



Inflation Scar and Expectations Formation



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Abstract

We investigate the long-lasting influences of high inflation experiences on future inflation by analyzing the **impacts of individuals' lifetime inflation experience on their expected inflation**.

To summarize individuals' lifetime inflation experience, we build **frequency distributions consist of individuals' experienced inflation** and estimate a **functional regression model** that connects inflation expectation of respondents to the distributions reflecting their inflation experiences.

Our findings show that **individuals expect higher inflation when they have faced higher actual inflation more frequently in their lifetime**, even after controlling for average lifetime experienced inflation and demographic characteristics.

Introduction

Recently, the US economy has witnessed an unusually high inflation surge, and at the same time, expected inflation is also rising and remains at higher levels. This situation raises important questions related to the future developments of expected and realized inflation.

This research investigates the **long-lasting influences of high inflation experiences on future inflation** by analyzing the **impacts of individuals' lifetime inflation experience on their expected inflation**.

The most closely related previous study is Malmendier and Nagel (2016) which finds that young respondents update their inflation expectations more vigorously in the direction of recent surprises than older individuals. However, while that paper primarily considers the way past inflation experience influences expected inflation through the differences in gain parameters in the learning process, this research emphasizes the direct impacts of past experience on the current expected inflation.

Data

The primary dataset we employ is the Michigan Survey of Consumers (MSC), which is the most widely used survey for the general public that contains inflation expectations for a long horizon. In particular, we use the monthly report, which has been available since January 1978. The availability of older vintage data is quite appealing in this study, as it provides more heterogeneity in individuals' inflation experiences (See Figure 1 below).

The next step required is to transform individuals' histories of experienced inflation into frequency distribution functions. Dealing with functions is a good way to overcome the problem of dimensionality while preserving rich information (Meeks and Monti, 2019). To do so, we collect the time series of changes in the consumer price index for the last 12 months, ranging from the month that the respondent became 15 years old to a month ahead of the survey conducted. Then, we obtain the frequency distribution for each respondent-month pair by smoothing the histogram of the collected monthly year-over-year CPI inflation.

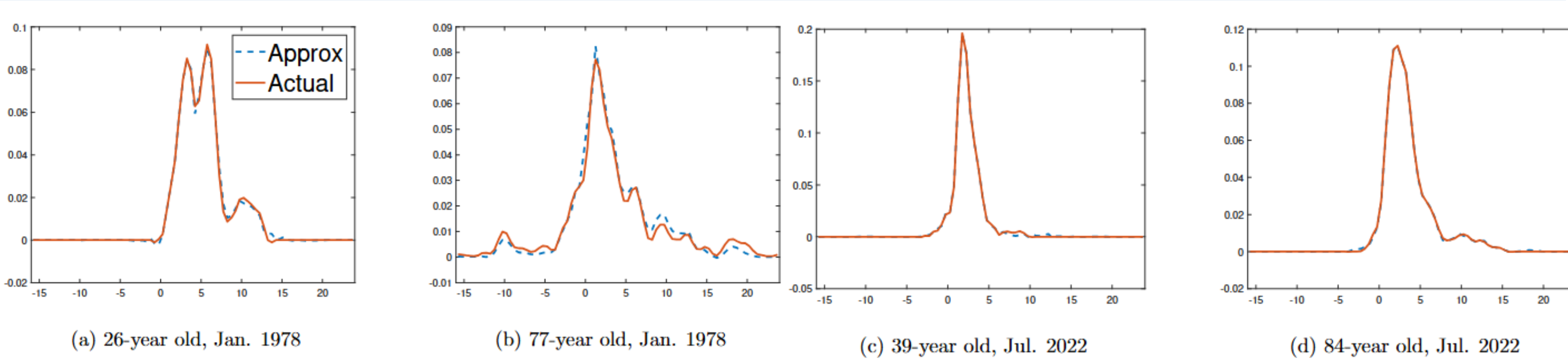


Figure 1. Approximations of Frequency Distributions for Selected Respondents

Empirical Model

To investigate the extent to which individuals' inflation experiences affect their expected inflation, we implement the functional regression model given by

$$\pi_{it}^e = d_t + \int_a^b \beta(r) x_{it-1}(r) dr + z_{it} + e_{it}$$

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In this model, i and t represent the index for survey respondents and the date that the survey is reported. π_{it}^e is the expected price change for the next 12 months. d_t is the time dummy that captures macroeconomic developments common to all respondents. x_{it} is a functional regressor with a functional regression coefficient β . In this research, x_{it} is a frequency distribution of experienced monthly inflation of respondent i . The argument r signifies the level of inflation. z_{it} is the vector of additional control variables, and e_{it} is the regression error.

Results

Firstly, we present the shape of the estimated coefficient function (obtained from specification (1) explained below) in Figure 2. This figure clearly indicates that the coefficient function tends to be positive when inflation is greater than about 1%, while it becomes negative below that point. This can be interpreted to mean that **individuals who have experienced higher inflation, say exceeding 1% over the year, more often, are more likely to expect higher inflation over the next year**, given that the coefficient function is statistically significant.

Overall, it turns out that **individuals' inflation experience have a statistically significant impact on their inflation expectations** regardless of the specification (See Table 1 below). Across all specifications, the null hypothesis of zero coefficient function can be easily rejected based on the F-test even under 99% confidence level. Given the shape of the estimated coefficient function, we can conclude that the more high inflation experienced, the higher expected inflation is. That is, **individuals' high inflation experiences create an upward pressure on their expected future inflation that we call 'inflation scar'**.

This **inflation scar survives even when we include additional control variables**. First, **individuals' average experienced inflation** is included in Specification (3). The result shows that the impact of the average experienced inflation on expected inflation is statistically significant. In particular, if a respondent's average experienced inflation increases by 1%, his inflation expectations for the next year gets 0.53% higher. At the same time, the frequency distribution is still highly significant. This indicates that the **distribution as a whole contains a lot larger information than the first moment** that is helpful to predict individuals' inflation expectations.

Second, additional variables that describe respondents' demographic heterogeneity are considered in Specification (4). On the one hand, the result shows that the distribution variable is still significant even after we control various demographic variables. On the other hand, the result indicates that the additional demographic variables are also statistically significant and the fit of the model improves. In particular, the **respondent who earns more income, is a male, and finished college education tends to expect lower inflation**. When an individual's income is 100% larger than that of the average earners, his expected inflation is 0.45% lower compared to those who earn the average income. In addition, a female respondent tends to report a higher inflation expectations as high as 0.84% on average. Finally, a college graduate expects 0.47% lower inflation on average compared to those who did not finish their college education.

Dependent variable	year-ahead expected inflation			
	(1)	(2)	(3)	(4)
Distribution	sig. [125.69]	sig. [127.62]	sig. [147.91]	sig. [5879.2]
1st FPC	-0.75 (-5.49)	-0.97 (-9.53)	3.08 (7.93)	4.32 (11.16)
2nd FPC	1.33 (8.27)	0.96 (7.79)	0.63 (3.61)	0.95 (5.49)
Average inflation	-	-	0.40 (10.54)	0.52 (13.68)
Income	-	-	-	-0.44 (-29.38)
Female	-	-	-	0.85 (36.70)
College	-	-	-	-0.46 (-18.44)
Sample period	Jan. 1978 - Jul. 2022			
Time dummy	Yes	Yes	Yes	Yes
Number of basis	5	5	5	5
R ²	0.42	0.42	0.42	0.43
Number of Obs.	253,846	253,846	253,846	253,846

Table 1. Model (1) represents the baseline specification with only frequency distribution and time dummies. Model (3) and (4) show specifications with additional features: individual heterogeneity (income, gender and education) and the average experienced inflation. Parentheses represent t-values for scalar explanatory variables. F test statistic for the functional explanatory variable appear in brackets. 'sig' indicates that the functional explanatory variable is statistically significant.

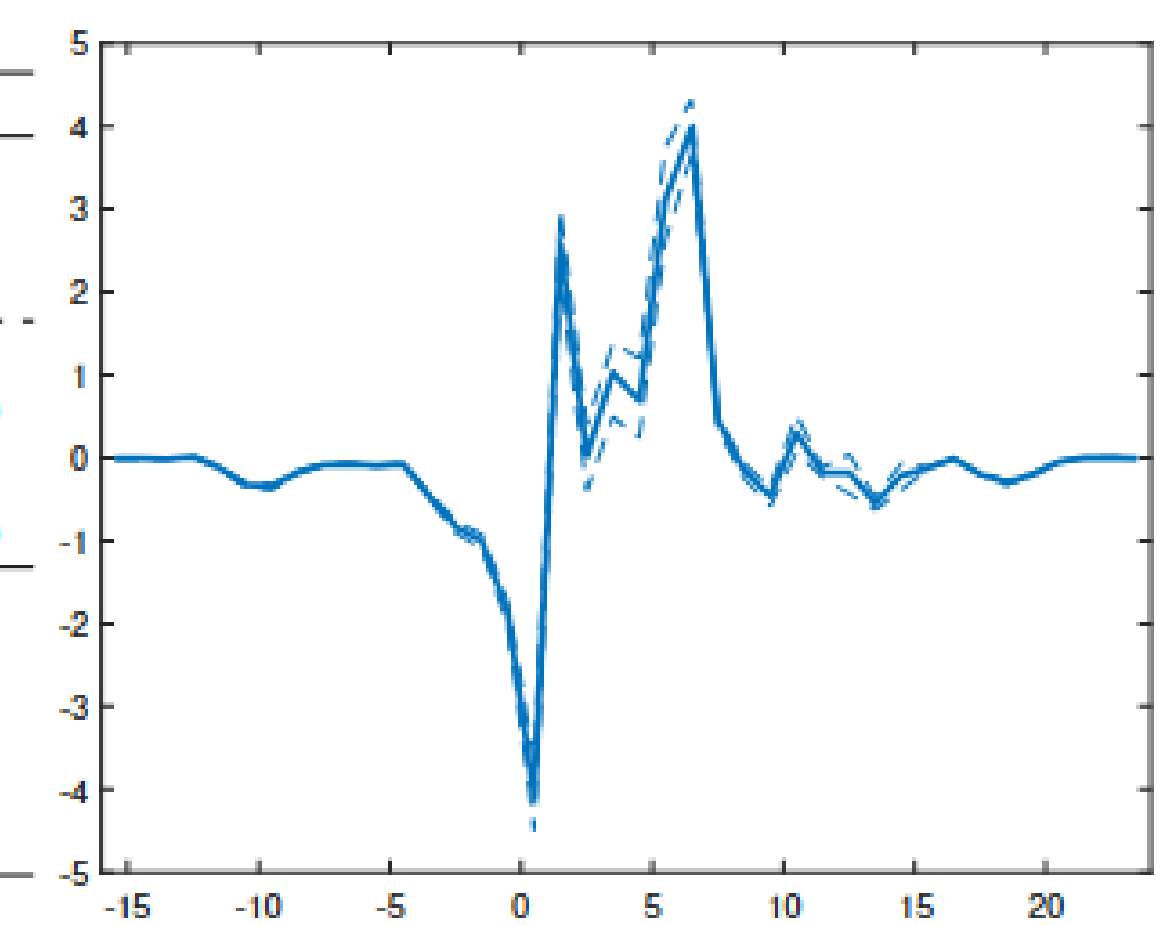


Figure 2. Estimated Coefficient Function

Conclusions

We find that individuals expect higher inflation when they have undergone high inflation periods more often during their lifetime. This result remains intact even if we control for the average lifetime experienced inflation and heterogeneity in demographic characteristics such as income, education level, and gender of respondents.

References

- Malmendier, Ulrike and Stefan Nagel, "Learning from inflation experiences," The Quarterly Journal of Economics, 2016, 131 (1), 53-87.
- Meeks, Roland and Francesca Monti, "Heterogeneous beliefs and the Phillips curve," Bank of England Staff Working Paper No. 807, 2019.