Low Passthrough from Inflation Expectations to Income Growth Expectations: Why People Dislike Inflation*

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Abstract

Using a novel experimental setup, we study the direction of causality between consumers' inflation expectations and their income growth expectations. In a large, nationally representative survey of US consumers, we find that the rate of passthrough from expected inflation to expected income growth is incomplete, on the order of 20 percent. There is no statistically significant effect going in the other direction. Passthrough varies systematically with demographic and socioeconomic factors, with greater passthrough for higher-income individuals than lower-income individuals, although it is still incomplete. Higher inflation expectations also cause consumers to report a higher probability that they will search for a new job that pays more. Using our survey findings to calibrate a search-and-matching model, we find that dampened responses of real wages to demand and supply shocks translate into greater fluctuations in output. Taken together, the survey results and model exercises provide a labor market channel to explain why people dislike inflation.

JEL codes: E31, E24, E71, C83

Keywords: inflation, wage-price spiral, expectations, randomized controlled trial

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1 Introduction

The rapid economic recovery in the US from the COVID-19-induced recession saw inflation rates return to multi-decade highs. This inflationary surge has been accompanied by two developments. First, consumer inflation expectations also rose – across measures covering consumers, firms, and financial markets. Second, the economic recovery produced a robust labor market, with the vacancy-to-unemployment ratio, a typical measure of labor market tightness, reaching historic highs. This tight labor market has put upward pressure on measures of nominal wage growth and employee compensation. The combination of high inflation readings, increases in inflation expectations, tight labor markets, and strong wage gains has raised concerns about the potential for a wage-price spiral that may partially be driven by expectations (e.g., Curtin (2022); Blanchard (1986)). Even with forward-looking price and wage-setters, however, it is unclear whether higher expected prices would drive higher expected wages or vice-versa.

This paper investigates the relationship between consumers' inflation expectations and their income growth expectations in the United States. Using a novel experimental setup in a large-scale survey conducted in early 2022, we measure these two sets of expectations and assess the causal link between them. Our central finding is that exogenous variations in inflation expectations causally affect income expectations, but we do not find a statistically significant effect going in the other direction. Overall, passthrough from expected inflation to expected income growth is low and far less than one-for-one. At the same time, it is consistent with a belief among consumers that higher inflation will reduce their real income growth and thereby leave them worse off, thus helping to explain why consumers view high inflation with such antipathy. Higher inflation expectations also cause consumers to report a higher probability that they will search for a new job that pays more but does not affect the likelihood that they will negotiate for a higher wage with their current employer, consistent with substantial nominal wage rigidity. A canonical search-and-matching model calibrated to fit our empirical findings provides further evidence of this labor market channel to explain why consumers dislike inflation.

Our empirical findings come from a module designed specifically to study the relationship between inflation expectations and income growth expectations that was placed inside of a large, nationally representative survey of the US population. This online survey was fielded in two stages in January and February 2022 by the decision intelligence company Morning Consult. Together, the two stages collected responses from more than 25,000 US consumers. The survey module had four parts. The first part elicited estimates of an individual's inflation expectations over the next 12 months and the same individual's income growth expectations over the next 12 months. We find a positive correlation between these two variables, but it is not clear from the responses whether one expectation is somehow driving the other because inflation and income growth can affect each other.

To determine the causal relationship between inflation expectations and income growth expectations, the second and third parts of the survey comprised a novel experiment. In the second part, we implemented a randomized controlled trial (RCT) that allowed us to control the information provided to different respondents. Building upon the approach in Coibion, Gorodnichenko, and Weber (2022) to provide monetary policy communications information, we instead provided survey participants with information on two different objects: inflation and income growth. We randomly assigned information treatments to six groups: a control group, a placebo group, three groups that received different pieces of information on inflation, and one group that received information on wage growth, which for most consumers is their primary source of income growth.

Following the treatments, in the third part of the survey we again elicited each individual's inflation expectations and income growth expectations, using questions with slightly different wording than in the first part. This experimental setting allows us to measure how consumers react to the different information treatments in terms of movements in their inflation expectations and their income growth expectations while conditioning on their prior beliefs. We find that the information treatments affect consumers' inflation expectations to varying degrees, except for the placebo. By contrast, only the wage growth information treatment has a statistically significant effect on income growth expectations.

Exploiting this exogenously induced, experimental variation in beliefs as an instrument then allows us to obtain an estimate of the causal link between inflation expectations and income growth expectations. We find that a 1.0 percentage point increase in inflation expectations increases income growth expectations by 0.2 percentage point – implying an expected decrease in real income growth of 0.8 percentage point. The rate of passthrough is larger for higher-income respondents than it is for lower-income respondents, suggesting that the former group is better protected from increases in expected inflation than the latter group. We also find larger passthrough for male respondents than for female respondents. However, in all cases, passthrough remains incomplete and is well below one-for-one. We find no statistically significant evidence for a causal relationship running in the other direction, from income growth expectations to inflation expectations.

Finally, in the fourth part of our survey, we asked respondents about the likelihood that they would pursue different labor market actions over the following year to increase their incomes. Again exploiting the induced variation in beliefs coming from our treatments, we find that higher inflation expectations moderately increase the perceived likelihood that an individual will apply for another job that pays a higher wage, but higher inflation expectations do not increase the perceived likelihood of two other actions aimed at increasing total income to offset higher inflation: working more hours at the current wage or asking for a raise from one's current employer. These results suggest that consumers perceive a high degree of rigidity in their nominal wages with their current employer.

To evaluate the importance of our findings for economic adjustment dynamics in the context of a structural framework, we adapt a relatively standard New Keynesian model with search-and-matching in labor markets as in Mortensen and Pissarides (1994), following papers such as Christoffel and Kuester (2008) and Christoffel, Kuester, and Lizert (2009), among many others. In the model, we allow for sticky information in the formation process of inflation expectations, similar to the Mankiw and Reis (2002). We calibrate the degree of information stickiness to be consistent with the estimated effect that new information from treatments has on our respondents' inflation expectations.[1] We interpret the moderate passthrough from inflation expectations to nominal income growth expectations as a tell-tale sign of severe contemporaneous nominal wage rigidities that feed into expectations, which we model as infrequent nominal wage renegotiation in a Calvo (1983) fashion, calibrated to match our estimate of empirical passthrough. To capture the impact of inflation expectations on labor market actions, we assume that those workers who cannot renegotiate their wages and who apply for other jobs due to higher inflation expectations generate an outside contract with certainty. This wage-push factor puts upward pressure on their nominal wage with the current employer, with an elasticity that we calibrate to match our empirical findings.

We examine the responses of key macroeconomic variables in this setup to a positive demand shock and a negative supply shock that are meant to broadly capture the prevailing inflationary disturbances in the US economy at the time of our survey in early 2022. Nominal wage rigidity plays a crucial role in the dynamics of macroeconomic variables. Subject to an inflationary demand (respectively, supply) shocks, this friction causes a decline in real wages (respectively, mitigated response of real wages) relative to a counterfactual scenario of unit passthrough from inflation

[1] We find that the degree of information stickiness is about 0.28.

expectations to nominal wage growth. The negative and dampened response of real wages translates into an amplified response of output and consumption. As a result, when the shock arises on the demand side, nominal wage rigidity results in consumers working longer hours at a lower real wage, causing thus a larger decline in consumers' utility compared with the counterfactual case of complete passthrough. In the case of an adverse supply shock, nominal wage rigidity exacerbates the decline in consumption and output, strengthening the negative association of inflation and economic performance.[2]

This paper presents a novel experimental setup to measure consumers' inflation expectations and income growth expectations and to attempt to disentangle causation among these variables of interest using an RCT in a large-scale survey. Our empirical findings of limited passthrough from inflation expectations to income growth expectations, resulting in a net decline in expected real income growth, provide additional evidence for why consumers dislike inflation, while our theoretical model further develops this labor market channel. Related to the extant literature, our empirical findings build on the earlier survey work of Shiller (1997), who documented a strong negative perception of inflation. However, the survey approaches differ markedly. The consumer surveys used in Shiller (1997) were more directly focused on eliciting the reasons why people dislike inflation, which can raise difficult questions around framing and confirmation bias in survey design and analysis, alongside selection bias (e.g., those more concerned about inflation may have been more likely to respond). By contrast, our survey design is more indirect, treating inflation expectations and income growth expectations symmetrically; more flexible, allowing us to test for two-way causation; but also quantitative, compared with the narrative approach in Shiller (1997).

Beyond Shiller (1997), Candia, Coibion, and Gorodnichenko (2020) and Coibion, Gorodnichenko, and Ropele (2020a) provide suggestive evidence that higher inflation expectations are associated with lower output by consumers and firms, respectively, without addressing causation.[3]

Some recent discussion suggests a limited role for inflation expectations in explaining current economic outcomes (Rudd (2022)). While that discussion contrasts with evidence that inflation expectations affect economic decisions, there is a general lack of understanding of why households and firms seem to dislike inflation and, therefore, of what the implications of higher or lower

[2] Due to information stickiness in inflation expectations, a fixed fraction of consumers update their expectations to information made available in the present period. Hence, along the impulse response functions to one-time exogenous shocks occurring in the present period, future inflation is equivalent to a fraction of full-information rational inflation expectation. Therefore, we subsequently use the two terms almost interchangeably.

[3] These results contrast with the literature that suggests that higher inflation expectations should lead to higher output when monetary policy is constrained by the zero lower bound, providing one rationale for average inflation targeting monetary policy regimes; see, e.g., Coibion et al. (2020b), Coibion et al. (2020c).

inflation expectations are.

Taken together, our survey results and model exercises provide such theoretical and empirical insight: In particular, we show that frictions in nominal wages can explain why consumers associate higher inflation with worse economic outcomes, without the need for behavioral biases or inattention as in Kamdar (2019). While this negative association seems straightforward from a supply-side view, the perceived frictions affecting nominal incomes found in the empirical section help explain why consumers link inflation with worse economic outcomes even in the presence of demand shocks.

Our paper is related to two further strands of the literature. First, our work fits into a growing literature that focuses on survey data to understand how economic agents form expectations about key variables, such as inflation; see, e.g., Coibion and Gorodnichenko (2015), Bordalo et al. (2020), Coibion, Gorodnichenko, and Ropele (2020a), Angeletos, Huo, and Sastry (2021), Coibion, Gorodnichenko, and Weber (2022), among many others. An even more recent literature is investigating relationships between inflation and economic activity expectations (see, e.g., Candia, Coibion, and Gorodnichenko (2020) and Coibion et al. (2019)). The present paper contributes to this branch of the literature with, to the best of our knowledge, the first in-depth investigation of the causal links between consumers' inflation and nominal income growth expectations in a large-scale survey. Other studies, such as Savignac et al. (2021), look at the relationship between firms' inflation expectations and wage expectations (through the lens of the latter being a cost of production), finding a low correlation in the context of France. We complement these findings by providing evidence of a causal relationship from inflation expectations to income growth expectations from the consumer's point of view. In addition, we link exogenous changes in inflation expectations to anticipated labor market actions.

Second, our paper is linked to the New Keynesian body of literature that incorporates Mortensen and Pissarides (1994) types of labor market search-and-matching frictions. Our model is largely adapted from papers such as Trigari (2006), Christoffel and Kuester (2008), Christoffel, Kuester, and Lizert (2009), and Gertler and Trigari (2009). Differently from these papers, we calibrate the model, namely, the nominal wage stickiness and elasticity of the wage-push factor with respect to inflation expectations, to match our new empirical facts. Papers such as Christiano, Eichenbaum, and Evans (2005), Smets and Wouters (2007), and Gali, Smets, and Wouters (2012) have shown that wage rigidities play an important role in explaining US aggregate data. Our paper provides additional evidence that wage rigidity is further reflected in consumers' inflation and income growth expectations. Furthermore, the assumption of a wage-push factor plays a similar role to within-quarter job-to-job transition probabilities being affected by inflation expectations. Krusell et al. (2017), for instance, consider within-period job-to-job transitions with a fixed probability.

The rest of the paper is organized as follows. Sections 2 and 3 provide a detailed description of our survey data and experiment, respectively. Section 4 explains our identification strategy and presents the main empirical findings. Section 5 gives a brief overview of the model, our calibration strategy, and the macroeconomic implications of the model. Section 6 concludes.

2 Data Description

Morning Consult and researchers at the Center for Inflation Research at the Federal Reserve of Cleveland as well as Brandeis University recently introduced a new way of measuring inflation expectations: the indirect consumers inflation expectations (ICIE). The idea underlying these expectations data is not to elicit inflation expectations directly, but rather to ask for the change in income that consumers think is required to buy the same goods and services a year from the date of the survey. Details of the implementation and results of this survey-based measure are described in Hajdini et al. (2022). The data contain responses for approximately 20,000 respondents per week who have answered the following question about inflation expectations since February 2021:

"Next we are asking you to think about changes in prices during the next 12 months in relation to your income. Given your expectations about developments in prices of goods and services during the next 12 months, how would your income have to change to make you equally well-off relative to your current situation, such that you can buy the same amount of goods and services as today? (For example, if you consider prices will fall by 2% over the next 12 months, you may still be able to buy the same goods and services if your income also decreases by 2%.) To make me equally well off, my income would have to"

Respondents then select from three options, filling in the percentages if they select (1) or (3), while (2) is coded as zero:

1. Increase by %;
2. Stay about the same; and
3. Decrease by %.

In January 2022, a question was added to the survey to allow for an investigation into the relationship between consumers' inflation expectations and income growth expectations. The question is the following:

Do you expect your income to increase, decrease, or stay about the same over the next 12 months?
The question comes with the same options as in the previous question. If respondents indicated they expect their income to increase or decrease, then they were subsequently asked to provide a quantitative percentage response.

We note that while the question refers to income, wages are the main source of income for most individuals. Panel A in Table 1 reports various summary statistics for expected inflation, expected nominal income growth, and an implied expected real income growth series derived by subtracting expected inflation from expected nominal income growth at the individual level. We winsorize 5 percent of the data, which leaves us with 20,550 observations where outliers with answers that are above the 97.5 percentile or below the 2.5 percentile of the distribution are assigned the value of that percentile. In addition, Panel B in Table 1 reports the results from a regression of expected nominal income growth on expected inflation.

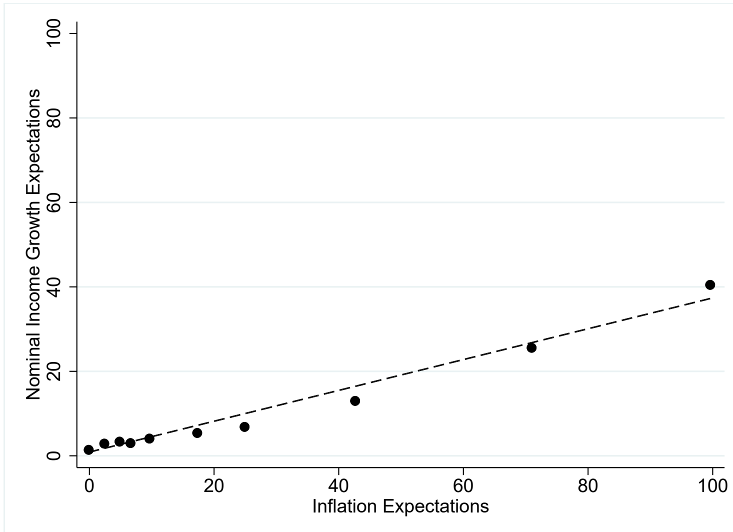
Table 1: Summary Statistics and Relationship between Price and Wage Inflation

	Inflation Exp	Nominal Income Growth Exp	Real Income Growth Exp		Nominal Income Growth Exp
1st percentile	-2	-12	-100	Inflation Exp	0.365***
First quartile	0	0	-7		(0.012)
Median	0	0	0	Constant	0.891***
Third quartile	10	2	0		(0.104)
99th percentile	100	100	50		
Mean	12.692	5.523	-7.169		
Standard deviation	24.536	18.822	22.735		
Observations	20,550	20,550	20,550		20,550

Notes: This table shows summary statistics for expectations of inflation and nominal income growth. We also report a measure of expected real income growth derived as the difference between expected nominal income growth and expected inflation at the individual level. The right part of the table shows a regression of expected nominal wage on expected inflation. We calculate Huber-robust standard errors and *** denotes statistical significance at the 1 percent level.

Summary statistics of the data in Panel A of Table 1 show that on average expected inflation is higher than expected income growth, indicating that expected real income growth is negative on average. As shown by the estimated regression in Panel B, the relationship between expected inflation and expected nominal income growth is positive but the estimated coefficient on expected inflation is noticeably less than one. Figure 1 illustrates this feature of the relationship between the two series, where the co-movement appears to be stronger at the lower range of values.

Figure 1: Relationship between Inflation Expectations and Income Growth Expectations



Notes: The figure shows a bin-scatter graph between nominal income growth expectations and the indirect consumers' inflation expectations. The dashed line shows the linear fit of the data.

It is important to note that the estimated regression only captures a correlation between the expectations series. Reverse causality is likely present in this relationship. That is, expected income growth could influence inflation expectations, biasing the estimated effect of expected inflation on income growth expectations. In addition, the error term affects both variables, as inflation and wage growth expectations are jointly determined. In order to circumvent those biases, we will look at a factor that can affect each of those variables directly to determine the causal relationship between inflation expectations and income growth expectations.

3 Experiment Description

To address potential reverse causality and to clarify the direction of causality – from income growth expectations to inflation expectations and/or from inflation expectations to income growth expectations – we introduced an experimental component to the survey. In February 2022, we asked two additional questions intended to capture posterior beliefs after an information treatment. While not repeating the precise wording of the two initial questions described above to avoid confusing respondents, the two additional questions are similar and aim to capture comparable information.

In terms of inflation expectations, the added question is the following:

"In the next year, do you think prices in general will increase, decrease, or stay about the same?"

If respondents' answers indicated an expected increase or decrease, then they were subsequently asked to provide a quantitative percentage response. This question is slightly different from the initial question about inflation expectations. First, it asks directly about prices. In addition, it asks about prices in general, instead of the prices they are exposed to. We expected that answers to this question would not be perfectly correlated with the indirect measure of inflation expectations. Nevertheless, we expected the responses to be strongly positively correlated, which would allow us to capture the posterior beliefs after an information treatment.

In terms of income growth expectations, the added question is the following:

"Between December 2022 and December 2023, do you expect your income to increase, decrease, or stay about the same over the next 12 months?"

Compared to the initial question on income growth expectations, this question mainly differs in its reference to a fixed time period. This period overlaps with the previous question, so we expected a positive correlation with the previous question given the overlap as well as the fact that many wages are adjusted infrequently and at a particular time of the year.

The structure of the experiment is then the following: First, the survey administers two initial questions (priors) about inflation and income growth expectations to all respondents. Second, we apply different information treatments to respondents. Third, we ask the two additional survey questions just described. The total sample for the experiment contains 6,629 respondents who are split up and randomly receive one of the following treatments that includes being part of a control group:

1. Control (N=1,075)
2. The Federal Reserve targets an inflation rate of 2% per year in the long run. (1,155)
3. A recent survey from the Conference Board found that wages were expected to rise 3.9% in 2022. (1,093)
4. Between January 2021 and January 2022, the Consumer Price Index (CPI), which measures the average change in prices over time that consumers pay for goods and services, showed the inflation rate in the US was 7.5%. (1,112)

5. According to the Survey of Professional Forecasters, the Consumer Price Index (CPI), which measures the average change in prices over time that consumers pay for goods and services, showed the inflation rate will be 3.7% by the end of 2022. (1,074)
6. According to the US Census Bureau, the United States population was 332,402,978 as of December 31, 2021. (1,120)

Treatment 2 aims to inform respondents about the price stability objective of the Federal Reserve and potentially influence their long-run inflation expectations. Treatment 3 provides information about wage growth expectations that can be used to evaluate causality from wage growth expectations to inflation expectations. Treatment 4 provides information about past inflation that may affect future inflation expectations as well as perceived real income in case the reported inflation rate was not known. Treatment 5 provides information about future inflation that can affect consumers' inflation expectations. Last, treatment 6 provides information that should not be relevant and is intended to work as a placebo, allowing us to determine whether consumers react to receiving any information.

In addition to these questions, we ask respondents about labor market decisions. After the question about the posterior beliefs, we ask consumers "How likely are you to do the following to increase your income over the next three months?" We follow up with three options and one open-ended question, where they have to answer whether it is *very likely*, *somewhat likely*, *somewhat unlikely*, or *very unlikely*. We also add an option for *do not know*. The actions we ask are:

- Apply for a job(s) that pays more
- Work longer hours
- Ask for a raise

In addition, we leave an open-ended answer option to record any further choices. The order of the experiment can be summarized as follows:

1. **Prior Inflation**: Indirect measure of inflation expectations question
2. **Prior Wages**: Income over the next year question
3. **Information Treatment or Control**
4. **Posterior Inflation**: Prices in general inflation expectations question
5. **Posterior Wages**: Income December 2022-December 2023 question

6. **Actions**: Options about labor market outcomes question

With this design we would be able to determine the causal effect from inflation and wage growth expectations for each of the posterior responses and actions while controlling for the individuals' priors, in case the information treatments affect respondents' expectations. In the next section we evaluate those effects.

4 Results

In this section we evaluate the effect of the treatments on respondents' posterior beliefs and on their labor market decisions. We first evaluate the effect on inflation and income growth expectations, and then turn to an analysis of labor decisions. We find three main results. First, passthrough of inflation expectations to income growth expectations is positive and statistically significant but less than unity; there is no statistically significant passthrough from income growth expectations to inflation expectations. Second, passthrough of inflation expectations to income growth expectations increases in the consumer's level of current income, and it is higher for male respondents than for female respondents. Third, higher inflation expectations cause consumers to report a moderately higher probability that they will search for a new job that pays more, but they do not increase the perceived probability of working more hours or asking for a raise from one's current employer.

4.1 Main Analysis

To arrive at these results, our analysis takes three steps. First, we verify that our additional "posterior" questions capture information similar to that of the baseline "a priori" questions. Second, we establish which treatments affect the posterior beliefs. Third, we show how we can use the information from the treatments to infer the causal effect of inflation expectations on income growth expectations, and vice versa.

As a first step, we estimate two specifications that relate prior beliefs to posterior beliefs. For inflation expectations, we estimate the following specification:

$$E\left[\pi_i^{Prices}\right] = \alpha + \beta E\left[\pi_i^{ICIE}\right] + \varepsilon_i \quad (1)$$

and for income growth expectations, we estimate the following specification:

$$E\left[\pi_i^{Income2y}\right] = \alpha + \beta E\left[\pi_i^{Income1y}\right] + \varepsilon_i \tag{2}$$

where π_i^{ICIE} denotes the inflation expectations from the ICIE question for respondent i, π_i^{Prices} denotes the income growth expectations between December 2021 and December 2022 for respondent i. $\pi_i^{Income2y}$ contains the answer to the question concerning income growth expectations between December 2021 and December 2022 and $\pi_i^{Income1y}$ denotes the income growth expectations over the next year for person i. We estimate these specifications for the full sample of respondents as well as the control group. As columns 1-2 and 5-6 in Table 2 show, we find positive and statistically significant correlations between prior and posterior expectations, for both income growth and inflation expectations. This result holds for the full sample and the control group.

As a second step, we establish that some but not all of our treatments affect posterior beliefs. In the case of inflation expectations, we estimate the following specification:

$$E\left[\pi_i^{Prices}\right] = \alpha + \beta\pi_i^{ICIE} + \sum_{j=2}^{6}\gamma_\pi^j \times T_i^j + \sum_{j=2}^{6}\theta_\pi^i \times T_i^j \times E\left[\pi_i^{ICIE}\right] + \varepsilon_i \tag{3}$$

and for income growth expectations, we estimate the following specification:

$$E\left[\pi_i^{Income2y}\right] = \alpha + \beta\pi_i^{Income1y} + \sum_{j=2}^{6}\gamma_I^j \times T_i^j + \sum_{i=2}^{6}\theta_I^i \times T_i^j \times E\left[\pi_i^{Income1y}\right] + \varepsilon_i \tag{4}$$

where for respondent i, T_i^j is a variable that takes value 1 if respondent i received treatment j and 0 otherwise. The control group $j = 1$ is the reference group. We winsorize 2.5 percent of the highest and lowest answers and we also conduct Huber-robust regressions. Regressions (3) and (4) examine whether the role of priors is affected by the treatment. Ideally, the information treatment should reduce the influence of the prior on the posterior. In that case, if treatment i is effective, then we should expect a negative coefficient for θ_π^i and θ_I^i, as the prior will have a reduced role for the treated group in explaining the posterior compared with the control group. Table 2, columns 3-4 and 7-8, show our results.

Table 2: Effects of Treatments on Expectations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$E\left[\pi_i^{Prices}\right]$	$E\left[\pi_i^{Prices}\right]$	$E\left[\pi_i^{Prices}\right]$	$E\left[\pi_i^{Prices}\right]$	$E\left[\pi_i^{Income2y}\right]$	$E\left[\pi_i^{Income2y}\right]$	$E\left[\pi_i^{Income2y}\right]$	$E\left[\pi_i^{Income2y}\right]$
$E\left[\pi_i^{ICIE}\right]$	0.264***	0.262***	0.262***	0.505***				
	(0.010)	(0.026)	(0.026)	(0.007)				
$E\left[\pi_i^{Income1y}\right]$					0.705***	0.775***	0.775***	0.604***
					(0.022)	(0.048)	(0.048)	(0.074)
T2: Target			-0.627	0.126			-0.203	0.011
			(0.460)	(0.138)			(0.248)	(0.127)
T3: Wages			-0.695	0.771***			-0.208	0.243*
			(0.450)	(0.153)			(0.230)	(0.125)
T4: CPI			-0.825*	0.586***			-0.109	0.200
			(0.456)	(0.150)			(0.254)	(0.131)
T5: SPF			-0.749	0.720***			-0.100	0.064
			(0.465)	(0.149)			(0.247)	(0.127)
T6: Placebo			0.133	0.498***			-0.373	-0.186
			(0.465)	(0.148)			(0.248)	(0.125)
T2 x prior			0.002	-0.023***			-0.127*	-0.094
			(0.036)	(0.008)			(0.072)	(0.117)
T3 x prior			-0.003	-0.213***			-0.047	-0.210*
			(0.035)	(0.013)			(0.071)	(0.101)
T4 x prior			-0.015	-0.258***			-0.114	0.084
			(0.035)	(0.011)			(0.074)	(0.112)
T5 x prior			-0.025	-0.281***			-0.039	-0.091
			(0.036)	(0.011)			(0.071)	(0.111)
T6 x prior			0.047	-0.008			-0.078	0.001
			(0.035)	(0.008)			(0.074)	(0.131)
Constant	5.203***	5.667***	5.667***	1.343***	0.761***	0.925***	0.925***	0.520***
	(0.129)	(0.337)	(0.337)	(0.098)	(0.068)	(0.185)	(0.185)	(0.131)
Sample	All	Control	All	All	All	Control	All	Trimmed
Regression	OLS	OLS	OLS	Huber	OLS	OLS	OLS	OLS
Observations	6,620	1,072	6,620	5,892	6,622	1,074	6,622	5,753
R-squared	0.256	0.236	0.261	0.7856	0.557	0.604	0.559	0.322

Notes: The table shows estimates of equations 1 and 2 that relate priors and posteriors, as well as estimates of equations 3 and 4 that gauge the effect of treatments and their interaction with prior beliefs.

We first find a high correlation of the posteriors with the priors. After controlling for outliers (column (4)), we find that for the control group, a 1 percentage point increase in the prior of inflation expectations (the ICIE measure) increases the posterior by 0.5 percentage point. In the case of income, the correlation is even higher, with a 0.6 percentage point increase after controlling for outliers(column (8)).

In terms of the effect of the treatment, the following results emerge. With regard to inflation expectations, we find no statistically significant effects in the OLS regressions when we control for prior expectations interacted with the treatments. This result is largely due to the presence of outliers. It motivates our adoption of Huber-robust regressions, as in Coibion, Gorodnichenko, and Ropele (2020a). When we apply this estimation technique to the data, we now observe that all of the treatments have a statistically significant effect except for the placebo (comparing columns 3 and 4). Moreover, the estimated coefficients are negative, indicating that consumers who received one of the treatments place less weight on their prior expectations. We can also see that there is variation in the magnitude of the effects across treatments. In particular, while the treatment on the Federal Reserve's inflation target is negative and statistically significant, the coefficient is smaller compared with those reported for treatments 3-5. The placebo does not seem to affect posteriors compared to the control group.

With regard to the income question, the OLS regressions provide little evidence that the treatments display statistically significant effects, similar to the results from our analysis of inflation expectations. This result is again affected by the presence of outliers. However, Huber-robust regressions fail to run here because there are many respondents who answer "stay about the same," which is coded as 0, invalidating the Huber approach by eliminating the necessary variation. As an alternative to the Huber-robust regressions, we therefore trim the sample by dropping observations between the 5th and 95th percentiles. We use population weights as in the Huber approach, so we are considering a similar sample. As shown, we find little effect of the information treatments other than for the wage inflation treatment. Overall, the results in Table 2 suggest that the information treatments have a greater effect on inflation expectations than on income growth expectations.

As a third step, we use the information from the effective treatments as instruments to infer the causal effect of inflation expectations on income growth expectations, and vice versa. To estimate the effect of inflation expectations on income growth expectations, we use the following instrument:

$$E\left[\widehat{\pi_{\pi,i}^{Prices}}\right] = \begin{cases} \sum_{j=2,4,5} \gamma_{\pi}^{j} \times T_i^j + \sum_{j=2,4,5} \theta_{\pi}^{j} \times T_i^j \times E\left[\pi_i^{ICIE}\right] & if \quad T_i = 2,4,5 \\ 0 & if \quad T_i = 1,6 \end{cases}$$

where we exclude the treatment providing information on wage inflation because that treatment directly affects income growth expectations as shown in Table 2. To evaluate the effect of income growth expectations on inflation expectations, we use the wage treatment as an instrument:

$$E\left[\widehat{\pi_i^{Income2y}}\right] = \begin{cases} \gamma_I^3 \times T_i^3 + \theta_I^3 \times T_i^3 \times E\left[\pi_i^{Income1y}\right] & if \quad T_i = 3 \\ 0 & if \quad T_i = 1,6 \end{cases}$$

Given these instruments, we run instrumental-variable (IV) regressions. The instrument captures the exogenously induced variation in beliefs created by the randomly assigned information treatment(s). In addition, we control for the priors in the regressions in order to gauge their importance.

The result will indicate the changes in the wage or price inflation expectations, given a certain path or prior. We run the IV regression for the inflation treatment using the coefficients obtained by the Huber regression in column (4) in Table 2. In the case of the wage treatment, we run IV regressions with the coefficients from the trimmed sample. For inflation we use the Huber regression. This approach is similar in spirit to the approach used in Coibion et al. (2019). They use the prior as an instrument. In this case, because we have multiple instruments, we can weight them according to their importance in affecting the prior. Coibion, Gorodnichenko, and Ropele (2020a) use the past inflation treatment as an instrument. Unfortunately, we do not have the time series dimension that they have to generate enough predictive power to the instrument. Table 3 shows the results.

Table 3: Effect of Inflation on Income Growth Expectations

	(1)	(2)	(3)	(4)
	$E\left[\pi^{Income2y}\right]$	$E\left[\pi^{Income2y}\right]$	$E\left[\pi^{Prices}\right]$	$E\left[\pi^{Prices}\right]$
$E\left[\pi^{Prices}\right]$	0.085***	0.203***		
	(0.014)	(0.069)		
$E\left[\pi^{Income1y}\right]$	0.674***	0.636***		
	(0.025)	(0.033)		
$E\left[\pi^{Income2y}\right]$			0.403***	0.325
			(0.074)	(0.381)
$E\left[\pi^{ICIE}\right]$			0.269***	0.269***
			(0.017)	(0.018)
Constant	0.109	-0.805	4.593***	4.633***
	(0.101)	(0.521)	(0.185)	(0.451)
Regression	OLS	IV	OLS	IV
F-test		120.584		51.202
Observations	5,525	5,525	2,975	2,910
R-squared	0.558	0.539	0.262	0.257

Notes: This table shows results from OLS and IV regressions. Columns (1) and (2) are the results of regressing the posterior of income growth expectations on the prior of income growth expectations and the posterior of inflation expectations. In column (2) we use IV, instrumenting with $E\left[\pi_i^{Prices}\right]$. Columns (3) and (4) are the results of regressing the posterior of inflation expectations on the prior of inflation expectations and the posterior of income growth expectations. In column (4) we use IV, instrumenting with $E\left[\pi_i^{Income2y}\right]$. Regressions have robust standard errors.

Here, the main empirical finding of our paper emerges: There is a causal positive relationship from inflation expectations to income growth expectations with only partial passthrough, while there is no passthrough from income growth expectations to inflation expectations. As shown in column (1), inflation expectations appear to have a very low correlation with income growth expectations, after controlling for priors. However, as shown in column (2), using the instrument yields a coefficient that is significantly higher. As expected, the instrument displays a relatively high F-test statistic. Quantitatively, a 1 percentage point increase in inflation expectations increases income growth expectations by 0.2 percentage point. This result suggests that passthrough is positive, but considerably lower than one-to-one. Therefore, the same 1 percentage point increase in inflation expectations implies a 0.8 percentage point reduction in real income growth expectations.

When we run a similar exercise with the wage treatment, we find no evidence of a statistically significant causal relationship from income growth expectations to inflation expectations. As shown in column (3), the OLS regression suggests a relatively high relationship between expectations of income growth and price inflation. However, when we use the instrument derived from the wage information treatment, which also comes with a high F-test as shown in column (4), we now observe that the observed statistical significance in the OLS results vanishes. While the point estimate is similar, the standard error is much larger. This increase in the standard error leads us to conclude that there is no statistically significant causality running from income growth expectations to inflation expectations or associated passthrough.

The results support the view that consumers believe that inflation will translate into some movement of their nominal incomes. In that sense, even though the information treatments are about aggregate variables, they understand that aggregate price changes affect their nominal incomes, even if the passthrough is not complete. This result shows that they expect a reduction of their real incomes after an increase in inflation expectations. In the case of income expectations, we do not see the same pattern. In that sense, the results suggest that households fail to connect changes in their expectations for income growth to broader macroeconomic conditions, including expected inflation, as might be expected in general equilibrium.

Finally, we find evidence for a strong effect of demographics on the relationship between inflation expectations and income growth expectations. For this exercise, we separate our sample based on how the survey respondents identified themselves as male or female and their self-reported annual income (less than \$50,000, between \$50,000 and \$100,000, and more than \$100,000). We only report the IV results, displayed in Table 4.

Table 4: Passthrough from Inflation Expectations to Income Growth Expectations, by Demographics

	$E\left[\pi^{Income2y}\right]$					
	All	Male	Female	<50k	50k-100k	>100k
$E\left[\pi^{Prices}\right]$	0.201***	0.267***	0.156	0.129	0.309*	0.336***
	(0.070)	(0.103)	(0.097)	(0.091)	(0.171)	(0.122)
$E\left[\pi^{Income1y}\right]$	0.637***	0.621***	0.634***	0.656***	0.579***	0.589***
	(0.034)	(0.054)	(0.045)	(0.041)	(0.067)	(0.102)
Constant	-0.792	-1.079	-0.534	-0.314	-1.562	-1.503**
	(0.530)	(0.660)	(0.843)	(0.741)	(1.278)	(0.766)
F-test	117.408	51.174	61.95	64.121	27.205	42.654
Observations	5,525	2,724	2,801	2,503	1,894	1,128
R-squared	0.540	0.600	0.483	0.528	0.452	0.657

Notes: This table shows results from IV regressions from different demographics. The regression used is the same in Column (2) in Table 3. Regressions have robust standard errors.

Large differences exist across these groups. Male respondents have a higher and statistically significant passthrough compared with female respondents, with the former coefficient almost 70 percent higher, and the latter not statistically significantly different from zero. In the case of income groups, we also see very heterogeneous effects. Respondents in the highest income group have a perceived passthrough that is more than 2.5 times higher compared with the lowest-income respondents. The passthrough coefficient is statistically different from zero only for respondents in the middle or highest income group, but not the lowest income group. These results suggest that higher-income individuals perceive that their incomes are better insulated from higher inflation than lower-income individuals do, though with passthrough less than one-for-one, even higher-income individuals do not believe their incomes will fully keep up.

4.2 Labor Market Decisions

Following the posterior question about income, we elicited the likelihood of three different labor market decisions: "Apply for a job(s) that pays more," "Work longer hours," and "Ask for a raise." For each of these answers, respondents were asked to indicate the respective likelihood, as explained in Section 3.

We run regressions of the assessed likelihood, y_i^j, on expected inflation to assess the extent to which expected inflation drives labor market decisions. Here, y_i^j takes values from 1 to 4, indicating qualitative probabilities ranging from *very unlikely* to *very likely*. We use the same instrument for expected inflation as before. This leads us to estimate the following specification:

$$y_i^j = \alpha + \beta E\left[\widehat{\pi_i^{Prices}}\right] + \varepsilon_i \tag{5}$$

Our results, shown in Table 5, indicate that higher inflation expectations increase the likelihood that consumers may apply for another job. To gauge the associated magnitudes, we derive an elasticity by taking the partial effect found in the estimated regression and multiplying and dividing by the average values of the relevant variables in the sample. In the case of "Apply for a job(s) that pays more," the estimated OLS regression shows that a 1 percentage point increase in inflation expectations increases the probability of applying for another job by 2 percent, assuming that the minimum value is equal to a zero probability of applying for another job and the highest value is equal to complete certainty of applying for another job. When we run the IV regression, the estimated coefficient of the effect of inflation expectations on the likelihood of applying for another job is higher and the elasticity increases to 11 percent. This coefficient is also statistically significant. Our instrument is valid, with an F-test of 143.3. Overall, we find evidence that higher inflation expectations increase the likelihood that consumers will consider applying for a new job, which also implies an increase in the probability of a consumer moving to another job.

Table 5: Effect of Inflation Expectations on Wage Increase Actions

	Apply for a job(s) that pays more		Work longer hours		Ask for a raise	
	(1)	(2)	(3)	(4)	(5)	(6)
$E\left[\pi_i^{Prices}\right]$	0.005***	0.030***	0.004**	0.009	-0.002	0.002
	(0.002)	(0.006)	(0.002)	(0.005)	(0.002)	(0.006)
Constant	2.231***	2.013***	2.263***	2.216***	2.111***	2.072***
	(0.022)	(0.053)	(0.022)	(0.050)	(0.022)	(0.051)
Regression	OLS	IV	OLS	IV	OLS	IV
F-Test		143.3		149.8		143.3
$\frac{dy}{dx}\frac{\bar{x}}{\bar{y}}$	0.019	0.114	0.015	0.034	-0.009	0.011
Observations	4,651	4,651	4,573	4,573	4,409	4,409

Notes: This table shows OLS and IV regressions from equation 5. y_i^j is a value that ranges from 1 to 4, where 1 is "Very unlikely, " 2 is "Somewhat unlikely," 3 is "Somewhat likely" and 4 is "Very Likely." For columns (1) and (2) y_i^j is the answer to the question about "apply for a job that pays more," columns (3) and (4) are the answers to the question about "work longer hours," and columns (5) and (6) are the answers about "ask for a raise." Regressions have robust standard errors.

In terms of the other margins, we find no evidence of relevant actions. While the OLS regression reveals a significant effect of expected inflation on respondents' plan to work longer hours, the result is not robust under IV estimation. Similarly, we do not find evidence of a channel through which expected inflation will lead respondents to ask for a raise in their current jobs. The estimates that these effects are not statistically different from zero do not come from a high degree of variation in the variable, but from a very small point estimate. The implied elasticity for "Work longer hours" is 0.03 and for "Ask for a raise" only 0.01, while the standard errors are similar to those of "Apply for a job(s) that pays more." We view these as rather precisely estimated zero responses.

We also check the effect of income growth expectations on labor market actions. In that case, we use the wage growth treatment. Table 12 in Appendix E show the results. We find that income growth expectations cause a higher likelihood of asking for a raise, but no other actions. Finally, we also see if there is demographic heterogeneity in terms of the effect of inflation expectation on labor market actions. Tables 13, 14, and 15 in Appendix E show the results. We find female and middle income workers have a higher coefficient and elasticity in terms of the effect of inflation expectations on apply to another job, we find that for female and middle income higher inflation expectations cause a higher likelihood of working longer hours. Finally, higher income workers high an statistically significant effect of inflation expectation on asking for a raise, but the elasticity is relatively small.

In addition to the question concerning consumers' actions, we added a complementary open-ended question to investigate if respondents were undertaking any other actions to increase their income. From the 6,629 total responses, 5,993 decided not to provide any additional information. From those who responded (636), 199 said that they were going to look for a second job in different ways, while 112 said that they received some type of fixed income, such as retirement or Social Security. Among the other answers, some individuals named different forms of investments, adjusting their billing rates (likely for independent contractors, who have the power to set their wages), or some others associated this situation with adjusting their spending. Only one respondent claimed that their income is adjusted automatically every year.

5 Why Do Households Dislike Inflation?

This section assesses the role of our empirical findings, and in particular the role of inflation expectations, in the macroeconomic adjustment process to shocks in the context of a structural model. This modeling exercise provides a complementary explanation for why households dislike current and future inflation. The analysis employs a DSGE model with search-and-matching in the labor market while explicitly allowing inflation expectations to affect nominal wage growth expectations. To capture our finding that consumers' inflation expectations are affected by publicly available information, we allow for sticky information in inflation expectations similar to Mankiw and Reis (2002). The model is calibrated to match key features of the US economy in early 2022, when our survey was conducted, the reaction of our respondents' inflation expectations to information treatments, and our three main empirical facts:

1. **Less than unity passthrough to income growth expectations:** A 1 percentage point increase in inflation expectations causes nominal income growth expectations to rise by about 0.20 percentage point.
2. **Passthrough to income growth expectations increases in consumers' current income:** For low- (high-) income respondents, a 1 percentage point increase in inflation expectations leads

to a statistically insignificant (statistically significant 0.34 percentage point) increase in nominal income growth expectations.

3. **Small impact on labor market actions:** A 1 percentage point increase in inflation expectations raises the odds of applying for another job by about 0.11 percentage point.

Two lessons emerge when we focus our analysis on the responses of key macroeconomic variables to a positive demand shock and a positive (adverse) supply shock, which we view as the prevailing shocks hitting the US economy around the time of our survey. First, regardless of the shock, the dampened response of real wages due to nominal wage rigidity translates into an amplified response of output and consumption. Inflationary shocks, whether coming from either the demand side or the supply side, produce a decline in consumers' utility. In the case of a demand-side shock, the utility decline is greater for higher degrees of nominal wage rigidity. Second, the mechanism we use to capture the relationship between inflation expectations and labor market actions has a negligible effect on the macroeconomic dynamics of the model; on average, consumers' efforts to increase their wages due to inflation expectations do not improve their utility, real wage, or consumption. These lessons help us understand why consumers dislike current and future inflation.

5.1 A Search-and-Matching Model

We employ a New Keynesian model featuring a Mortensen and Pissarides (1994) type of search-and-matching frictions in labor markets. We further incorporate a right-to-manage feature as developed in Trigari (2006), where firms and workers bargain over nominal wages and then firms demand labor hours that are guaranteed to be supplied for the bargained wage.[4] A matched firm-worker pair negotiates wages infrequently in a Calvo fashion. Finally, as in Christoffel and Kuester (2008), we account for firms' fixed costs of maintaining a job.[5]

The economy in the model is composed of representative families that make optimal decisions on behalf of their members with respect to consumption and one-period riskless bond holdings. There are three types of firms: labor goods firms produce a homogeneous labor intermediate good; wholesalers use the labor good as an intermediate to produce differentiated goods and face

[4]For our purposes, the right-to-manage (RTM) framework differs from, for instance, "efficient bargaining" (EB), where labor supply always equals labor demand. The advantage of the RTM over EB is that it generates more realistic movements in inflation dynamics, which facilitates matching the model-implied passthrough with the empirical estimates. On the other hand, RTM can trigger fluctuations in labor hours that are larger than what is observed in the data. See de Walque et al. (2009) for a great review of such tensions in this group of models.

[5]The RTM framework can counterfactually dampen the response of employment in the extensive margin, and, as shown in Christoffel and Kuester (2008), the presence of a fixed cost amplifies the response of unemployment over the business cycle.

Calvo price rigidity; and retailers bundle the differentiated goods into a homogeneous consumption basket sold to households and the government. Monetary policy sets the nominal interest rate following a Taylor rule, and government spending is exogenous. Because these parts of the model are standard in the literature and are not central to our paper, we describe them in more detail in Appendix A.

We now lay out some key features of the labor market because they directly connect the model with our empirical findings presented in Section 4. The matching process between workers and labor firms is governed by a Cobb-Douglas function:

$$m_t = \sigma_m u_t^{\xi} v_t^{1-\xi} \tag{6}$$

where m_t are matches formed in period t; u_t is unemployment; v_t are vacancies; $\xi \in [0,1]$ is the elasticity of matching with respect to unemployment; and $\sigma_m > 0$ is matching efficiency. Matches become productive in the following period, so employment in the extensive margin evolves according to

$$n_t = (1-\mu)n_{t-1} + m_{t-1} \tag{7}$$

where $\mu \in [0,1]$ is the employment separation rate. Labor market tightness is defined as:

$$\theta_t = \frac{v_t}{u_t} \tag{8}$$

Then, the probabilities that a vacancy is filled and that an unemployed worker matches with a firm are, respectively,

$$q_t = \frac{m_t}{v_t}, \quad s_t = \frac{m_t}{u_t} \tag{9}$$

To match our findings in Table 2 that treatments related to publicly available information at time t have an effect on our respondents' inflation expectations, we assume that inflation expectations are subject to sticky information, such that:

$$\widetilde{\mathbb{E}}_t \hat{\pi}_{t+h} = (1-\lambda)\mathbb{E}_t \hat{\pi}_{t+h} + \lambda \widetilde{\mathbb{E}}_{t-1} \hat{\pi}_{t+h}, \qquad \text{for any } h \geq 1 \tag{10}$$

where $\mathbb{E}_t$ is the full-information rational expectations operator, $\lambda \in [0,1]$ denotes the probability that our agents do *not* update their information set in period t, and $\hat{\pi}_t$ is inflation in log-linear deviation from its steady state value.

To match **Fact 1** qualitatively, we assume that agents in the economy face nominal wage rigidities. If a worker is not separated from employment, she can bargain her nominal wage to W^*_{t+1} in period $(t+1)$ with probability $(1-\gamma) \in [0,1]$. In contrast, the nominal wage of the γ share of workers who cannot bargain partially adjusts for past inflation such that $W_{t+1} = W_t(e^w_t \pi_t^{\zeta^w} \bar{\pi}^{1-\zeta^w})$, where $\zeta^w \in [0,1]$ denotes time-varying wage indexation to past inflation and e^w_t is a newly introduced wage-push factor explained further in the subsequent paragraph. In our setup, different combinations of the nominal wage stickiness parameter, γ, generate different levels of model-implied passthrough from inflation expectations to nominal wage growth expectations. This model feature allows us to study the macro implications of **Fact 2** and of a counterfactual scenario of unit passthrough.

To match **Fact 3**, we assume that, given that a worker cannot renegotiate her nominal wage and applies for another job due to higher inflation expectations, she generates an outside contract with certainty, which is used to put upward pressure on the nominal wage with her current employer. Our wage-push factor e^w_t introduced above captures this idea.[6] The wage-push factor is persistent and is affected by inflation expectations as follows

$$\hat{e}^w_t = \rho_w \hat{e}^w_{t-1} + \bar{e}_\pi \mathbb{E}_t \hat{\pi}_{t+1} \tag{11}$$

where $\hat{e}^w_t$ is the wage-push factor in log deviations from its steady-state value; $\bar{e}_\pi$ is the elasticity between inflation expectations and the wage-push factor; and $\rho_w \in [0,1)$ is the persistence in the wage-push factor.

For workers who bargain in a given period, the nominal wage is set according to Nash bargaining,

$$W^*_t = argmax_{W_t} (\mathcal{V}^E_t - \mathcal{V}^U_t)^{\eta_t} (J_t)^{1-\eta_t} \tag{12}$$

where $\mathcal{V}^E_t$ and $\mathcal{V}^U_t$ denote, respectively, the value of employment and unemployment for a worker; J_t the market value of a labor firm matched to a worker; and η_t the time-varying bargaining power of workers.[7]

[6] The wage-push factor plays a role similar to having within-quarter job-to-job transitions with a time-varying transition probability that is affected by inflation expectations only. Within-period job-to-job transitions with constant probability have been incorporated in Krusell et al. (2017). Another interpretation would be to have a non-bargaining worker's nominal wage be indexed to a base, fixed real wage growth that is greater than 1, along with the indexation to past inflation. Time variation in this case would be induced by inflation expectations only.

[7] Under EB, optimal nominal wages satisfy $\eta_t J_t = (1-\eta_t)(\mathcal{V}^E_t - \mathcal{V}^U_t)$. In our case of an RTM framework, the optimal nominal wage condition is $\eta_t \delta^W_t J_t = (1-\eta_t)\delta^F_t(\mathcal{V}^E_t - \mathcal{V}^U_t)$, where δ^W_t and δ^F_t denote, respectively, the net marginal benefits from an increase in the wage to the worker and the firm. See Christoffel and Kuester (2008) for more details.

5.2 Calibration

Our calibration of the model aims to capture US labor market trends around the time of our survey in early 2022 while also matching our three empirical findings. In terms of steady-state values, we set the unemployment and vacancy rates to their respective quarterly realizations in 2021:IV of 4.2 percent and 7 percent. The separation rate in the steady state is set to 4.1 percent, matching the quarterly separation rate in 2021:IV. Table 6 summarizes these choices. Due to high labor market tightness these choices imply that in steady state the probability of finding a job is very high (s = 93.52 percent), whereas the likelihood that a firm finds a worker is very low (q = 0.27 percent).

Table 6: Steady State: Labor Market Variables

Variable	Value	Description
u	4.2 percent	Unemployment rate; US quarterly unemployment rate in 2021:IV
v	7 percent	Vacancy rate; US quarterly vacancy rate in 2021:IV
μ	4.1 percent	Quarterly separation rate; US data in 2021:IV
s	0.9352	Probability of finding a job (implied by the steady-state model equilibrium)
q	0.0027	Probability of finding a worker (implied by the steady-state model equilibrium)

In terms of labor market parameters, we parameterize the model as follows: The elasticity of matches with respect to unemployment, ζ, is set to 0.6, consistent with Petrongolo and Pissarides (2001). Wage bargaining power is set to its conventional value in the literature, i.e., $\eta = 0.5$. The implied efficiency of matching, σ_m, is set to 0.0037 to be consistent with the steady-state values of the unemployment and vacancy rates, and matching. We assume the wage-push factor process is persistent with an autocorrelation coefficient of 0.9.

A few more parameters remain to be calibrated in a way that directly relates to our empirical results. First, to calibrate λ, we investigate how our respondents react to new information . Specifically, we rearrange equation (10) into:

$$\underbrace{\widetilde{\mathbb{E}}_t \pi_{t+h} - \widetilde{\mathbb{E}}_{t-1} \pi_{t+h}}_{\text{(posterior - prior)}} = (1-\lambda) \underbrace{\left(\mathbb{E}_t \pi_{t+h} - \widetilde{\mathbb{E}}_{t-1} \pi_{t+h} \right)}_{\textit{new} \text{ info in period } t}$$

with $(1-\lambda)$ capturing the effect of *new* information made available in period t on inflation expectations. Hence, to estimate λ consistently with our experiment, we consider the following regression:

$$\mathbb{E}_i\left(\pi^{Prices}\right) - \mathbb{E}_i\left(\pi^{ICIE}\right) = \alpha + \beta T_i\left[I_{ij} - \mathbb{E}_i\left(\pi^{ICIE}\right)\right] + \varepsilon_i \tag{13}$$

where T_i is an indicator that takes value 1 if individual i is treated by treatments 2, 4, and 5 (and 3, depending on the specification), and takes a value of zero if the individual i is in the control or placebo group. $\left[I_{ij} - \mathbb{E}_i\left(\pi^{ICIE}\right)\right]$ captures new information due to information treatment j. I_{ij} is the numerical information contained in treatments 2,3,4, or 5. In this specification, $\beta = (1-\lambda)$. Results in Table 8 exhibit the estimates of β. As our benchmark calibration, we use the estimate in column (4) of $\lambda = 0.285$, where we account for the control, placebo, and wage treated groups.[8]

Table 7: Labor Market Parameters and Information Stickiness Calibration

Parameter	Value	Description; Reference
ξ	0.6	Elasticity of matches w.r.t. unemployment; see Petrongolo and Pissarides (2001)
η	0.5	Bargaining power of workers; conventional value
σ_m	0.0037	Efficiency of matching; reconciles m with $u = 4.2$ percent and $v = 7$ percent
ρ_w	0.9	Persistence of the wage-push factor
$\bar{e}_\pi$	0.0228	Elasticity of wage-push w.r.t. inflation expectations across all respondents; Tables 3, 5
$\bar{e}_\pi$	0.114	Elasticity of wage-push w.r.t. inflation expectations for counterfactual analysis; Table 5
γ	0.875	Nominal wage stickiness; passthrough across all respondents in Table 3
γ	0.65	Nominal wage stickiness; unit passthrough for counterfactual analysis
ζ_w	0.675	Wage indexation; passthrough across all respondents in Table 3
ζ_w	0.306	Wage indexation; passthrough for counterfactual analysis
λ	0.285	Information stickiness; Table 8

[8] Coibion, Gorodnichenko, and Weber (2022) argue that the inclusion of the control group is important since the prior and posterior questions about inflation expectations are worded differently. Our results remain qualitatively similar if we calibrate λ to a lower value of about 0.26.

Table 8: Effect of new information in inflation expectations

	(1)	(2)	(3)	(4)
New information	0.742***	0.711***	0.742***	0.715***
	(0.014)	(0.014)	(0.012)	(0.012)
Constant	1.581***	-0.678***	1.702***	-0.251
	(0.163)	(0.208)	(0.139)	(0.181)
Wage Treatment	No	No	Yes	Yes
Control and Placebo	No	Yes	No	Yes
Observations	3,338	5,528	4,430	6,620
R-squared	0.730	0.432	0.735	0.483

Notes: The table shows estimates of equations (13). Column (1) only contain information for treatments 2, 4 and 5. Column (2) includes the placebo and control group. Column (3) is (1) plus control (3) and column (4) contains all treated and control groups. We use robust standard errors.

Second, we calibrate nominal wage stickiness, γ, and wage indexation to past inflation, ζ_w, to match **Fact 1** and **Fact 2** *quantitatively* along the IRFs of nominal wage growth to various shocks. Solving the model under rational expectations, one can show under general assumptions (see details in Appendix B) that the response of nominal wage growth expectations to a change in inflation expectations is given by:

$$\frac{\partial \widetilde{\mathbb{E}}_t(\hat{W}_{t+7} - \hat{W}_{t+3})}{\partial \widetilde{\mathbb{E}}_t \hat{\pi}_{t+4}} = \frac{a_1 - a_2}{1 - \lambda} + 1 + a_3 \tag{14}$$

where the elements a_1, a_2, and a_3 are convoluted functions of the many structural parameters of the model.[9,10] However, wage indexation to past inflation, and especially nominal wage stickiness, γ, are key parameters in these functions, and it is possible to calibrate them such that we are able to match **Fact 1** and **Fact 2** quantitatively. In particular, we can match the inflation expectations passthrough to nominal wage growth across our respondents by choosing a wage contract duration of about 8 quarters ($\gamma = 0.875$) with indexation to past inflation of 0.675.[11] To construct a

[9]While there are many parameter combinations that can match the model-implied passthrough in (14) with the empirical one, we interpret a less than unity passthrough as evidence of significant nominal wage rigidity and thus remain focused on calibrating this parameter together with the wage indexation to past inflation.

[10]Recall that our posterior question about income growth expectations infers $\widetilde{\mathbb{E}}_t(\hat{W}_{t+7} - \hat{W}_{t+3})$.

[11]Duration of a wage contract is given by $1/(1-\gamma)$.

counterfactual scenario of unity passthrough from inflation expectations to nominal wage growth expectations, we set $\gamma = 0.65$, which implies an average wage contract duration of about 3 quarters. The wage indexation to past inflation in this case is set to $\zeta_w = 0.306$.

Second, to match **Fact 3**, we set the elasticity of the wage-push factor with respect to inflation expectations so that we match the evidence shown in Tables 3-5. Parameter $\bar{e}_\pi$ is the elasticity between inflation and nominal wage growth expectations *conditional* on having applied for another job due to higher inflation expectations. Hence, we parameterize $\bar{e}_\pi$ as follows:

$$\bar{e}_\pi = \underbrace{\text{passthrough}}_{\text{Tables 3, 4}} \times \underbrace{\text{elasticity of job applications w.r.t. inflation expectations}}_{=0.114,\ \text{Table 5}} \tag{15}$$

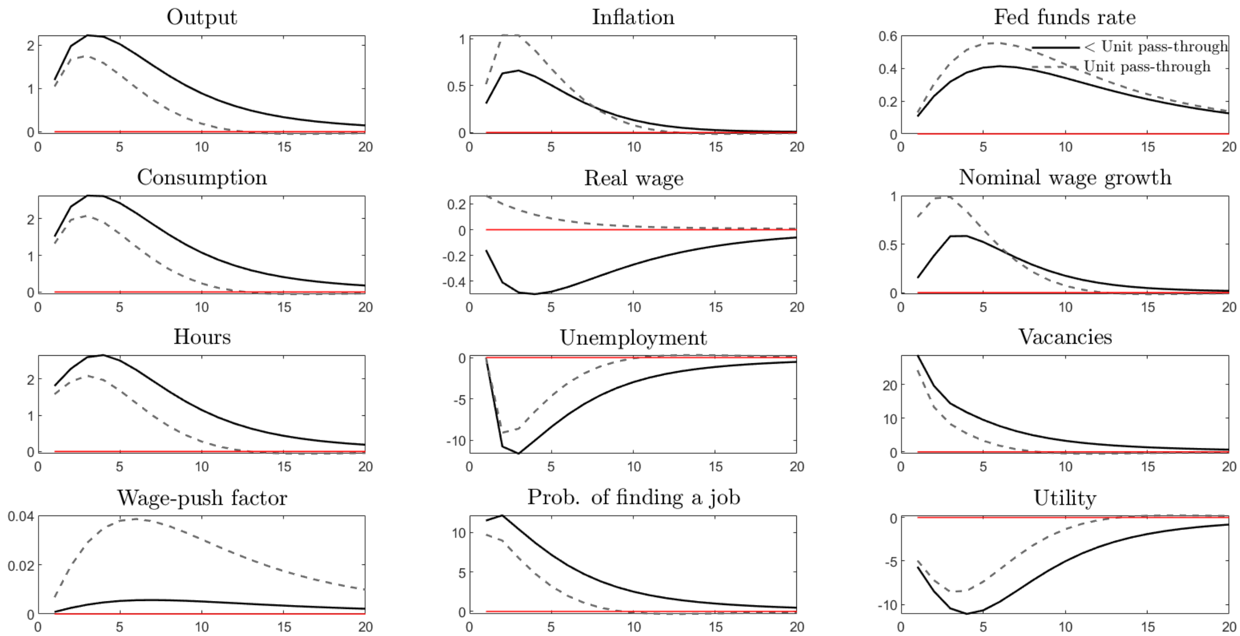
5.3 Impulse Response Functions: Lessons

Next, we analyze the dynamics of our model subject to a positive demand shock and a cost-push shock, the two predominant disturbances affecting the US economy around our survey period. Two lessons emerge that help us understand the mechanism behind households' association of higher inflation with worse economic outcomes, consistent with our empirical findings and the work of Shiller (1997) and Candia, Coibion, and Gorodnichenko (2020).

Lesson 1: Negative and dampened responses of real wages to shocks due to nominal wage rigidity translate into greater fluctuations in output and consumption.

Regardless of whether the model is subjected to a demand- or supply-side inflationary disturbance, an economy calibrated to quantitatively match our empirical passthrough of inflation expectations to income growth expectations compresses real wage fluctuations relative to a counterfactual scenario of a unit passthrough. As we subsequently explain, severe nominal wage rigidity is the source for consumers' dislike of inflation in the model.

Figure 2: Response to a Positive Demand Shock



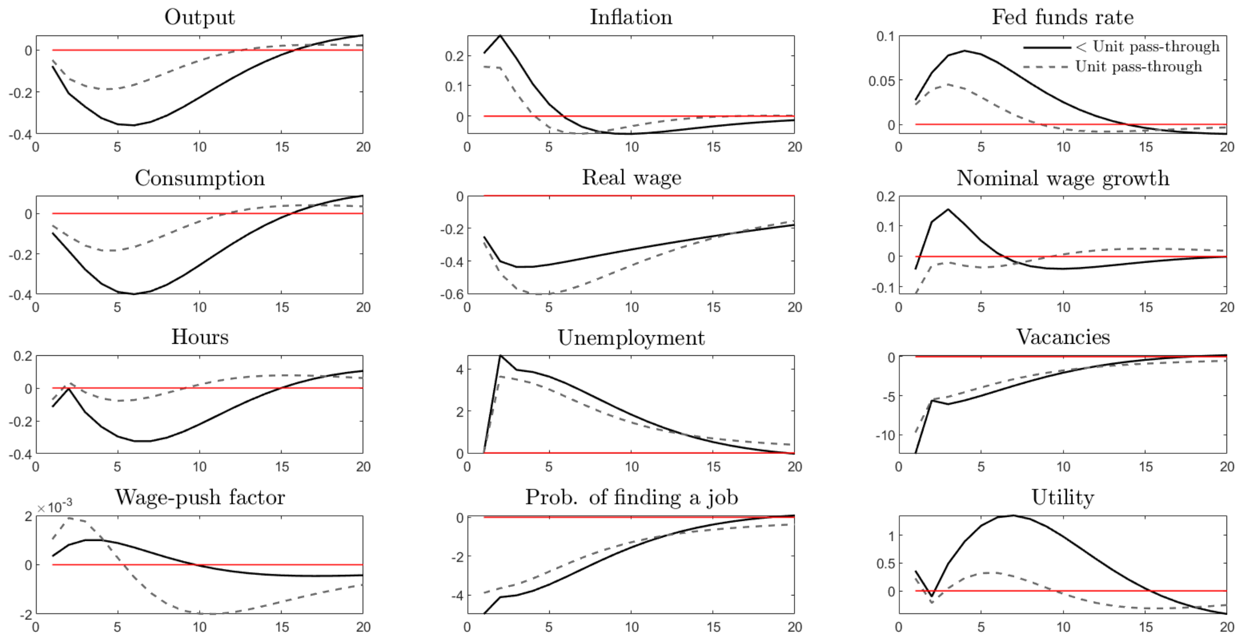
Notes: In black: calibration matching our empirical passthrough from inflation to nominal wage growth expectations ($\gamma = 0.875, \zeta_w = 0.675$). In dashed gray: calibration matching counterfactual of unity passthrough from inflation to nominal wage growth expectations ($\gamma = 0.65, \zeta_w = 0.306$). In red: x axis.

Consider Figure 2, where the economy is subject to a one standard deviation positive demand shock.[12] Relative to the counterfactual of unit passthrough, real wages decline, which results in a larger increase in labor hours that further feeds positively into output and consumption. Consumers' utility is affected by two opposing forces: It declines in response to working more along both the extensive and the intensive margins, but it increases in response to higher consumption.[13] The former channel is considerably larger in the case of 20 percent passthrough compared with full passthrough, yielding a larger decline in utility even though inflation has risen by less.

[12]The standard deviation of the demand shock is set equal to 1.

[13]It is worth noting that hours in the model fluctuate in response to both the demand and the supply shocks that drive inflation up, while the survey respondents indicated that they did not expect to change their hours in response to higher inflation, indicating some tension between the theoretical model and the empirical data. We leave the resolution of this conundrum for future work.

Figure 3: Response to a Positive Cost-Push Shock



Notes: In black: calibration matching our empirical passthrough from inflation to nominal wage growth expectations ($\gamma = 0.875, \zeta_w = 0.675$). In dashed gray: calibration matching counterfactual of unity passthrough from inflation to nominal wage growth expectations ($\gamma = 0.65, \zeta_w = 0.306$). In red: x axis.

Figure 3 considers the case where the economy is shocked by a one standard deviation cost-push supply disturbance.[14] Relative to the counterfactual of a unit passthrough economy, real wages decline less, putting more downward pressure on labor hours. Because the response of hours is tempered, however, there is greater downward pressure on output and consumption. Greater nominal wage frictions cause larger increases in inflation and larger decreases in consumption/output, strengthening the consumers' negative association between the two. As was the case for a positive demand shock, a positive cost-push supply shock initially causes an increase in utility, followed by a decline a few periods later.

The comparative analysis pertaining to Figures 2 and 3 is similar when the model is calibrated to match the passthrough from inflation expectations to income growth expectations associated with high- versus low-income respondents. To avoid repetition, we report those IRFs in Appendix

[14]The standard deviation of the cost-push shock is set equal to 1.

D.

We next try to understand how the correlation between expected period-utility and inflation expectations varies with the degree of nominal wage stickiness and wage indexation to past inflation. A representative family's period utility in deviation from its steady-state value is given by:

$$\mathcal{U}_t = (c(1-\varrho))^{1-\sigma} (\hat{c}_t - \varrho \hat{c}_{t-1}) - \frac{\kappa_h n h^{1+\varphi}}{1+\varphi} \left(\hat{n}_t + (1+\varphi)\hat{h}_t \right) \tag{16}$$

where $\hat{c}_t$ and $\hat{h}_t$ denote consumption and labor hours, respectively, in deviation from their steady-state values; ϱ is the degree of external habit in consumption; φ is the inverse of labor supply elasticity; and κ_h is a scaling factor to labor disutility.[15]

We simulate 50 periods of expected period-utility and inflation expectations data when shocking the model with demand and cost-push innovations, for a given pair j of (γ, ζ_w), and consider the following regression:[16]

$$\mathbb{E}_t \mathcal{U}_{j,t+1} = \alpha_j + \gamma_t + \beta \widetilde{\mathbb{E}}_t \hat{\pi}_{t+1} + \theta \left(\gamma_j \times \widetilde{\mathbb{E}}_t \hat{\pi}_{t+1} \right) + \phi \left(\zeta_{w,j} \times \widetilde{\mathbb{E}}_t \hat{\pi}_{t+1} \right) + \varepsilon_{j,t} \tag{17}$$

where α_j is an IRF fixed effect, with an IRF being the series of expected period-utility and expected inflation for a given combination of γ and ζ_w; and γ_{t+1} is a period after the shock fixed effect. In the regression we drop the coefficient for each specific value γ and ζ_w as it will be absorb by the IRF fixed effect. Table 9 shows the results for a demand a supply shock.

[15] See Tables 10 and 11 for their calibration.

[16] For each shock, we consider a total of $10 \times 11 = 110$ pairs of (γ, ζ_w), where $\gamma \in \{0, 0.1, ..., 0.9\}$ and $\zeta_w \in \{0, 0.1, ..., 0.9, 1\}$

Table 9: Relationship between Expected Inflation and Utility for Different Levels of Wage Rigidity

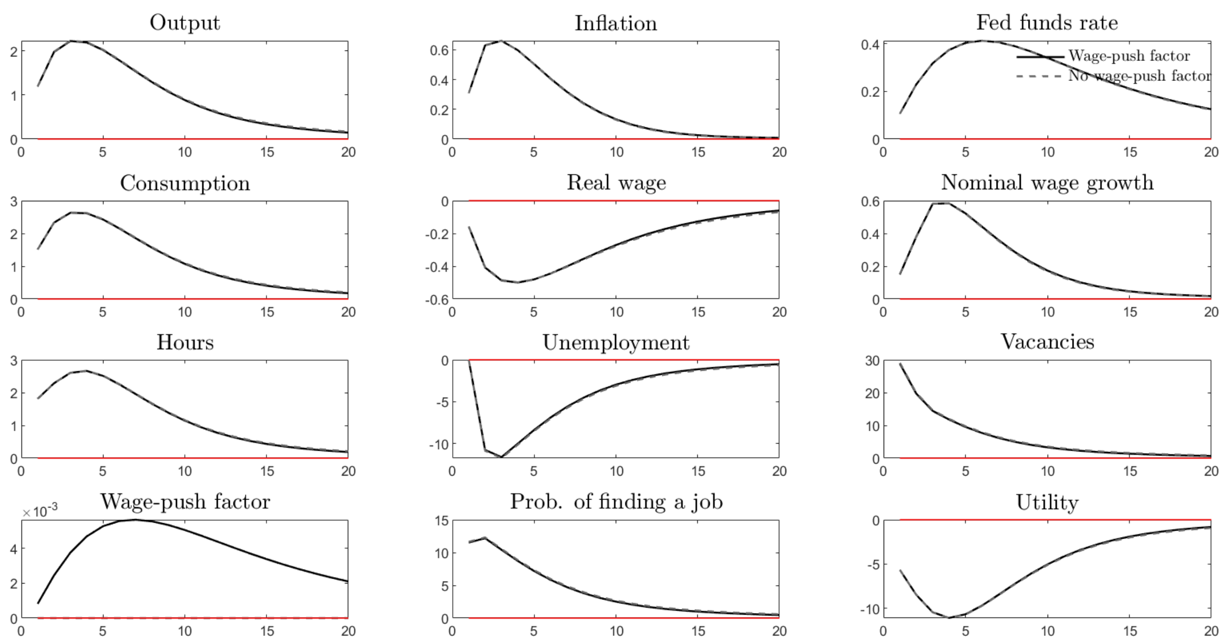
	Cost-push Shock				Demand Shock			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$E_t\pi_{t+1}$	8.842***	1.232**	9.906***	9.897***	1.187***	-1.034**	0.236	-0.285
	(1.438)	(0.561)	(1.756)	(1.669)	(0.223)	(0.482)	(0.227)	(0.183)
γ	0.119***		0.121***		-1.501***		-1.464***	
	(0.016)		(0.016)		(0.071)		(0.067)	
$\gamma \times E_t\pi_{t+1}$	-9.961***		-10.115***	-10.187***	-12.939***		-13.470***	-14.486***
	(1.807)		(1.861)	(1.800)	(0.356)		(0.388)	(0.347)
ζ_w		0.050***	0.051***			0.756***	0.736***	
		(0.011)	(0.011)			(0.059)	(0.046)	
$\zeta_w \times E_t\pi_{t+1}$		-0.830	-1.321	-1.305		0.040	1.509***	1.791***
		(0.816)	(0.897)	(0.842)		(0.394)	(0.255)	(0.227)
Period FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IRF FE	No	No	No	Yes	No	No	No	Yes
Observations	5,500	5,500	5,500	5,500	5,500	5,500	5,500	5,500
R-squared	0.185	0.150	0.190	0.204	0.743	0.530	0.762	0.844

Notes: This table shows results for regression (17). Columns (1) to (4) show results conditional on a positive cost-push shock and columns (5) to (8) show results conditional on a positive demand shock. Period FE denotes a fixed effect of every period after the shock. IRF FE is a series constant fixed effect. Robust standard errors in parenthesis.

As shown in Table 9, the correlation between expected period utility and inflation expectations is generally dropping as the probability of nominal wages re-negotiation, γ, drops, regardless of whether the inflationary shock is demand- or supply-sided. Furthermore, as the nominal wage indexation to past inflation increases, the correlation between expected period-utility and expected inflation increases when the inflationary shock is demand-sided, but it is statistically insignificant when the inflationary shock is supply-sided. The results in Table 9 highlight that, on average, a. In Appendix C we explore in more details the implied correlation between expected utility and inflation, when the economy is shocked with a demand and cost-push innovations. We find that the correlation between the two can be non-linear in the two parameters governing nominal wage rigidity, but the implications of that non-linearity is beyond the scope of the present paper.

Lesson 2: No macroeconomic effects from inflation expectations operating through the wage-push factor.

Figure 4: Response to a Positive Demand Shock

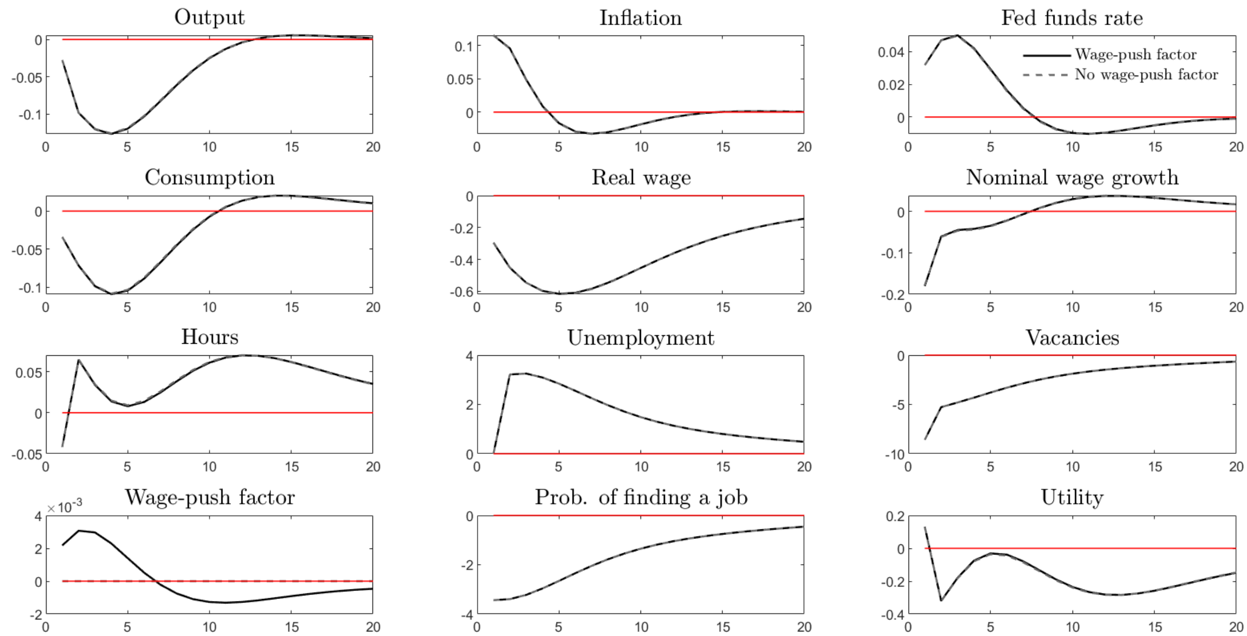


Notes: In black: calibration matching our empirical passthrough from inflation expectations to wage-push factor ($\bar{e}_{\pi} = 0.0228$). In dashed gray: counterfactual calibration of no passthrough from inflation expectations to wage-push factor ($\bar{e}_{\pi} = 0$). In red: x axis.

The second macroeconomic implication of our empirical novel facts is that inflation expectations - via the wage-push factor - generate visually no effects on the macroeconomy. To show this, we repeat the same IRF exercises when the wage-push factor responds to inflation expectations with an elasticity that matches the passthrough across all respondents, that is, $\bar{e}_w = 0.0228$, compared to a case when $\bar{e}_w = 0$. Figures 4 and 5 plot the responses of key macroeconomic variables under both scenarios.

The low passthrough from inflation expectations to nominal wage growth expectations results in a low elasticity of the wage-push factor with respect to expected inflation. On average then, consumers' efforts to raise their wages due to higher inflation expectations do not generate visible changes in their utility, real wage, or consumption.

Figure 5: Response to a positive Cost-Push Shock



Notes: In black: calibration matching our empirical passthrough from inflation expectations to wage-push factor ($\bar{e}_{\pi} = 0.0228$). In dashed gray: counterfactual calibration of no passthrough from inflation expectations to wage-push factor ($\bar{e}_{\pi} = 0$). In red: x axis.

6 Concluding Remarks

This paper relies on a novel experimental setup to study the direction of causality between consumers' inflation expectations and their income growth expectations. Based on the results from a large, nationally representative survey, we find that the rate of passthrough from consumers' inflation expectations to income growth expectations is incomplete, on the order of only 20 percent. We do not find a statistically significant effect in the other direction. Moreover, the degree of passthrough varies systematically with our respondents' socioeconomic and demographic characteristics. Specifically, we find a higher passthrough for higher-income individuals and for male consumers. The passthrough for lower-income and for female consumers is not statistically different from zero.

In a general equilibrium model with search-and-matching in labor markets, we calibrate the degree of nominal wage rigidity and wage indexation to past inflation to match the empirical passthrough of inflation expectations to income growth expectations. We show that regardless of whether an inflationary shock originates from the demand or supply side, the matched (less than unity) passthrough leads to amplified output and consumption responses, relative to a counterfactual scenario of unit passthrough.

In a seminal paper, Shiller (1997) argued that consumers associate higher inflation with a reduction in their purchasing power. We find that this relationship holds causally based on our experimental setup. We also explore the consequences of these results. Respondents seem to perceive very rigid nominal labor contracts, as higher inflation expectations only makes them willing to look for other jobs in order to improve their wages. The implications from these results are that consumers will associate inflationary shocks with a reduction in welfare, which can explain why consumers associate higher inflation expectations with worse economic outcomes, as shown by Candia, Coibion, and Gorodnichenko (2020)). Overall, our empirical findings and our theoretical model provide evidence of a labor market channel to explain why people dislike inflation.

Appendix

A Model

The model has been largely adapted from Christoffel and Kuester (2008) and Christoffel, Kuester, and Lizert (2009).

Households. There is a large number of identical families with unit measure. Each family consists of a measure n_t of employed members and $u_t = 1 - n_t$ of unemployed members. Each family member has the following utility function:

$$\widetilde{\mathbb{E}}_0 \sum_{t=0}^{\infty} \left(\frac{(c_{it} - \varrho c_{t-1})^{1-\sigma}}{1-\sigma} - \kappa_h \frac{h_{it}^{1+\varphi}}{1+\varphi} \right) \tag{A.1}$$

where c_{it} denotes the consumption of consumer i; c_{t-1} is the family's aggregate real consumption in period $(t-1)$; h_{it} is the working hours of employed consumer i; $\kappa_h > 0$ is a parameter of work disutility; and $\varrho \in [0,1)$ captures the degree of external habit in consumption. Each family faces the following constraint:

$$c_t + \tau_t + \kappa_t v_t = \int_0^{1-u_t} w_{it} h_{it} di + u_t b + e_t^d d_{t-1} \frac{R_{t-1}}{\pi_t} - d_t + \Psi_t + n_t \Phi^K \tag{A.2}$$

where $\widetilde{\mathbb{E}}_t$ is a generic expectations operator; τ_t is lump-sum taxes per capita in real terms; κ_t denotes real cost per vacancy posting v_t; w_{it} is the real wage of employed consumer i; d_t denotes the risk-free one-period real bond holdings with return $e_t^d R_t$ and e_t^d being a shock to the risk premium; b is real unemployment benefits. Variable Ψ_t denotes the real dividends of the family from firms in the economy, such that $\Psi_t = \Psi_t^C + \int_0^{1-u_t} \Psi_{it}^h di$, where Ψ_t^C and Ψ_{it}^h are dividends arising from the differentiated goods and labor goods firms, respectively, to be described in what follows. The model does not account for capital income, so we assume that the family receives a fixed share $n_t \Phi^K$, $\Phi^K \geq 0$, out of current revenue of labor firms as "capital income." The family makes optimal decisions on behalf of its members by maximizing the aggregate utility function in (A.1) with respect to consumption and real bond holdings, subject to the budget constraint in (A.2).

Firms. There are three types of firms: i) firms that produce a homogeneous intermediate good, "labor good"; ii) wholesale firms that purchase labor goods in a perfectly competitive market, and use them as inputs to produce differentiated goods; and iii) retail firms that purchase differentiated goods from the wholesalers and bundle those goods into a homogeneous consumption basket sold to consumers and the government.

Retailers' demand for differentiated good j is given by:

$$y_{jt} = \left(\frac{P_{jt}}{P_t}\right)^{-\varepsilon} y_t \tag{A.3}$$

where P_{jt} is the j^{th} good price; $\varepsilon > 1$ is the own-price elasticity of demand; P_t is the aggregate price level; and y_t denotes the final good/economy's aggregate output.

The wholesale sector has a unit mass with firms indexed by $j \in [0,1]$. Each firm produces variety j according to $y_{jt} = l^d_{jt}$, where l^d_{jt} denotes firm j's demand for the intermediate labor good which it can acquire in a perfectly competitive market at real price x^h_t. Wholesalers face Calvo-type price stickiness such that in every period, a fraction $\omega \in (0,1)$ of them cannot reset the price. Similar to Christiano, Eichenbaum, and Evans (2005), we assume that the firms that cannot reoptimize can adjust prices by the index factor $\pi_{t-1}^{\zeta_p} \bar{\pi}^{1-\zeta_p}$, where $\zeta_p \in [0,1]$ denotes the degree of inflation indexation. The problem of wholesalers then is expressed as follows:

$$\max_{P_{jt}} \widetilde{\mathbb{E}}_t \sum_{h=0}^{\infty} \left[\omega^h \Gamma_{t,t+h} \left(\frac{P_{jt} \pi_{t-1,t-1+h}^{\zeta_p} (\bar{\pi}^{1-\zeta_p})^h}{P_{t+h}} - mc_{t+h} \right) y_{j,t+h} \right] \tag{A.4}$$

where $\Gamma_{t,t+h} = \beta^h \frac{\lambda_{t+h}}{\lambda_t}$, with λ_t being households' marginal utility of consumption; $\pi_{t-1,t-1+h} = P_{t-1+h}/P_{t-1}$; and $mc_t = x^h_t e^C_t$ is the marginal cost, with e^C_t being a cost-push shock. Total profits of the wholesale sector in period t are given by

$$\Psi^C_t = \int_{j=0}^{1} \left(\frac{P_{jt}}{P_t} - mc_t \right) y_{jt} dj \tag{A.5}$$

Finally, the labor good firms are homogeneous and they need exactly one worker to operate. So, there is a mass of $n_t = (1 - u_t)$ of such firms at any given time. Match i can produce l_{it} labor good units via $l_{it} = z_t h^{\alpha}_{it}$, where z_t is a productivity shock and $\alpha \in (0,1)$.

Labor markets. The matching process between workers and labor firms is governed by a Cobb-Douglas function,

$$m_t = \sigma_m u_t^{\xi} v_t^{1-\xi} \tag{A.6}$$

where m_t is matches formed in period t; u_t is unemployment; v_t is vacancies; $\xi \in [0,1]$ is the elasticity of matching with respect to unemployment; and $\sigma_m > 0$ is a scaling factor. Labor market tightness is defined as:

$$\theta_t = \frac{v_t}{u_t} \tag{A.7}$$

Then, the probabilities that a vacancy is filled and that an unemployed worker matches with a firm are, respectively,

$$q_t = \frac{m_t}{v_t}, \quad s_t = \frac{m_t}{u_t} \tag{A.8}$$

New matches become productive in $(t+1)$. Employment then evolves according to

$$n_t = (1-\mu)n_{t-1} + m_{t-1} \tag{A.9}$$

If a worker is not separated from employment, she can bargain her nominal wage to W^*_{t+1} in period $(t+1)$ with probability $(1-\gamma) \in [0,1]$. The nominal wage of the γ share of workers who cannot bargain partially adjusts for past inflation such that $W_{t+1} = W_t(e^w_t \pi_t^{\zeta_w} \bar{\pi}^{1-\zeta_w})$, where e^w_t is the wage-push factor as defined in the main text and $\zeta_w \in [0,1]$. In this framework, we define the value of employment as follows:

$$\begin{aligned}\mathcal{V}^E_t(W_{it}) = w_{it}h_{it} - \kappa_h \frac{h_{it}^{1+\varphi}}{(1+\varphi)\lambda_t} &+ (1-\mu)\widetilde{\mathbb{E}}_t \left[\Gamma_{t,t+1}\left(\gamma \mathcal{V}^E_{t+1}(W_{it}(e^w_t \pi_t^{\zeta_w}\bar{\pi}^{1-\zeta_w})) + (1-\gamma)\mathcal{V}^E_{t+1}(W^*_{t+1})\right)\right] \\ &+ \mu \widetilde{\mathbb{E}}_t\left[\Gamma_{t,t+1}\mathcal{V}^U_{t+1}\right]\end{aligned} \tag{A.10}$$

The value of an employed worker depends on her labor nominal income and her utility loss from working. An employed worker retains her job with probability $(1-\mu)$. In the next period, if she stays employed, she will not be able to renegotiate her nominal wage with probability γ, in which case her employment value is $\mathcal{V}^E_{t+1}(W_{it}(e^w_t \pi_t^{\zeta_w}\bar{\pi}^{1-\zeta_w}))$; in the case of rebargaining, the employment value is given by $V^E_{t+1}(W^*_{t+1})$. With probability μ the worker will be unemployed next period.

The value of unemployment is described as follows:

$$\mathcal{V}^U_t = b + s_t \widetilde{\mathbb{E}}_t\left[\Gamma_{t,t+1}\left(\gamma \mathcal{V}^E_{t+1}(W_t(e^w_t \pi_t^{\zeta_w}\bar{\pi}^{1-\zeta_w})) + (1-\gamma)\mathcal{V}^E_{t+1}(W^*_{t+1})\right)\right] + (1-s_t)\widetilde{\mathbb{E}}_t\left[\Gamma_{t,t+1}\mathcal{V}^U_{t+1}\right] \tag{A.11}$$

An unemployed worker finds a new job with probability s_t. In that case, she enters the same Calvo scheme as the average currently employed worker.[17]

Labor good firms are worthless unless they are matched with a worker. Therefore, the market value of a labor firm matched to a worker is

$$J_t(W_{it}) = \Psi^h_t(W_{it}) + (1-\mu)\widetilde{\mathbb{E}}_t\left[\Gamma_{t,t+1}\left(\gamma J_{t+1}(W_{it}(e^w_t \pi_t^{\zeta_w}\bar{\pi}^{1-\zeta_w})) + (1-\gamma)J_{t+1}(W^*_{t+1})\right)\right] \tag{A.12}$$

[17] The Calvo scheme of wages is imposed on both new matches and existing matches to preserve some degree of homogeneity in the model for tractability reasons.

where $\Psi_t^h(W_{it}) = x_t^h z_t h_{it}^\alpha - w_{it}h_{it} - \Phi$ with $\Phi \geq 0$ denoting a per-period fixed cost of production. For firms that bargain in a given period, the nominal wage is set according to Nash bargaining,

$$W_{it}^* = argmax_{W_{it}}(\mathcal{V}_{it}^E - \mathcal{V}_t^U)^{\eta_t}(J_{it})^{1-\eta_t} \tag{A.13}$$

where η_t is the time-varying bargaining power of workers.[18]

Free entry into the vacancy posting market implies that the ex ante value of vacancy posting is 0, yieldiing the following relationship:

$$\kappa_t = q_t \widetilde{\mathbb{E}}_t \left[\Gamma_{t,t+1}\left(\gamma J_{t+1}(W_t(e_t^w \pi_t^{\zeta_w} \bar{\pi}^{1-\zeta_w})) + (1-\gamma)J_{t+1}(W_{t+1}^*)\right)\right] \tag{A.14}$$

Expectations. We assume that expectations about any variable, but inflation, are full-information and rational. We introduce some degree of information stickiness, $\lambda \in [0,1]$, in the inflation expectations formation process, such that

$$\widetilde{\mathbb{E}}_t \hat{\pi}_{t+1} = (1-\lambda)\mathbb{E}_t \hat{\pi}_{t+1} + \lambda \widetilde{\mathbb{E}}_{t-1}\hat{\pi}_{t+1} \tag{A.15}$$

where $\mathbb{E}_t$ is the full-information rational expectations operator.

Policy. We assume that the monetary authority sets nominal interest rates R_t by responding to inflation deviations from a fixed target $\bar{\pi}$ and output growth.

$$log\left(\frac{R_t}{\bar{R}}\right) = \phi_R log\left(\frac{R_{t-1}}{\bar{R}}\right) + (1-\phi_R)\left[\phi_\pi log\left(\frac{\pi_t}{\bar{\pi}}\right) + \phi_{\Delta y} log\left(\frac{y_t}{y_{t-1}}\right)\right] + e_t^R \tag{A.16}$$

where $\rho_R \in [0,1)$ denotes the interest rate smoothing and e_t^R is a monetary shock. On the fiscal front, we assume that government spending, g_t is exogenous. Overall, there is a total of 7 shocks in the economy, e_t^d, e_t^R, e_t^C, g_t, κ_t, z_t, and η_t. Let $sh\hat{o}ck_t = log(shock_t/sh\bar{o}ck)$; then, each one of the shocks in log-linear deviation from the steady state is given by

$$sh\hat{o}ck_t = \rho_{shock} sh\hat{o}ck_{t-1} + \epsilon_t^{shock}, \epsilon_t^{shock} \sim \mathcal{N}(0, \sigma_{shock}^2) \tag{A.17}$$

[18] Differently from efficient Nash bargaining, we employ the right-to-manage framework of Trigari (2006). The difference between the two is that under the former, firms and workers bargain over both hours and wages, whereas under the latter, they bargain over wages only. Optimal hours and wages in the former case yield $\eta_t J_t = (1-\eta_t)(\mathcal{V}_t^E - \mathcal{V}_t^U)$. In our case, the optimality condition satisfies $\eta_t \delta_t^W J_t = (1-\eta_t)\delta_t^F(\mathcal{V}_t^E - \mathcal{V}_t^U)$, where δ_t^W and δ_t^F denote, respectively, the net marginal benefits from an increase in the wage to worker and firm. See Christoffel and Kuester (2008) for more details.

Tables 10 and 11 show, respectively, values for the steady state of a number of variables and model parameters.

Table 10: Steady State

Variable	Value	Description
y	1	Ouput
c	0.79	Consumption
whn/y	0.6	Labor income share
J	0.1582	Value of a labor firm
$\mathcal{V}^E - \mathcal{V}^U$	0.1582	Worker's surplus from working

Table 11: Parameter Calibration

Parameter	Value	Description; Reference
$\bar{e}_\pi$	0.0148	Elasticity of wage-push w.r.t. inflation expectations for low income; Tables 4, 5
$\bar{e}_\pi$	0.0388	Elasticity of wage-push w.r.t. inflation expectations for high income; Tables 4, 5
γ	0.895	Nominal wage stickiness; low income passthrough in Table 4
γ	0.8515	Nominal wage stickiness; high income passthrough in Table 4
ζ_w	0.6	Wage indexation to past inflation; low income passthrough in Table 4
ζ_w	0.35	Wage indexation to past inflation; high income passthrough in Table 4
β	0.99	Discount factor; corresponds to a quarterly real rate of 1.01%
φ	10	Labor supply elasticity of 0.1; as in Trigari (2006)
σ	1.38	Risk aversion; posterior mean found in Smets and Wouters (2007)
ϱ	0.71	Degree of external habit; posterior mean found in Smets and Wouters (2007)
κ_h	107.2023	Scaling factor to labor disutility; targets $h = 1/3$
α	0.66	Labor elasticity of production; matches labor share of about 60%
κ	0.0004	Vacancy posting costs; reconciles m with $u = 0.042$ and $v = 0.07$
z	2.1554	Steady-state technology; matches with $y = 1$
Φ^K	0.3042	Imputed share of capital in revenue; matches with capital income share
Φ^h	0.0104	Fixed costs linked to labor; matches with y and h
ε	11	Price markup; conventional markup of 10%
ω	0.65	Calvo price stickiness; posterior mean found in Smets and Wouters (2007)
ζ_p	0.3	Price indexation to past inflation
ϕ_π	1.5	Response to inflation; conventional Taylor rule
$\phi_{\Delta y}$	0.5	Response to output growth; conventional Taylor rule
ϕ_R	0.8	Interest rate rule smoothness; conventional Taylor rule
$\bar{\pi}$	1	Inflation target
$\bar{g}$	0.2	Steady-state government spending; US government spending as share of GDP
b	0.2505	Unemployment benefits; matches replacement rate of 0.4
ρ_{shock}	0.9	Autocorrelation of every shock
σ_{shock}	1	Standard deviation of every shock

B Calibration Strategy for Nominal Wage Stickiness

Solving the model under full information rational expectations, the minimum state variable solution is given by

$$\hat{X}_t = A\hat{X}_{t-1} + B\mathcal{E}_t \ , \mathcal{E}_t \sim MN(0,\Sigma) \tag{B.1}$$

where $\hat{X}_t$ is a vector of size $n_x \times 1$ containing the model's endogenous variables in deviations from their steady-state values; $\mathcal{E}_t$ is a vector of size $n_e \times 1$ containing the exogenous shock innovations; and Σ is the covariance (diagonal) matrix of $\mathcal{E}_t$.

In the presence of one-time innovations occurring in period $t = 0$, $\mathbb{E}_t\hat{x}_{t+h} = \hat{x}_{t+h}$ for any $t \geq 0$. Following a one-time shock innovation in period t, inflation expectations are described by:

$$\widetilde{\mathbb{E}}_t\hat{\pi}_{t+h} = (1-\lambda)\hat{\pi}_{t+h} \tag{B.2}$$

Let $A_{w:}$ denote the row in matrix A located in the same position as the real wage in $\hat{X}_t$, $A_{:\pi}$ denote the column in matrix A located in the same position as inflation in $\hat{X}_t$, $A_{x_k x_j}$ be the element in A whose row is the same x_k's and column the same as x_j's in $\hat{X}_t$. Then, expectations about nominal wage growth, $(\hat{W}_{t+7} - \hat{W}_{t+3})$, are given by:

$$\begin{aligned}
\widetilde{\mathbb{E}}_t(\hat{W}_{t+7} - \hat{W}_{t+3}) &= \widetilde{\mathbb{E}}_t\left(\hat{w}_{t+7} - \hat{w}_{t+3} + \hat{P}_{t+7} - \hat{P}_{t+3}\right) = \mathbb{E}_t\left(\hat{w}_{t+7} - \hat{w}_{t+3}\right) + \widetilde{\mathbb{E}}_t\sum_{j=4}^{7}\hat{\pi}_{t+j} \\
&= \left(\hat{w}_{t+7} - \hat{w}_{t+3}\right) + (1-\lambda)\sum_{j=4}^{7}\hat{\pi}_{t+j} \\
&= A_{w:}A\hat{X}_{t+5} - \hat{w}_{t+3} + (1-\lambda)(\hat{\pi}_{t+4} + \hat{\pi}_{t+5}) + (1-\lambda)\left(A_{\pi:} + A_{\pi:}A\right)\hat{X}_{t+5}
\end{aligned} \tag{B.3}$$

Note that

$$\frac{\partial\hat{X}_{t+5}}{\partial\hat{\pi}_{t+4}} = A_{:\pi}$$

Therefore,

$$\frac{\partial\widetilde{\mathbb{E}}_t(\hat{W}_{t+7} - \hat{W}_{t+3})}{\partial\widetilde{\mathbb{E}}_t\hat{\pi}_{t+4}} = \frac{a_1 - a_2}{1-\lambda} + 1 + a_3$$

where $a_1 = A_{w:}AA_{:\pi}$, $a_2 = A_{w\pi}(A_{\pi:}A_{:\pi})^{-1}$, and $a_3 = A_{\pi\pi} + A_{\pi:}(I + A)A_{:\pi}$.

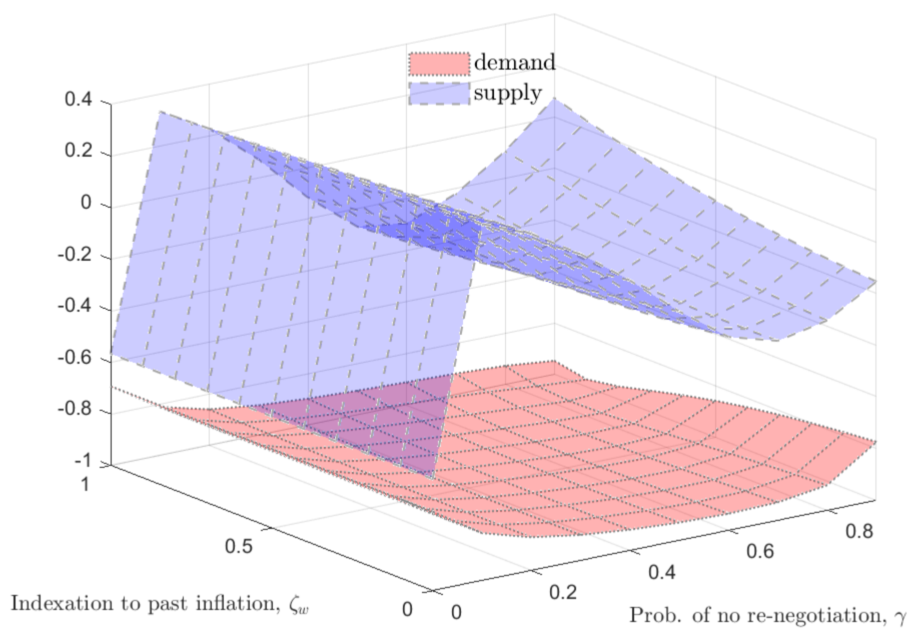
C Correlation between Inflation and Utility Expectations

For a set of (γ, ζ_w) pairs, we compute the model-implied correlation between expected period-utility and inflation expectations, conditional on the economy being shocked by only demand innovations or cost-push innovations, that is:

$$C_x = \frac{\mathbb{E}\left[\mathbb{E}_t(\mathcal{U}_{t+1})\widetilde{\mathbb{E}}_t(\hat{\pi}_{t+1})|\epsilon_t^x\right]}{\sqrt{\mathbb{E}\left[\mathbb{E}_t(\mathcal{U}_{t+1}|\epsilon_t^x)^2\right]\mathbb{E}\left[\widetilde{\mathbb{E}}_t(\hat{\pi}_{t+1}|\epsilon_t^x)^2\right]}} \tag{C.1}$$

where ϵ_t^x denotes the innovation to shock x. Figure 6 shows the surfaces of the computed correlation in (C.1) for various pairs of (γ, ζ_w). The surfaces seem to vary substantially more with nominal wage rigidity in the extensive margin (γ) than the intensive margin (ζ_w).

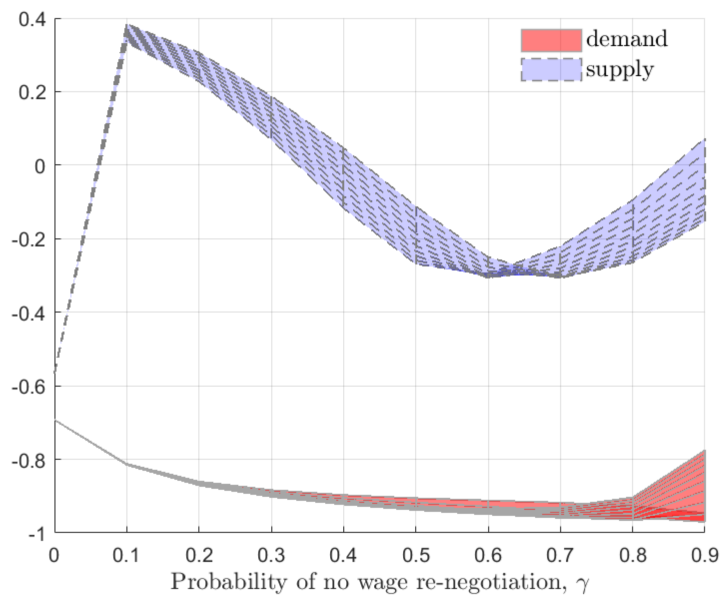
Figure 6: Correlation between $\mathbb{E}_t\mathcal{U}_{t+1}$ and $\widetilde{\mathbb{E}}_t\hat{\pi}_{t+1}$



Notes: In blue: cost-push shock; in red: demand shock.

To better understand the relationship between C_x and nominal wage rigidity, we project the 3-dimensional figure on the (γ, C_x) plane in Figure 6. Subject to cost-push shocks, the relationship between expected utility and inflation is clearly non-monotonic in γ, and it takes negative as well as positive values. On the other hand, conditional on demand innovations, the relationship between expected utility and inflation remains always negative, and it tends to decline with γ.

Figure 7: Correlation between $\mathbb{E}_t\mathcal{U}_{t+1}$ and $\widetilde{\mathbb{E}}_t\hat{\pi}_{t+1}$

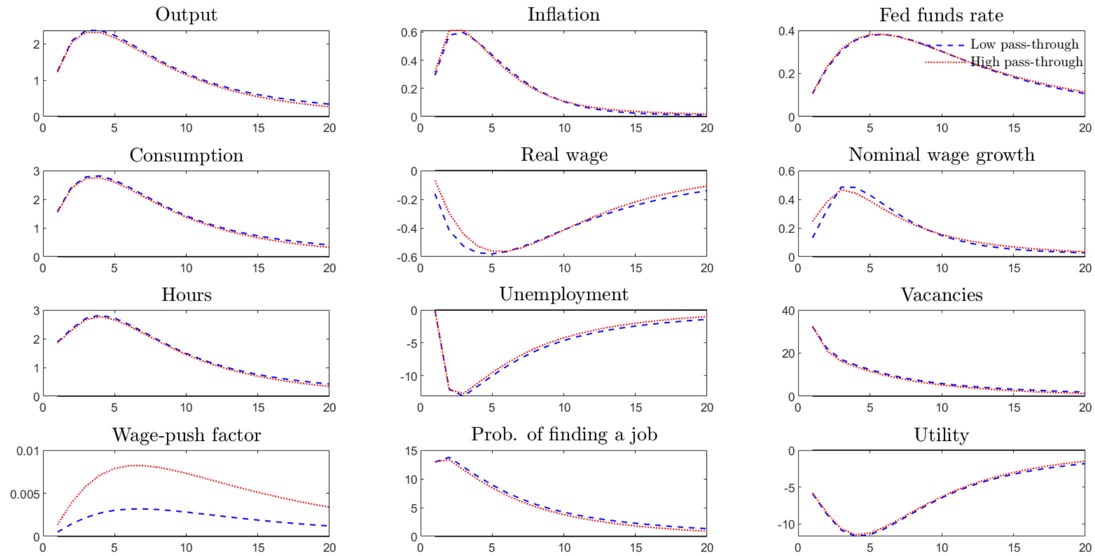


Notes: In blue: cost-push shock; in red: demand shock.

D Additional Impulse Response Functions

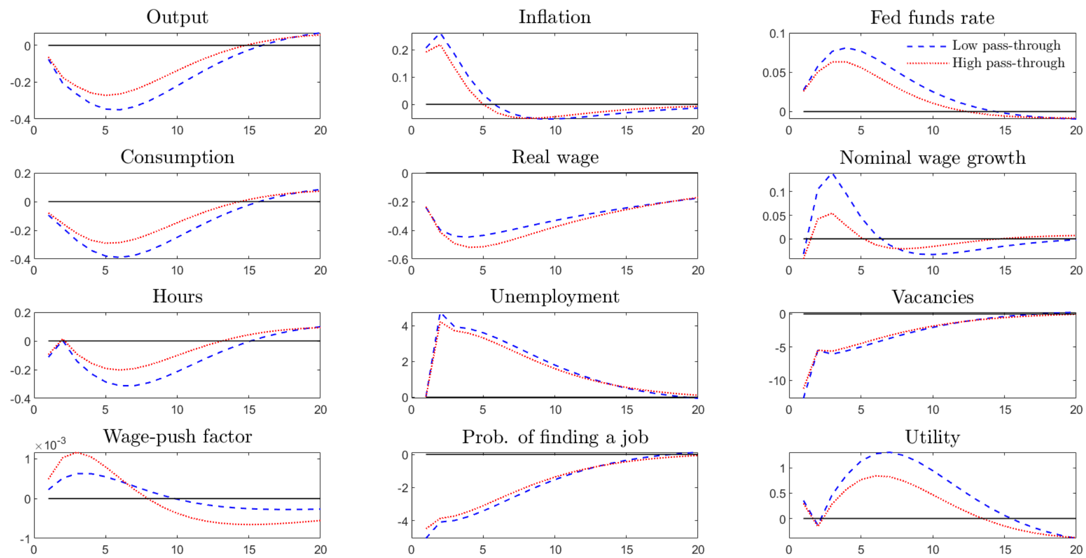
We present here the IRFs of key macroeconomic variables to a one standard deviation positive demand shock and a one standard deviation positive cost-push shock for calibrations that match the passthrough of inflation expectations to income growth expectations for high- and low-income respondents. We note that the gap between the IRFs with low versus high passthrough is siginificantly more noticeable when the economy is shocked with a demand innovation relative to a supply innovation.

Figure 8: Response to a Positive Demand Shock



Notes: In dotted red: calibration matching our empirical passthrough from inflation to nominal wage growth expectations for high-income consumers ($\gamma = 0.8515, \zeta_w = 0.35$). In dashed blue: calibration matching our empirical passthrough from inflation to nominal wage growth expectations for low-income consumers ($\gamma = 0.895, \zeta_w = 0.6$). In black: x axis.

Figure 9: Response to a Positive Cost-Push Shock



Notes: In dotted red: calibration matching our empirical passthrough from inflation to nominal wage growth expectations for high-income consumers ($\gamma = 0.8515, \zeta_w = 0.35$). In dashed blue: calibration matching our empirical passthrough from inflation to nominal wage growth expectations for low-income consumers ($\gamma = 0.895, \zeta_w = 0.6$). In black: x axis.

E Additional Tables

Table 12: Effect of Income Growth Expectations on Wage Increase Actions

	Apply for a job(s) that pays more		Work longer hours		Ask for a raise	
	(1)	(2)	(3)	(4)	(5)	(6)
$E\left[\pi^{Income2y}\right]$	0.032***	0.044	0.036***	0.038	0.039***	0.051**
	(0.008)	(0.027)	(0.007)	(0.023)	(0.008)	(0.024)
Constant	2.155***	2.130***	2.183***	2.174***	1.982***	1.964***
	(0.026)	(0.043)	(0.026)	(0.040)	(0.025)	(0.039)
Regression	OLS	IV	OLS	IV	OLS	IV
F-Test		64.519		63.921		61.995
$\frac{dy}{dx}\frac{\bar{x}}{\bar{y}}$	0.019	0.026	0.022	0.023	0.025	0.033
Observations	2,476	2,420	2,448	2,394	2,392	2,338

Table 13: Effect of Inflation Expectations on Apply for a job(s) by demographics

	Apply for a Job(s) that Pays More					
	All	Male	Female	<50k	50k-100k	100k+
	(1)	(2)	(3)	(4)	(5)	(6)
$E\left[\pi^{Prices}\right]$	0.029***	0.021***	0.042***	0.019**	0.048***	0.025***
	(0.006)	(0.007)	(0.010)	(0.010)	(0.011)	(0.007)
Constant	2.015***	2.172***	1.802***	2.173***	1.801***	2.033***
	(0.054)	(0.060)	(0.102)	(0.095)	(0.096)	(0.074)
Regression	IV	IV	IV	IV	IV	IV
F-Test	143.328	82.591	59.017	59.277	36.924	137.812
$\frac{dy}{dx}\frac{\bar{x}}{\bar{y}}$	0.114	0.072	0.184	0.076	0.182	0.094
Observations	4,651	2,371	2,280	1,984	1,662	1,005

Table 14: Effect of Inflation Expectations on Work Longer Hours by demographics

	Work Longer Hours					
	All	Male	Female	<50k	50k-100k	100k+
	(1)	(2)	(3)	(4)	(5)	(6)
$E\left[\pi^{Prices}\right]$	0.009	0.004	0.018**	0.001	0.024**	0.012
	(0.005)	(0.007)	(0.009)	(0.009)	(0.011)	(0.008)
Constant	2.219***	2.372***	2.008***	2.263***	2.067***	2.296***
	(0.051)	(0.060)	(0.091)	(0.088)	(0.093)	(0.078)
Regression	IV	IV	IV	IV	IV	IV
F-Test	149.752	88.642	60.033	61.735	39.939	138.630
$\frac{dy}{dx}\frac{\bar{x}}{\bar{y}}$	0.034	0.014	0.080	0.003	0.088	0.043
Observations	4,573	2,339	2,234	1,942	1,630	1,001

Table 15: Effect of Inflation Expectations on Ask for a Raise by demographics

	Ask for a Raise					
	All	Male	Female	<50k	50k-100k	100k+
	(1)	(2)	(3)	(4)	(5)	(6)
$E\left[\pi^{Prices}\right]$	0.003	0.007	0.000	-0.011	0.016*	0.018**
	(0.006)	(0.007)	(0.010)	(0.010)	(0.009)	(0.008)
Constant	2.068***	2.205***	1.910***	2.100***	1.962***	2.112***
	(0.052)	(0.058)	(0.092)	(0.094)	(0.083)	(0.076)
Regression	IV	IV	IV	IV	IV	IV
F-Test	143.25	88.667	53.836	49.857	50.938	194.820
$\frac{dy}{dx}\frac{\bar{x}}{\bar{y}}$	0.011	0.023	0.002	-0.051	0.064	0.066
Observations	4,406	2,283	2,126	1,847	1,593	969

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