# Unexpected Inflation and Fertility Rates in the US

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January 9, 2026

**Abstract**

This paper examines the impact of unexpected inflation on the total fertility rate in the United States. Using state-level data from 2003-2023, we employ the Kalman filter to extract the unexpected component of actual inflation rates then relate this value to the next year's total fertility rate. The empirical results show that unexpected inflation has a negative and significant impact on the total fertility rate. Younger women (under age 25) are more likely to postpone or reduce births due to an unanticipated inflation. A one percentage point increase in unexpected inflation is expected to result in 3-5 fewer births per 1,000 reproductive-age women. Insofar as we are aware, we are the first to document the role of unexpected inflation in delaying or preventing births within the contemporary U.S. context.

**Keywords:** Total fertility rate, Unexpected inflation.

Acknowledgements: We are grateful to Joshua Hendrickson for his guidance in carrying out this research. We also appreciate the constructive comments of the other member of Ahmed's dissertation committee, John Gardner, on this research. Additionally, Ahmed would like to thank other faculty members and graduate students for their comments upon presenting this paper at the Ole Miss Economics seminar.

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# 1 Introduction

Fertility decisions are forward-looking and sensitive to households' expectations of macroeconomic conditions. Past research identifies fertility rates as a "leading indicator," since the growth rate of conceptions tends to fall several quarters before economic decline is apparent (Buckles et al., 2021). One economic factor that could potentially change a household's fertility plans quite rapidly is an unexpected, large increase in the rate of inflation.

When inflation is low, stable, and close to expectations, households don't face a strong incentive to deviate from their existing fertility plans. In contrast, when inflation exceeds expectations, households face more uncertainty about future wages, prices, and borrowing conditions. Higher-than-expected inflation erodes real purchasing power and thus immediately increases the cost of raising a child. As such, households may prioritize precautionary savings, reduce discretionary spending, and delay childbearing decisions.

Many papers have identified the significant role that economic uncertainty plays in contemporary fertility declines, especially in the labor market (Adsera, 2011; Adsera and Menendez, 2011; Comolli, 2017a; Chabé-Ferret and Gobbi, 2018; Gozgor et al., 2021). Some of these papers find little effect of actual inflation rates on fertility, however, households would not necessarily be expected to respond to actual inflation but to how their expectations deviate from observed economic outcomes. They adjust to predictable inflation through savings and consumption smoothing, but unexpected inflation affects long-term planning, including fertility decisions. As of yet, no paper has directly investigated the role of *unexpected* inflation in contemporary fertility decline in the United States. The most similar paper to our approach, Wu (2024a), finds that emerging countries committed to inflation targeting (i.e., aiming to ensure price stability) experienced a smaller reduction in fertility rates compared to those without inflation targeting.

More generally, this paper contributes to the growing literature on families and macroeconomics (Doepke and Tertilt, 2016). While much attention has been given to the impact of various fiscal policies on household fertility decisions (e.g., baby bonuses), the relationship between monetary policy and fertility remains underexplored. For instance, when inflation is high and above expectations, the central bank may raise nominal interest rates. This increases borrowing costs, reduces housing affordability, and could prompt households to postpone childbearing decisions. Meanwhile, a monetary policy that anchors inflation expectations and promotes price stability benefits households and may encourage them to have more children. Hence, understanding the effect of unexpected inflation on fertility rate provides insight into the demographic consequences of monetary policy.

The paper proceeds as follows. First, we discuss previous related research and justify the basic economic intuition that an increase in the full cost of children lowers the quantity demanded. Next, we describe our panel data set (2003-2023) which combines state-level estimates of unexpected inflation rates using the Kalman filter with age-specific fertility rates (ASFRs) obtained from the U.S. Center for Disease Control and Prevention (CDC). We estimate whether lagged unexpected inflation rates can explain variation in both ASFRs and total fertility rates (TFRs) across the United States, employing state and year fixed effects along with standard controls for marriage, female labor-force participation rates, and other variables. As a robustness check, we also compute unexpected inflation using a time-trend method to ensure that the results are not sensitive to a particular measurement approach.

We find that higher rates of unexpected inflation are statistically significantly associated with lower fertility rates. In particular, younger women (under age 25) seem to be the most responsive, suggesting they postpone childbearing because they are more financially constrained and/or have more flexibility in adjusting the timing of births.

## 2 Background

Becker (1960) viewed children as durable goods, stating that increases in income or a decline in the price of childbearing would increase the quantity (or quality) of children demanded. Since then, many studies have sought to estimate how changes in the direct cost of raising a child (as an early example, see Blau and Robins 1989) or the opportunity cost (as another early example, see Cramer 1979) might explain fertility rates.[2] One drawback of this approach is that couples can respond strategically to price changes of specific commodities (e.g., formal childcare services) by finding lower-cost substitutes (e.g., care from grandparents). Our focus on inflation allows us to more closely estimate increases in any of the costs associated with raising children.

Other studies, such as Schaller (2016) and Comolli (2017b), broadly find that macroeconomic factors, such as inflation and unemployment, have a negative and significant effect on fertility. Sobotka et al. (2011) did a broad review of the effects of economic recessions on aggregate and individual-level fertility. From their review, most studies (Kiser and Whelpton, 1953; Morgan, 1991; Neels, 2010; Koech and García, 2010; Kreyenfeld, 2010) find that fertility is pro-cyclical, responding to the business cycle's ups and downs. In particular, these studies broadly find that economic recessions and high unemployment often lead to a postponement of childbearing, especially for first births. Additionally, other parts of the literature show that economic conditions, monetary policy, and family assets significantly affect birth rates in the United States (Black et al., 2013; Dettling and Kearney, 2014; Kearney and Wilson, 2018; Cumming and Dettling, 2023). We contribute to this literature by incorporating inflation expectations and exploiting state-level variation in the total fertility rate to examine how unexpected inflation influences fertility outcomes in the United States.

Given the central bank's role in managing inflation, Wu (2024b) examines the relationship between inflation targeting and fertility rates in emerging countries using fixed-effects regression models and difference-in-differences (DID) methods. The paper finds that countries with inflation targeting experience a smaller reduction in fertility rates in emerging economies. This empirical finding suggests that inflation targeting can help address demographic challenges by ensuring price stability and reducing economic uncertainty. A related paper (Chang et al., 2013) models the effects of monetary policy with endogenous fertility, finding that "the superneutrality of money does not hold in the presence of endogenous fertility."

[2]This is also an important legal question for issues of child support or welfare benefits (Comanor et al., 2015).

Finally, inflation expectations play a role in household plans for the future (Binder and Brunet, 2022). Recent work emphasizes how households adjust their inflation expectations upon receiving new information about inflation rates from the news (Binder et al., 2025). We contribute to this growing literature by focusing on the role that *unexpected* changes in inflation have for the fertility decisions of women at different points in their reproductive careers.

# 3 Data and Methodology

To estimate the relationship between unexpected inflation and the total fertility rate, we extract unexpected inflation using the Kalman filter and calculate state-level TFRs in each year using data from the CDC. The resulting dataset is a balanced panel of the fifty U.S. states covering the period from 2003 to 2023.

## 3.1 Data

### 3.1.1 Unexpected Inflation

In this paper, we use state-level panel data on annual inflation, which is measured with the percentage change in the GDP deflator. The dataset covers the 50 U.S.states over the years 2003 to 2023. Nominal and real GDP data are sourced from the United States Bureau of Economic Analysis (BEA) and used to construct the GDP deflator. Bianchi et al. (2023) and Asab (2025) also used the percentage change in GDP deflator to measure inflation.

To decompose actual inflation into expected and unexpected components, I use the local-level Kalman filter function within a state-space model. The full functional specification of the Kalman filter function can be found in the Appendix.

To assess the external validity of this approach, we first construct an alternative measure of unexpected inflation using the national monthly data on inflation expectations from the University of Michigan (UMich). In this case, unexpected inflation is defined as the difference between observed monthly consumer price index (CPI) inflation and the

UMich inflation expectation[3]. Then the Kalman filter is used to compute unexpected inflation using the national monthly CPI inflation [4]. Finally, we compare the estimated measure of unexpected inflation derived from the Kalman filter with the one constructed using the UMich's inflation expectations.

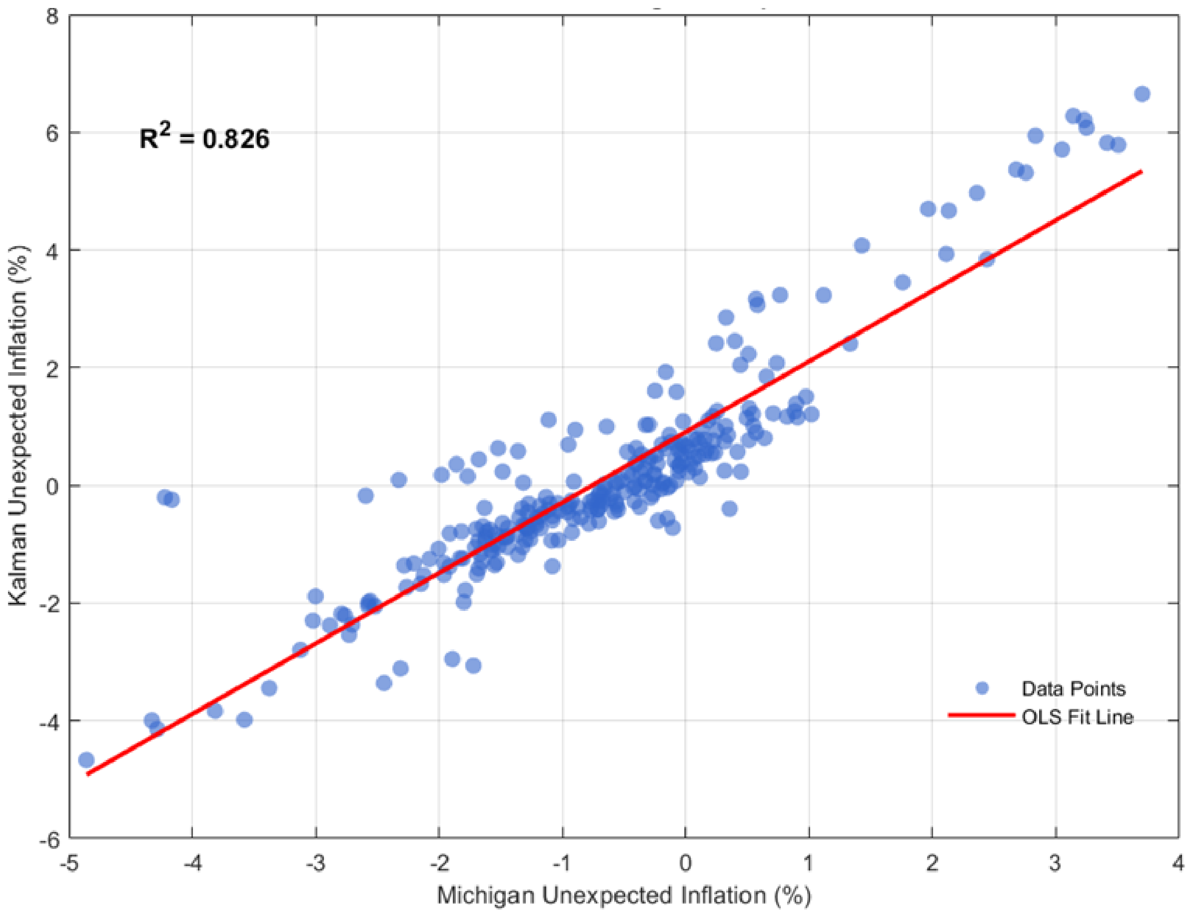



Figure 1: Comparing the Kalman Filter and University of Michigan's Survey Approach to Unexpected Inflation

The estimated unexpected inflation from the Kalman filter closely tracks that derived using the University of Michigan's inflation expectation, as shown in Figure 1. Both measures of unexpected inflation are strongly and positively correlated, with an R-square of 0.826. This provides an external validation for the use of the Kalman filter to extract unexpected inflation from the observed inflation data, which in the main analysis is

[3]We source the national monthly data on the University of Michigan's inflation expectation and CPI inflation rate from the Federal Reserve Economic Data (FRED).

[4]We use the CPI inflation rate to test external validity of the Kalman filter method because the UMich survey is monthly and consumer-based. This alignment is important to ensure that the unexpected inflation estimated using the Kalman filter is comparable to the measure constructed from the University of Michigan's inflation expectations.

measured using state-level annual panel data on GDP deflator inflation[5].

### 3.1.2 Fertility Rates

We use state-level data on the total fertility rate (TFR) to measure fertility in the United States. The TFR is derived using data on the total number of births and the female population aged 15-44, obtained from the US Center for Disease Control and Prevention (CDC). Birth counts are available from the CDC for the entire sample period (2003-2023), but female population data by age group are not available for all states between 2021 and 2023. Details of how female population counts were constructed for the missing years are provided in the Appendix.

To calculate the TFR, we first disaggregate the births and the female population data by age groups 15-19, 20-24, 25-29, 30-34, 35-39, and 40-44. We then estimate the age-specific fertility rate using the following formula:

$$\mathrm{ASFR}_{\mathrm{s,a,t}} = \frac{\mathrm{B}_{\mathrm{s,a,t}}}{\mathrm{N}_{\mathrm{s,a,t}}} \tag{1}$$

where:

- $\mathrm{ASFR}_{\mathrm{s,a,t}}$ is the age-specific fertility rate for state s, age group a, in year t;
- $\mathrm{B}_{\mathrm{s,a,t}}$ is the number of births to women in age group a in state s in year t;
- $\mathrm{N}_{\mathrm{s,a,t}}$ is the number of women in age group a in state s in year t.

Finally, we estimate the total fertility rate (TFR) by taking the sum of the computed age-specific total fertility rates as shown below:

$$\mathrm{TFR}_{\mathrm{s,t}} = 5 * \sum_{\mathrm{a=15}}^{44} \mathrm{ASFR}_{\mathrm{s,a,t}} \tag{2}$$

where:

[5] We did not use the University of Michigan's survey-based inflation expectations to construct unexpected inflation because state-level panel data from the survey are not publicly available. Instead, in the main analysis, I use the Kalman filter to extract the unexpected component of state-level GDP deflator inflation. As a robustness check, we also construct an alternative measure of unexpected inflation using a state-specific time-trend approach applied to the same GDP deflator data.

- $\text{TFR}_{s,t}$ is the total fertility rate for state s in year t;
- the factor 5 reflects the five-year width of each age group (15–19, 20–24, . . . , 40–44).

### 3.1.3 Control Variables

To create a battery of controls, we use the data on other variables such as median age, female labor force participation rate, married women as a percentage of total population, educational attainment measured as the percentage of those with high school education and above, and percentage of women with health insurance coverage. All of these variables are sourced from the 5-year American Community Survey (ACS) for years 2003-2023. Additionally, we use data on macroeconomic factors such as GDP per capita and unemployment rate, which are obtained from Federal Reserve Economic Data (FRED).

### 3.1.4 Summary Statistics

Table 1 presents the summary statistics for the dependent, explanatory, and control variables in this paper.

Table 1: Summary Statistics

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Total Fertility Rate (TFR) | 1,050 | 1.885 | 0.228 | 1.312 | 2.679 |
| Unexpected Inflation (Kalman) | 1,000 | 0.170 | 1.685 | -16.467 | 9.013 |
| Expected Inflation | 1,050 | 2.313 | 1.267 | -2.424 | 9.212 |
| GDP Deflator Inflation | 1,050 | 2.475 | 2.447 | -17.501 | 16.418 |
| Unexpected Inflation (Time Trend) | 1,050 | 0.000 | 2.365 | -21.121 | 13.250 |
| Median Age | 1,050 | 32.219 | 1.822 | 26.000 | 39.000 |
| Female Labor Force Participation (%) | 1,050 | 62.290 | 4.079 | 49.515 | 77.966 |
| Married Women (%) | 1,050 | 34.987 | 5.037 | 22.024 | 55.840 |
| Education (%) | 1,050 | 85.909 | 3.760 | 74.653 | 94.398 |
| Health Insurance Coverage (%) | 1,050 | 10.354 | 8.164 | 0.000 | 30.260 |
| Female Share of Population (%) | 1,050 | 50.076 | 1.691 | 41.448 | 56.701 |
| Unemployment Rate (%) | 1,050 | 5.447 | 2.099 | 1.800 | 13.670 |

Between the period of 2003 and 2023, the average GDP deflator inflation of U.S. states is 2.475%. This differs slightly from the expected inflation component (2.313%) derived using the Kalman filter. The unexpected component of inflation has a mean close to zero (0.17%) and a standard deviation of 1.69, indicating some cross-state variation.

In addition, the mean value of TFR is 1.89 children per woman, lower than the replacement rate of 2.1 children per woman. Moreover, there is substantial cross-state variation in TFR, ranging from a minimum of 1.31 children to a maximum of 2.68 children over the sample period.

### 3.2 Model

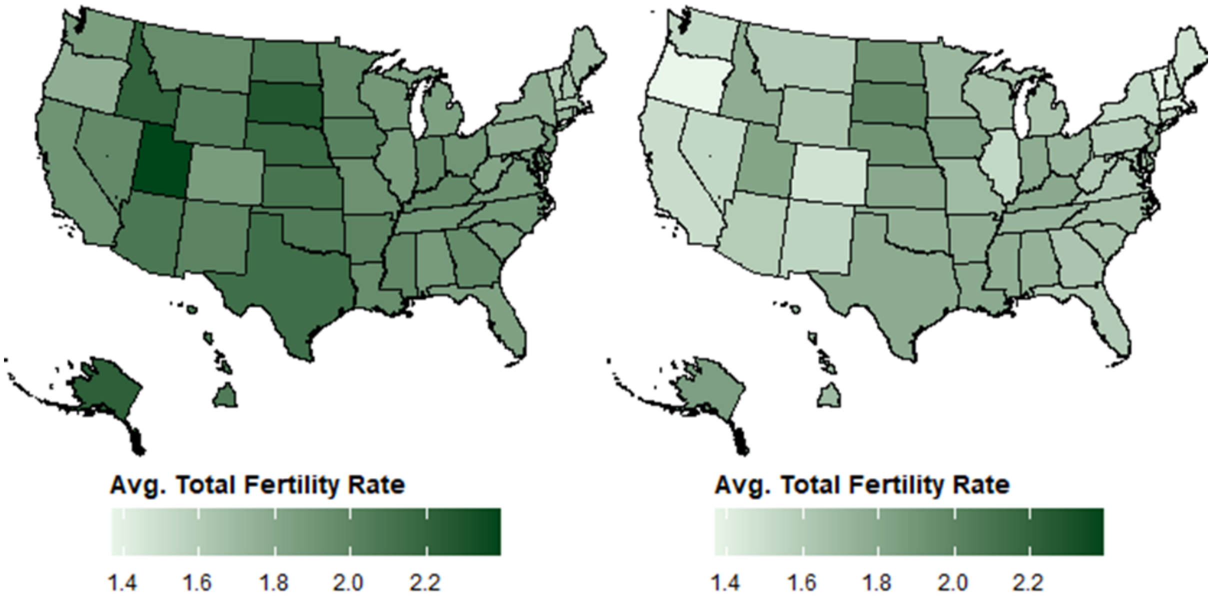
To investigate the impact of unexpected inflation on the total fertility rate in the U.S., we estimate the following regression model:

$$\mathrm{TFR_{st}} = \beta_1 \, \mathrm{L.UnexpectedInflation_{st}} + \mathbf{X}'_{\mathrm{st}}\boldsymbol{\beta} + \alpha_{\mathrm{s}} + \lambda_{\mathrm{t}} + \varepsilon_{\mathrm{st}}, \tag{3}$$

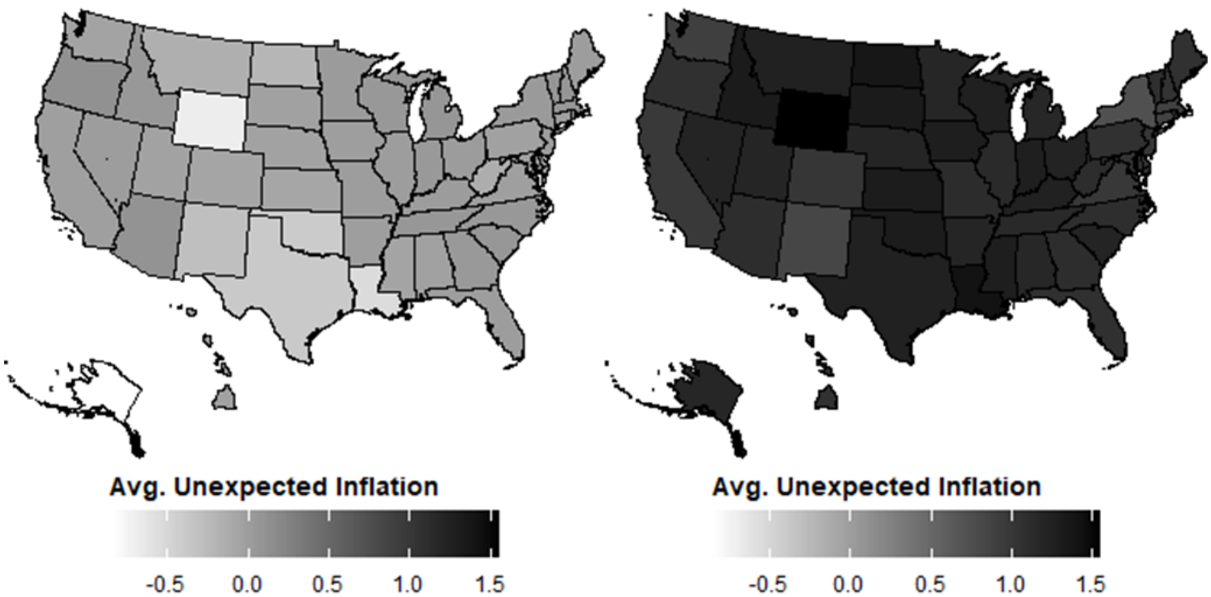
where $\mathrm{TFR_{st}}$ represents the total fertility rate of state s at time t. $\mathrm{L.UnexpectedInflation_{st}}$ is the one-period lag of unexpected inflation. A one-period lag is used because it takes at least 9-12 months for households to have a child. $\mathbf{X}_{\mathrm{st}}$ represents the control variables, which are gender composition, racial composition, educational attainment, marital status, female labor force participation, median age, log of GDP per capita, unemployment rate, dummy for abortion law, dummy for political affiliation (red vs blue state) and health insurance coverage. $\alpha_{\mathrm{s}}$ and $\lambda_{\mathrm{t}}$ are state and year fixed effects respectively. $\varepsilon_{\mathrm{st}}$ is the error term.

# 4 Results

## 4.1 Descriptive evidence of the effect of unexpected inflation on total fertility rate




(a) Total Fertility Rate by State




(b) Unexpected Inflation by State

Figure 2: Geographic Distribution of Fertility and Unexpected Inflation Rates

Figure 2 presents the geographical distribution of the total fertility rate and unexpected inflation in the U.S. In particular, panel (a) show the distribution of average TFR for two sub-periods, 2003-2019 (left) and 2020-2023 (right). Panel (b) displays the geographical distribution of average unexpected inflation for the same two sub-periods.

Inflation is relatively low (1.98%) and unexpected inflation is negative (-0.07%) in the first sub-period (2003-2019). In contrast, inflation is higher (4.52%) and unexpected inflation is positive (1.13%) in the second sub-period (2020-2023). In this context, we refer to the first sub-period as a low-inflation regime and the second sub-period as a high-inflation regime.

From the maps, the average TFR is relatively high across most states in the low-inflation regime. At the same time, unexpected inflation is low, with almost all states falling within the lighter grey region in panel (b). In the high-inflation regime, states are in the lighter green region in panel (a), indicating lower TFR. This coincides with periods of relatively high unexpected inflation, as indicated by the dark grey of the map.

## 4.2 Main Empirical Results

In this section, we present estimates on the overall impact of unexpected inflation on the total fertility rate in the U.S. The panel fixed-effects estimates are reported in Table 2. We also show the age-specific effects of unanticipated inflation on the total fertility rate in the US. Our results suggest that young women are mostly responsive to unexpected inflation.

### 4.2.1 Overall aggregate impact of unexpected inflation on fertility rate

The baseline result in Table 2 is that of the full sample (2003-2023), reported in column 3. From this, we find that unanticipated inflation has a negative and significant impact on the total fertility rate in the United States. This indicates that an increase in unexpected inflation is associated with a significant reduction in total fertility rate.

A one percentage point increase in unexpected inflation is associated with a reduction in the U.S. total fertility rate of 520 births per 100,000 women. This is significant, given

Table 2: Effect of Unexpected Inflation on Total Fertility Rate

| | Pre-COVID | Exclude 2020 | 2003–2023 |
|---|---|---|---|
| Unexpected inflation (Lag) | -0.0031*** | -0.0051*** | -0.0052*** |
| | (0.0012) | (0.0014) | (0.0012) |
| Observations | 750 | 900 | 950 |
| Number of states | 50 | 50 | 50 |
| R-squared | 0.857 | 0.861 | 0.865 |
| State fixed effects | Yes | Yes | Yes |
| Time fixed effects | Yes | Yes | Yes |

Robust standard errors clustered at the state level are in parentheses.
***p < 0.01, **p < 0.05, *p < 0.1.

that observed inflation has largely deviated from expected inflation in recent years. Hence, if observed inflation exceeds the expected inflation by at least 4%, as in the post-COVID period, households could reduce births by about 2,600 per 100,000 women.

There is concern that the COVID pandemic could confound the estimate of the full-sample result. To account for this, we re-estimate the panel fixed-effects model for the pre-COVID years (2003-2019) and for the full sample, excluding 2020. The new estimates are in Column 1 and Column 2 (Table 2). These new estimates also show that if there is an increase in unexpected inflation, total fertility rate is expected to significantly decrease. This indicates that the negative and significant effect observed using the full sample is not driven by COVID. However, the magnitude of the effect in the pre-COVID sample differs from that in the full sample result. This could be because inflation was relatively higher post-COVID.

These findings are consistent with the argument that substantial increases in unexpected inflation could prompt households to postpone their childbearing decisions, leading to a reduction in fertility rate.

#### 4.2.2 Age-Specific Effects of Unexpected Inflation on Fertility

Figure 3 presents the estimated effects of unexpected inflation on age-specific fertility rates across different maternal age groups. We use the same regression specification as in the main empirical results. The results show that younger women aged 15-24 are more responsive to unanticipated changes in inflation. This could be because, within this age

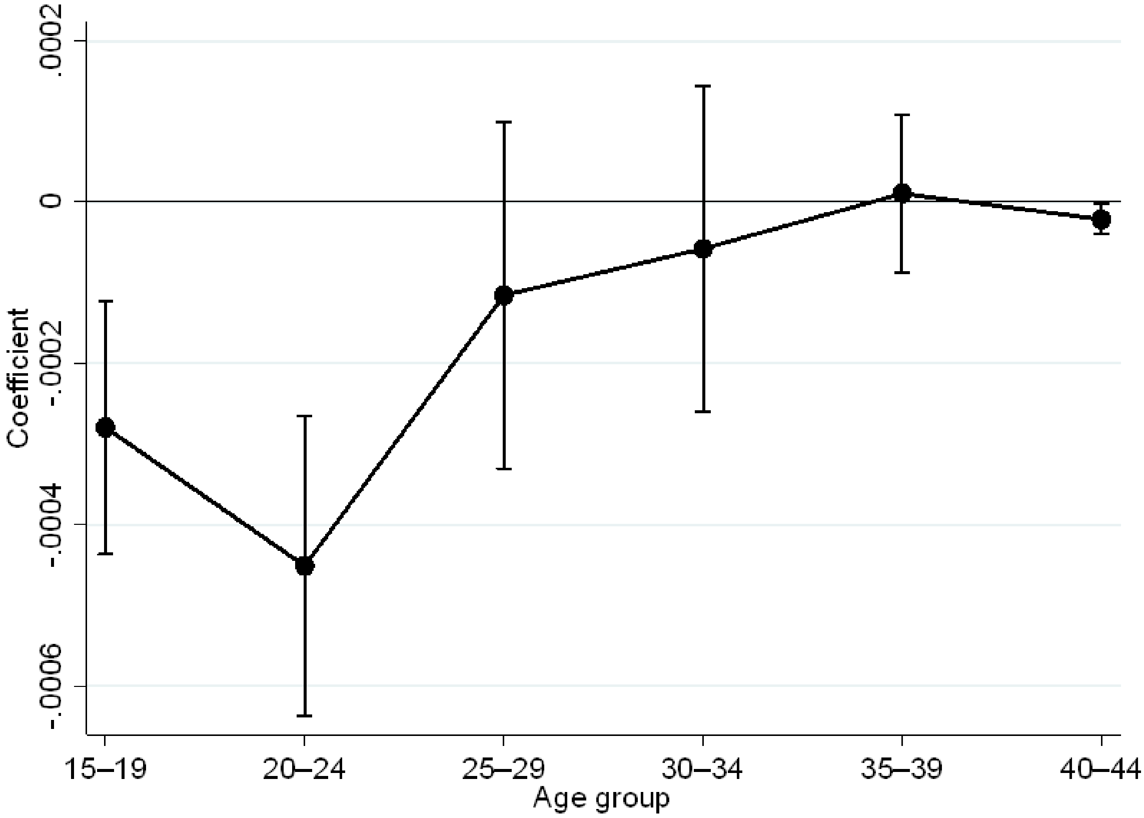



Figure 3: Effects of Unexpected Inflation on ASFRs

group, women are more sensitive to labor-market uncertainty and they also have more flexibility to postpone childbearing.

Meanwhile, women aged 25-44 do not respond significantly to unexpected inflation. A plausible explanation is that most women in this age group have already planned births or already have their desired children. Hence, if there is any unanticipated inflation, it does not affect their childbearing decisions.

## 4.3 Robustness checks

In this section, we present a robustness check using an alternative measure of unexpected inflation. We also test whether the results from the previous section hold when inflation is high or low by dividing the full sample into two sub-samples.

Table 3: Effect of Unexpected Inflation on the U.S. Total Fertility Rate

| | Pre-COVID | Exclude 2020 | 2003–2023 |
|---|---|---|---|
| Unexpected inflation (Lag) | -0.0019** | -0.0034*** | -0.0035*** |
| | (0.0007) | (0.0007) | (0.0007) |
| Observations | 800 | 950 | 1,000 |
| Number of states | 50 | 50 | 50 |
| R-squared | 0.848 | 0.856 | 0.861 |
| State fixed effects | Yes | Yes | Yes |
| Time fixed effects | Yes | Yes | Yes |

Robust standard errors clustered at the state level are in parentheses.
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

#### 4.3.1 Unexpected Inflation using Time Trends

In Table 3, we use the time-trend method to estimate unexpected inflation. This serves as a robustness check to confirm that the baseline findings are not sensitive to the use of the Kalman filter approach. Then, we re-estimate the impact of the new unexpected inflation measure on the total fertility rate in the U.S. The results in Table 3 show that unexpected inflation has a negative and statistically significant impact on the total fertility rate in the U.S., consistent with the results obtained using the Kalman filter for unexpected inflation.

#### 4.3.2 Unexpected Inflation and Crude Birth Rates

Table 4: Effect of Unexpected Inflation on the Crude Birth Rate

| | Pre-COVID | Exclude 2020 | 2003–2023 |
|---|---|---|---|
| Unexpected inflation (Lag) | −0.0245*** | −0.0302*** | −0.0303*** |
| | (0.00666) | (0.00936) | (0.00805) |
| Observations | 750 | 900 | 950 |
| R-squared | 0.836 | 0.858 | 0.862 |
| Number of states | 50 | 50 | 50 |
| State FE | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes |

Robust standard errors clustered at the state level are in parentheses.
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

In Table 4, we present estimates of the impact of unexpected inflation on crude birth rates in the United States. This serves as a robustness check to ensure that our findings are not driven by using the TFR as the measure of fertility. Across all specifications in Table 4, the negative and statistically significant impact of unexpected inflation on fertility persists. The estimates imply that a five percentage-point increase in unexpected inflation reduces the crude birth rate by about 1-1.5 births per 1000 people. These results reinforce the findings from the previous section, showing that deviations of observed inflation from expectations have demographic consequences.

#### 4.3.3 Disaggregation of Time Period

Table 5: Effect of Unexpected Inflation on Total Fertility Rate Across Inflation Regimes

| | 2003–2023 |
|---|---|
| Low inflation regime (2003–2019) | -0.0034** |
| | (0.00149) |
| High inflation regime (2020–2023) | -0.0108** |
| | (0.00430) |
| Observations | 950 |
| Number of states | 50 |
| R-squared | 0.866 |
| State fixed effects | Yes |
| Time fixed effects | Yes |

Robust standard errors clustered at the state level are in parentheses.
***p $<$ 0.01, **p $<$ 0.05, *p $<$ 0.1.

In Table 5, we conduct a robustness check by estimating a panel fixed-effects regression for two inflation regimes or sub-periods. The full sample is split into two: 2003-2019 and 2020-2023. On average, inflation was 1.97% in 2003-2019 and was 4.52% in 2020-2023. Having these two different subsamples allows us to assess whether the results in the previous section are stable across different subperiods.

Across the two sub-periods, unexpected inflation continues to exert a negative and statistically significant impact on the total fertility rate in the U.S. Notably, the effect was about three times relatively larger in the sub-sample of high inflation (2020-2023). These results show that the negative and significant relationship between unexpected inflation and the total fertility rate holds both when inflation is low and when it is high.

# 5 Conclusion

In this paper, we examine the impact of unanticipated inflation on the total fertility rate in the United States. We use the variation in total fertility rates across fifty U.S. states to identify the impact of unexpected inflation on fertility, employing a panel fixed-effects model and a Kalman filter to construct unexpected inflation.

The main empirical result shows that an increase in unanticipated inflation is associated with a significant reduction in the total fertility rate in the U.S. The age-specific estimates indicate that the negative effect is mostly driven by younger women, producing the intuitive result that younger women are most likely (and able) to postpone childbearing decisions in response to unexpected inflation.

We conduct several robustness checks to assess the consistency of the baseline result. First, we re-estimate the model using crude birth rate as an alternative measure of fertility, and the negative effect persists. Second, we use an alternative approach to construct unexpected inflation using a state-by-state time-trend model, and the results remain consistent. Finally, we assess the stability of the baseline estimates across subperiods by separately estimating the model for the pre-COVID and post-COVID periods. With this, the negative relationship between unexpected inflation and fertility holds in both subperiods. Overall, the results indicate that significant unanticipated inflation has demographic consequences in the United States. Unanticipated inflation could be a factor that causes women to postpone childbearing, thereby driving the decline in TFR in recent years.

This paper is important considering that the U.S. fertility rate in every state is not only currently below the rate of population replacement but also well below the fertility desires reported by individual women in those states (Piano and Stone, 2025). In the short- to medium-run, low fertility will shrink the labor force, increase the old-age dependency ratio, and pose a fiscal challenge for the social security system (Sobotka et al., 2011). Hence, persistent economic uncertainty due to high unexpected inflation may accelerate population aging and negatively impact economic growth in the long run.

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APPENDIX

# A Total fertility rate

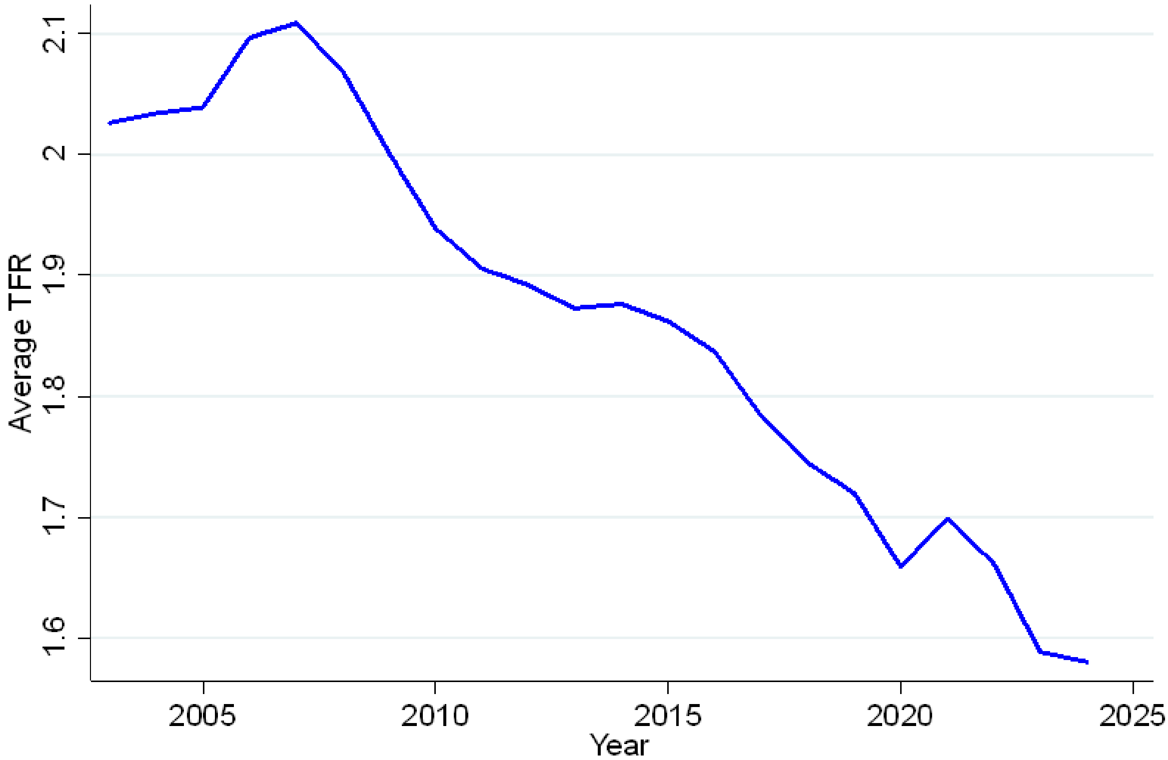


Figure 4: Average total fertility rate (TFR) across 50 U.S. states

# B Local-Level Kalman Filter Specification

To decompose observed inflation into its expected and unexpected components, I estimate a standard local–level state–space model using the Kalman filter. Let $\pi_t$ denote observed inflation at time t. The model is:

$$\textbf{Measurement Equation:} \quad \pi_t = A\mu_t + \varepsilon_t, \tag{4}$$

$$\textbf{State Equation:} \quad \mu_t = C\mu_{t-1} + \eta_t, \tag{5}$$

where:

- $\mu_{\mathrm{t}}$ is the latent (unobserved) *expected inflation* at time t.
- $\varepsilon_{\mathrm{t}} \sim \mathrm{N}(0, \mathrm{R})$ is the measurement noise.
- $\eta_{\mathrm{t}} \sim \mathrm{N}(0, \mathrm{Q})$ is the process noise governing the evolution of $\mu_{\mathrm{t}}$.

Thus, inflation is modeled as the sum of a slowly evolving trend component $\mu_{\mathrm{t}}$ and a transitory shock $\varepsilon_{\mathrm{t}}$. The Kalman filter produces the filtered estimate $\widehat{\mu}_{\mathrm{t}}$ of expected inflation, and the forecast error:

$$\mathrm{u_t} = \pi_{\mathrm{t}} - \widehat{\mu}_{\mathrm{t}}, \tag{6}$$

which represents the *unexpected inflation*, which I use in my empirical analysis.

# C Female Population (2021-2023)

To construct the female population estimate between 2021 and 2023, I first compute the share of the female population in each age group as a percentage of the total female population for the years in which data is available. Then, I estimate an age-specific quadratic trend regression of the share of the population as specified below:

$$\mathrm{Share_{s,a,t}} = \alpha_{\mathrm{a}} + \beta_{\mathrm{1a}}\mathrm{trend} + \beta_{\mathrm{2a}}\mathrm{trend}^2 + \mu_{\mathrm{s}} + \varepsilon_{\mathrm{s,a,t}} \tag{7}$$

where:

- $\mathrm{Share_{s,a,t}}$ is the share of the female population in age group a relative to the total female population in state s in year t;
- $\alpha_{\mathrm{a}}$ is an age-group–specific intercept;
- $\beta_{\mathrm{1a}}$ and $\beta_{\mathrm{2a}}$ capture the age-group–specific linear and quadratic time trends;
- $\mu_{\mathrm{s}}$ are state fixed effects that control for time-invariant differences across states;
- $\varepsilon_{\mathrm{s,a,t}}$ is an idiosyncratic error term.

After estimating the above, I use the fitted values to extrapolate population shares for the missing years (2021-2023). These predicted age-group shares are multiplied by the total female population counts to obtain age-specific female population counts.

As shown in Figure 5, there is a strong correlation between the predicted and actual shares of the age-specific female population as a percentage of the total female population for the years in which data is available (2003-2020). Hence, this validates that the predicted female proportion for the missing years is consistent with the observed data.

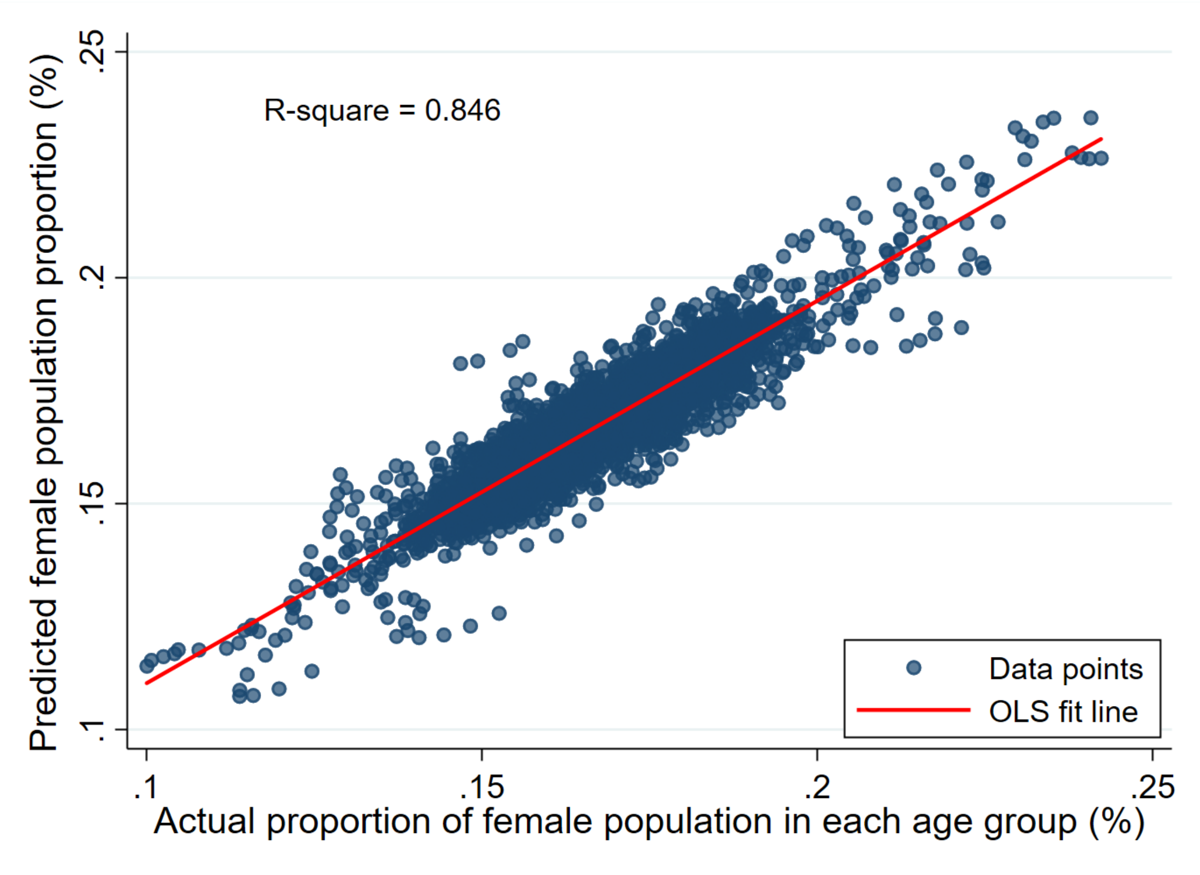


Figure 5: Scatter plot of actual and predicted female population (2021-2023)

# D Kalman Filter vs University of Michigan's survey

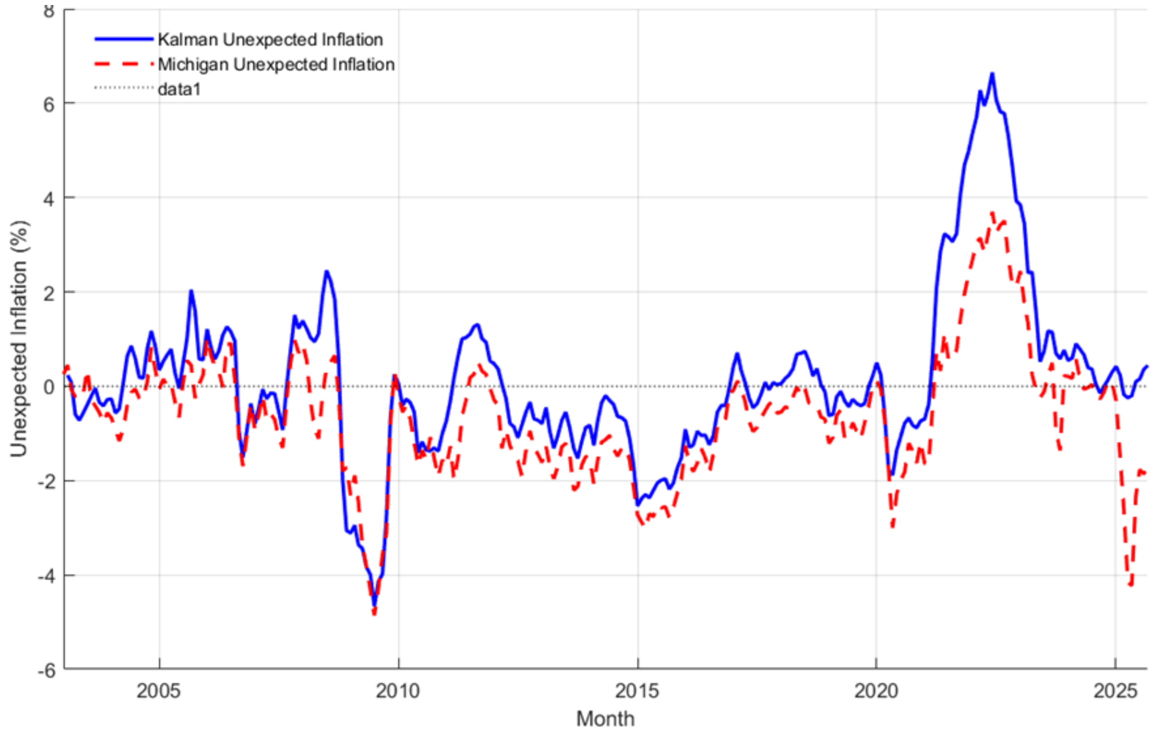


Figure 6: Enter Caption

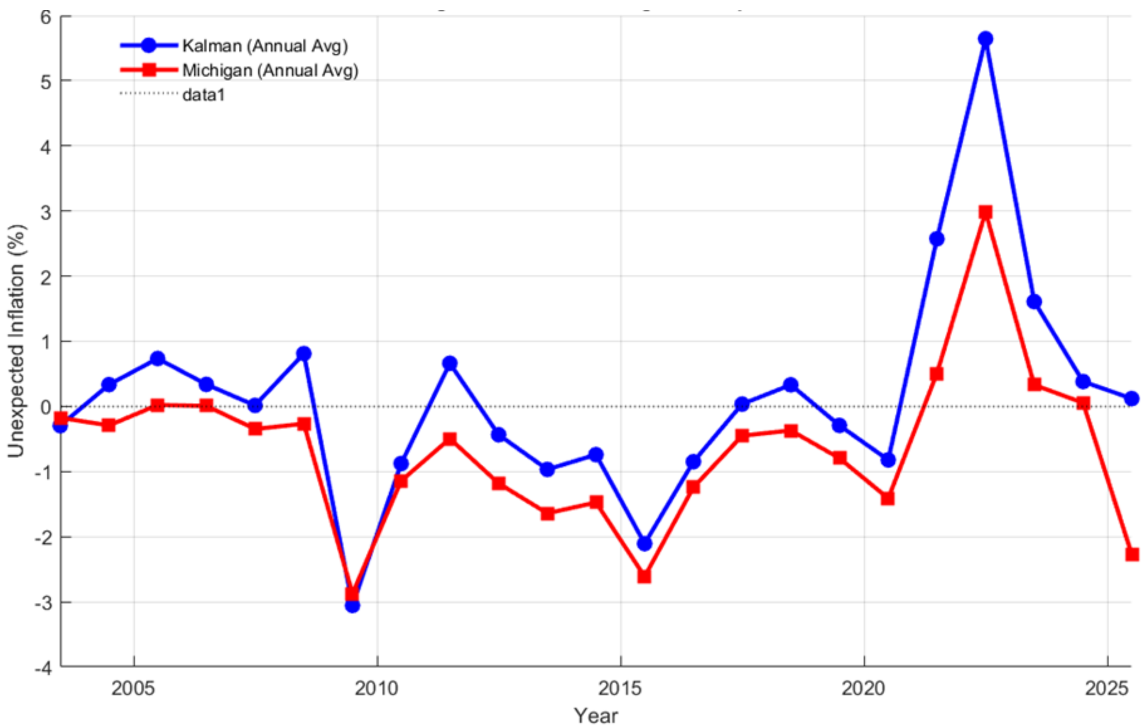


Figure 7: Enter Caption

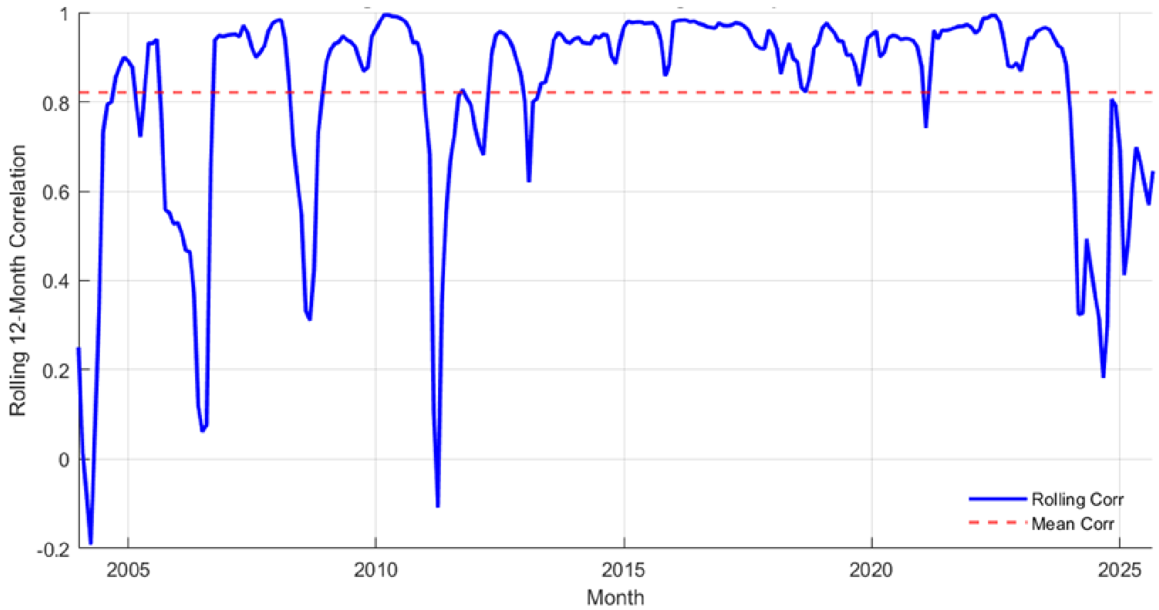


Figure 8: Enter Caption

# E Average unexpected inflation

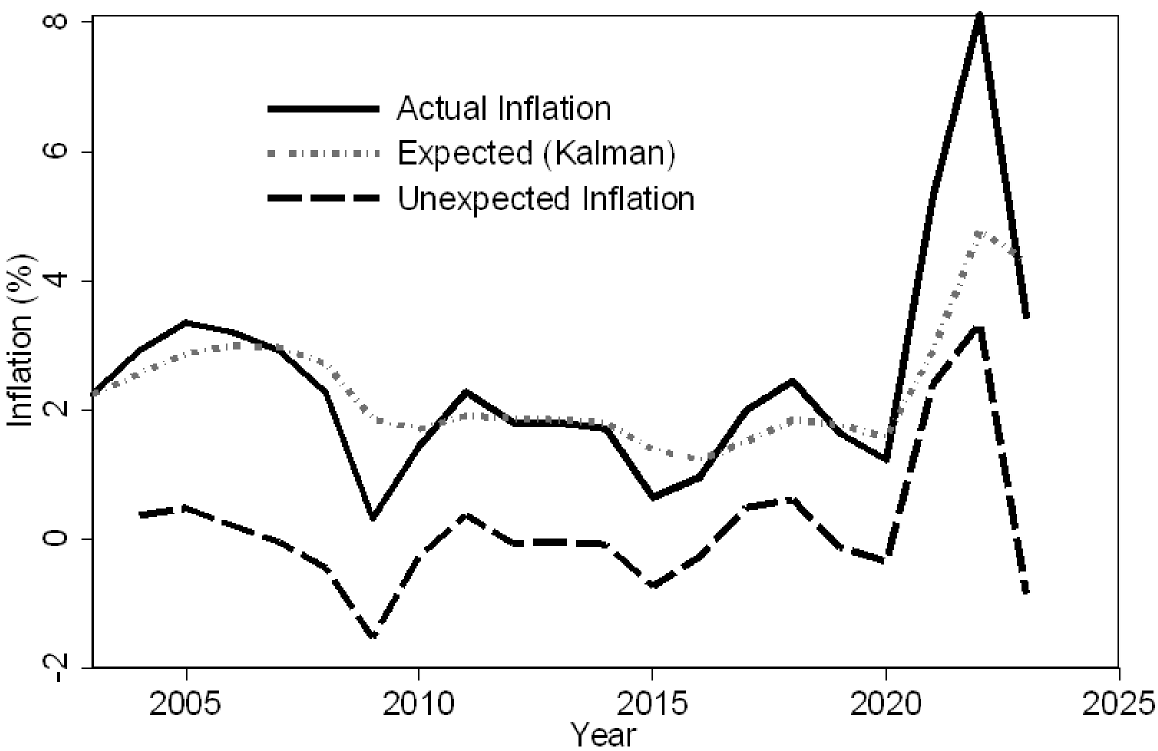


Figure 9: Enter Caption

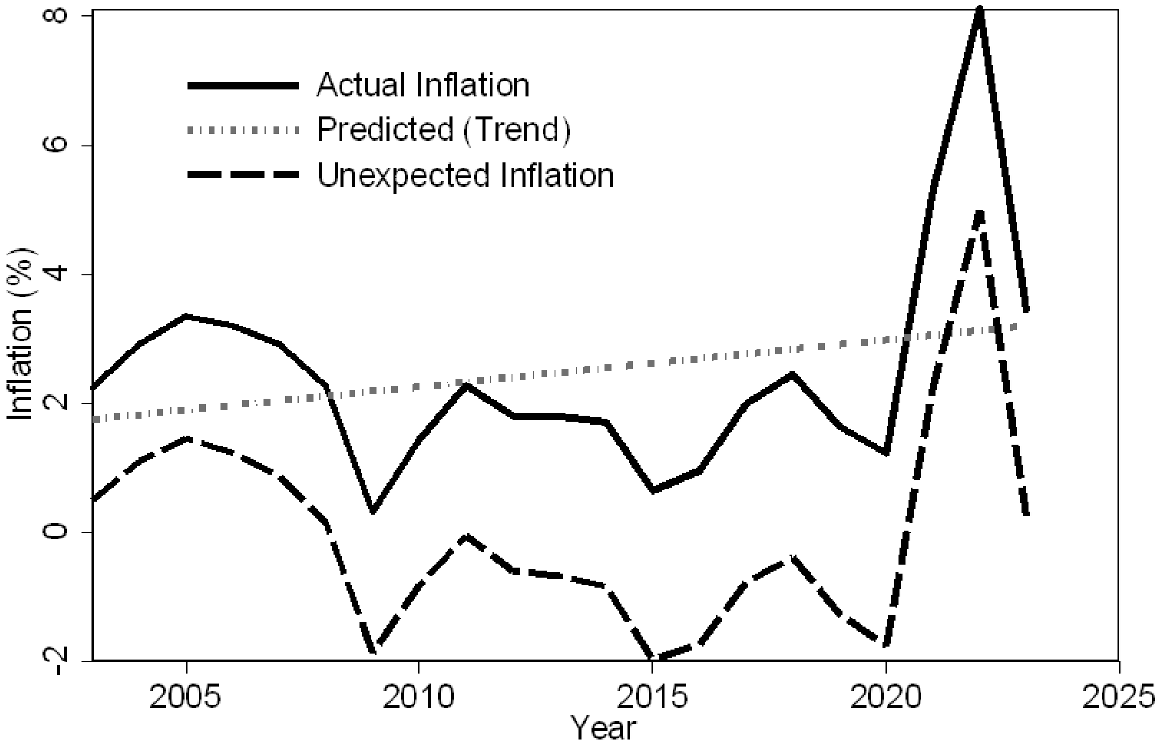


Figure 10: Enter Caption

# F Diagnostics for the unexpected inflation measure

## F.1 Testing if unexpected inflation is correlated with expected inflation

Table 6: Effect of Lagged Expected Inflation on Unexpected Inflation

| | **Unexpected Inflation (Kalman)** |
|---|---|
| L.expected_inflation | -0.0793 |
| | (0.138) |
| L2.expected_inflation | 0.0252 |
| | (0.115) |
| Observations | 950 |
| R-squared | 0.007 |

Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

## F.2 Testing for serial correlation of unexpected inflation

Table 7: Serial Correlation Test

| **Statistic** | **Value** |
|---|---|
| $F(1, 49)$ | 2.786 |
| Prob > F | 0.1015 |

## F.3 Mean-Zero test across states

Table 8: Mean Test for Unexpected Inflation Across States

| State | Mean | t-stat | p-value | State | Mean | t-stat | p-value |
|---|---|---|---|---|---|---|---|
| 1 | 0.203 | 1.01 | 0.326 | 26 | 0.121 | 0.35 | 0.731 |
| 2 | -0.438 | -0.35 | 0.730 | 27 | 0.198 | 0.92 | 0.368 |
| 3 | 0.289 | 1.71 | 0.103 | 28 | 0.238 | 1.07 | 0.296 |
| 4 | 0.231 | 1.03 | 0.317 | 29 | 0.262 | 1.71 | 0.104 |
| 5 | 0.178 | 1.11 | 0.281 | 30 | 0.204 | 1.26 | 0.223 |
| 6 | 0.144 | 0.52 | 0.607 | 31 | -0.076 | -0.14 | 0.894 |
| 7 | 0.169 | 1.34 | 0.195 | 32 | 0.163 | 1.19 | 0.250 |
| 8 | 0.143 | 0.64 | 0.531 | 33 | 0.255 | 1.60 | 0.126 |
| 9 | 0.213 | 1.29 | 0.212 | 34 | 0.091 | 0.11 | 0.914 |
| 10 | 0.250 | 1.45 | 0.165 | 35 | 0.252 | 1.18 | 0.253 |
| 11 | 0.182 | 0.96 | 0.347 | 36 | -0.069 | -0.08 | 0.938 |
| 12 | 0.301 | 1.40 | 0.177 | 37 | 0.299 | 2.07 | 0.052* |
| 13 | 0.230 | 1.20 | 0.246 | 38 | 0.179 | 0.92 | 0.369 |
| 14 | 0.278 | 1.25 | 0.228 | 39 | 0.202 | 0.79 | 0.440 |
| 15 | 0.249 | 1.17 | 0.255 | 40 | 0.287 | 1.49 | 0.152 |
| 16 | 0.196 | 0.83 | 0.417 | 41 | 0.233 | 0.61 | 0.548 |
| 17 | 0.257 | 1.34 | 0.196 | 42 | 0.274 | 1.56 | 0.134 |
| 18 | -0.153 | -0.23 | 0.822 | 43 | -0.065 | -0.09 | 0.926 |
| 19 | 0.213 | 1.36 | 0.190 | 44 | 0.202 | 0.79 | 0.440 |
| 20 | 0.186 | 1.19 | 0.247 | 45 | 0.271 | 1.80 | 0.088* |
| 21 | 0.227 | 1.68 | 0.109 | 46 | 0.183 | 1.23 | 0.232 |
| 22 | 0.281 | 1.40 | 0.177 | 47 | 0.136 | 0.92 | 0.369 |
| 23 | 0.250 | 1.28 | 0.216 | 48 | 0.107 | 0.21 | 0.837 |
| 24 | 0.208 | 0.77 | 0.451 | 49 | 0.284 | 1.53 | 0.143 |
| 25 | 0.224 | 1.36 | 0.189 | 50 | -0.245 | -0.23 | 0.822 |

# G Full Regression Results

## G.1 Kalman Filter Unexpected Inflation and Fertility Rate

Table 9: Determinants of Unexpected Inflation

| VARIABLES | Pre-COVID | Exclude 2020 | 2003–2023 |
|---|---|---|---|
| Unexpected inflation (Lag) | -0.00315*** | -0.00518*** | -0.00528*** |
| | (0.00114) | (0.00136) | (0.00121) |
| Married | 0.00476 | 0.00845*** | 0.00801*** |
| | (0.00296) | (0.00290) | (0.00291) |
| Education | -0.00513 | -0.00173 | -0.000606 |
| | (0.00368) | (0.00494) | (0.00475) |
| Race (black) | -0.00510* | -0.00709** | -0.00674** |
| | (0.00301) | (0.00325) | (0.00303) |
| Gender | -0.00612* | -0.00438 | -0.00388 |
| | (0.00305) | (0.00316) | (0.00316) |
| Median income (log) | 0.0375 | -0.0650 | -0.0623 |
| | (0.0678) | (0.0820) | (0.0809) |
| Blue state | -0.0468*** | -0.0628*** | -0.0656*** |
| | (0.0162) | (0.0164) | (0.0172) |
| Unemployment | -0.0106** | -0.00939* | -0.00722* |
| | (0.00497) | (0.00493) | (0.00424) |
| Median age | -0.00501 | -0.00672 | -0.00578 |
| | (0.00450) | (0.00418) | (0.00401) |
| Female labor force participation | -0.00270 | -0.00476* | -0.00525** |
| | (0.00186) | (0.00258) | (0.00244) |
| Health insurance | -0.00151 | -0.000676 | -0.000792 |
| | (0.00109) | (0.00129) | (0.00137) |
| Constant | 2.633*** | 3.454*** | 3.312*** |
| | (0.785) | (1.113) | (1.087) |
| Observations | 750 | 900 | 950 |
| R-squared | 0.857 | 0.861 | 0.865 |
| Number of states | 50 | 50 | 50 |

Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

## G.2 Time Trend Unexpected Inflation and Fertility Rate

Table 10: Effect of Unexpected Inflation on Total Fertility Rate

| | Pre-COVID | Exclude 2020 | 2003–2023 |
|---|---|---|---|
| Unexpected inflation (Lag) | -0.00206*** | -0.00353*** | -0.00363*** |
| | (0.000698) | (0.000668) | (0.000667) |
| Married | 0.00389 | 0.00705** | 0.00664** |
| | (0.00298) | (0.00297) | (0.00299) |
| Education | -0.00155 | 0.00118 | 0.00200 |
| | (0.00345) | (0.00448) | (0.00440) |
| Race (Black) | -0.00235 | -0.00470 | -0.00443 |
| | (0.00273) | (0.00299) | (0.00281) |
| Gender | -0.00686** | -0.00484 | -0.00430 |
| | (0.00277) | (0.00307) | (0.00306) |
| Median income (log) | 0.0677 | -0.0442 | -0.0451 |
| | (0.0717) | (0.0843) | (0.0832) |
| Blue state | -0.0478*** | -0.0651*** | -0.0684*** |
| | (0.0176) | (0.0181) | (0.0188) |
| Unemployment | -0.00985* | -0.00875* | -0.00680 |
| | (0.00512) | (0.00499) | (0.00433) |
| Median age | -0.00325 | -0.00551 | -0.00465 |
| | (0.00430) | (0.00418) | (0.00401) |
| Female labor force participation rate | -0.00375* | -0.00544** | -0.00582** |
| | (0.00190) | (0.00257) | (0.00247) |
| Health insurance | -0.00154 | -0.00105 | -0.00118 |
| | (0.00109) | (0.00126) | (0.00133) |
| Constant | 2.057** | 3.043*** | 2.958*** |
| | (0.818) | (1.094) | (1.082) |
| Observations | 800 | 950 | 1,000 |
| R-squared | 0.849 | 0.856 | 0.862 |
| Number of states | 50 | 50 | 50 |

Robust standard errors in parentheses.

*** p¡0.01, ** p¡0.05, * p¡0.1

## G.3 Birth rates and Unexpected inflation

Table 11: Effect of Unexpected Inflation on Birth Rate

| | Pre-COVID | Exclude 2020 | 2003–2023 |
|---|---|---|---|
| Unexpected inflation (Lag) | -0.0190*** | -0.0227*** | -0.0230*** |
| | (0.00632) | (0.00547) | (0.00524) |
| Married | 0.0600** | 0.0736** | 0.0744** |
| | (0.0273) | (0.0276) | (0.0280) |
| Education | -0.0383 | -0.0255 | -0.0199 |
| | (0.0318) | (0.0342) | (0.0344) |
| Race (Black) | -0.00607 | -0.0237 | -0.0223 |
| | (0.0228) | (0.0207) | (0.0199) |
| Gender | -0.0490** | -0.0448* | -0.0403 |
| | (0.0237) | (0.0239) | (0.0243) |
| Median income (log) | 1.025 | 0.102 | 0.0356 |
| | (0.648) | (0.642) | (0.641) |
| Blue state | -0.345** | -0.437*** | -0.455*** |
| | (0.132) | (0.120) | (0.120) |
| Unemployment | -0.0824** | -0.0864** | -0.0701** |
| | (0.0396) | (0.0353) | (0.0325) |
| Median age | -0.0456 | -0.0557* | -0.0545* |
| | (0.0354) | (0.0317) | (0.0295) |
| Female labor force participation rate | -0.0347* | -0.0461* | -0.0481* |
| | (0.0192) | (0.0248) | (0.0245) |
| Health Insurance | -0.0158 | -0.0130 | -0.0140 |
| | (0.00991) | (0.0103) | (0.0105) |
| Constant | 9.988 | 19.70*** | 19.70** |
| | (6.942) | (7.241) | (7.431) |
| Observations | 800 | 950 | 1,000 |
| R-squared | 0.815 | 0.854 | 0.860 |
| Number of states | 50 | 50 | 50 |

Robust standard errors in parentheses.

*** p¡0.01, ** p¡0.05, * p¡0.1