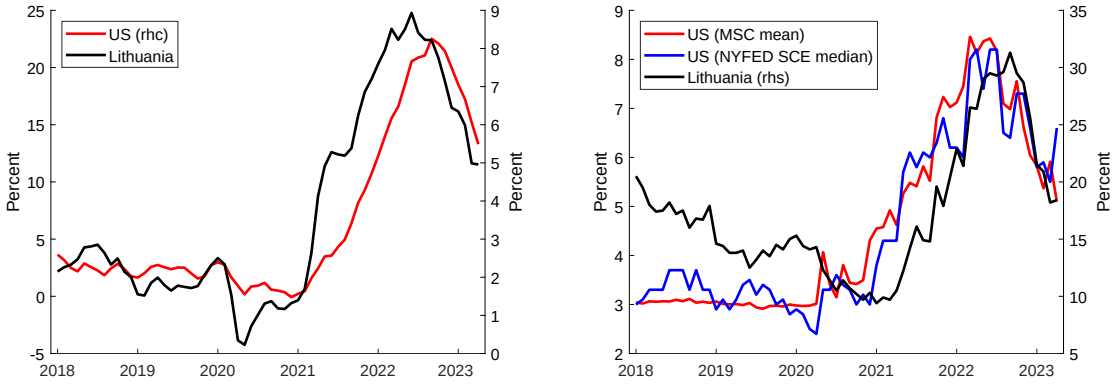

**Figure B.22:** Firm-level wage growth

Source: the Bank of Lithuania.

# C Annex: Comparison of inflation expectations in the US and Lithuania over the COVID-2019 crisis

Unexpectedly, we found that the inflation dynamic in the US and Lithuania from 2018 to mid-2022 is strikingly similar. This offers an opportunity to ascertain whether the dynamics of households' inflation expectations are also similar. Fig. C.23a provides a comparison of inflation calculated using corresponding CPI indexes in the US and Lithuania. We can see that, from 2018 to 2020, the inflation rates were around 3 percent. At the start of 2020 inflation fell significantly in both countries as Covid-induced global lockdowns had led to a collapse of oil prices. The trend shifted in 2021, with a global price surge due to a significant rise in oil price and various supply-side bottlenecks. Inflation in the US and Lithuania reached 6.2% and 8.2% in October of 2021, numbers which had not been seen in decades. However, later inflation in the US peaked at 8 percent, but in Lithuania it reached more than 20 percent.

In Fig. C.23b, we provide households' inflation expectations in the US and Lithuania. For the US, we provide time series: (i) *mean* households' inflation expectations from a survey of the University of Michigan; (ii) *median* households' inflation expectations from the NYFED survey of consumers expectations. While the levels of inflation expectations are different, we can observe striking co-movement. The upward bias in inflation expectations is significantly higher in Lithuania. Lithuanian households' inflation expectations were 12 pp higher than actual inflation; in the US they were 1.3-2.8 pp higher. Also, until 2021 we observe downward trending inflation expectations in Lithuania, which were not present in the US data. We see that inflation expectations started trending upwards from the second quarter of 2020 in the US, while in Lithuania they picked up from 2021. However, despite those differences, both in Lithuania and in the US, inflation expectations almost tripled from the low levels of 2021. In Lithuania they rose from 9.4% to 31.3%, and in the US they rose from 3.8%-4.5% to 8.2%-8.8%.




**(a)** Inflation **(b)** Inflation expectations of households

**Figure C.23:** Comparison inflation in US and Lithuania 2018-2023m4

Note: Inflation is calculated using corresponding consumer price indexes. The data is for one-year-ahead inflation expectations.

# D Annex: Households' inflation expectations and perceptions

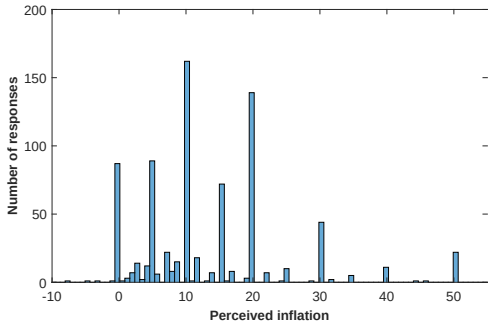



**Figure D.24:** Histogram of HHs' inflation perceptions

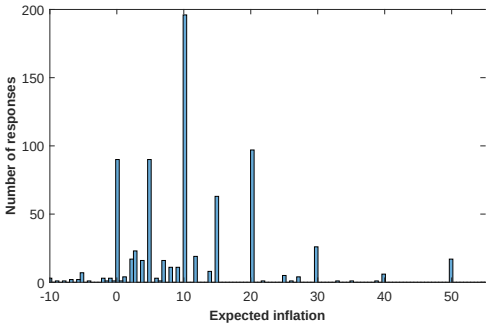



**Figure D.25:** Histogram of HHs' inflation expectations

Source: Survey of households conducted by the Bank of Lithuania
Note: 2020 survey conducted in August.