Estimating Consumer Price Inflation by Household

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Abstract

Using a new micro-level dataset on individuals' inflation expectations and purchasing behavior, we investigate the relationship between household age and household inflation rate. We find that inflation rates tend to increase with age. Consistent with previous research, we also find that inflation expectations increase with age. However, by distinguishing among the three effects of age, cohort and time, we find that the positive correlation between inflation expectations and age masks a positive correlation between expectations and cohort, with older cohorts having higher inflation expectations. When this effect is controlled for, inflation expectations actually decline with age.

Keywords: Inflation Expectations, Panel Data, Japan

1 Introduction

Since at least the time of Keynes (1936), economic agents' expectations of future inflation rates have played a pivotal role in macroeconomics. Woodford (2005) describes the central importance of inflation expectations to modern macroeconomic models due to the intertemporal nature of economic problems, while Sargent (1982) and Blinder (2000) highlight the dependence of monetary policy on these expectations. However, the formal inclusion of inflation expectations in macroeconomic models is usually ad-hoc with little empirical justification. Recent research suggests that inflation expectations are formed in complicated ways that elude the simplified rules of formal models and are affected by numerous factors. Bryan and Venkatu (2001) document large differences in inflation expectations between men and women while Piazzesi and Schneider (2009) use the Michigan Survey of Consumers to show that old and young households held significantly different expectations of future inflation rates during the late 1970s and argue that this disagreement led to greater borrowing and lending among households. In the case of Japan, Ueno and Namba (2013) find that the age profile of inflation expectations follows an inverted U-shape.

The early literature on the formation of expectations was dominated by the theory of adaptive expectations, in which economic agents use past data on a given variable to form expectations of the variable's future values. This approach to the formation of expectations of economic variables was exemplified by Friedman (1957), but fell out of favor with the rising influence of the Lucas Critique (Lucas (1976)) and rational expectations.

Nevertheless, recent research has revisited the idea that economic agents rely heavily on past data when forming expectations about the future. For example, Malmendier and Nagel (2009) propose that actual inflation rates experienced in the past play an important role in the formation of individuals' future inflation expectations. Using micro data from the Michigan Survey of Consumers, they estimate an adaptive leaning model in the tradition of Marcet and Sargent (1989) with a twist that allows individuals to overweight the inflation data realized in their own lifetimes. They show that differences in experienced inflation rates can predict differences in future inflation expectations.

While the notion that economic agents might overweight data that they have personally experienced has only recently been explored in the discussion of inflation expectations, evidence for such behavior has been documented in other areas. For example, Vissing-Jorgensen (2004) reports that during the stock-market boom of the late 1990s young retails investors with little investment experience displayed the highest expectations for future stock returns. In an experimental setting, Smith et al. (1988) find that asset market bubbles and crashes are less likely when subjects have experienced bubbles and crashes in previous trading sessions and Haruvy et al. (2007) find that inexperienced subjects tend to extrapolate recent price movements. These results suggest the use of adaptive expectations, especially among agents with less experience, in forming future expectations. Furthermore, the results of Greenwood and Nagel (2009) suggest that these results may not be limited to the laboratory. They show that during late 1990s' technology bubble inexperienced mutual fund managers tended to hold the riskiest portfolios and exhibited trend-chasing behavior.

This study seeks to build on previous research on the effect of experience on the formation of future inflation expectations. We combine micro data to investigate whether the variation in inflation expectations across age groups is driven by an age effect or a cohort effect that reflects past experiences. We show that the apparent positive correlation between inflation expectations and age is actually a positive correlation between inflation expectations and cohort (i.e. older cohorts display higher inflation expectations). Once this cohort effect is controlled for, inflation expectations decline with age.

One problem with studies that use data from surveys such as the Michigan Survey of Consumers is that consumers are asked about their views on "prices in general" whereas from a theoretical perspective what is most important is individuals' expectations of the prices that are likely to affect their behavior - namely the prices of goods that they purchase. In contrast to the Michigan Survey of Consumers, the survey used in this study asks respondents about the prices of goods that they commonly purchase.

Furthermore, we use individuals' actual purchasing data over a two-year period to construct age-group inflation rates which can be matched to individuals' views regarding future inflation rates. We find that although there is significant variation in inflation rates actually experienced across age groups, this variation is not enough to explain the variation in inflation expectations.

The remainder of the paper is organized as follows. In section 2 we describe the dataset used and present summary statistics. In section 3 we construct age-group-level price indices and inflation rates and in Section 4 we formally investigate the relationship between inflation expectations and age. Section 5 attempts to separate the effects of age on expectations from the effect of cohort on expectations and Section 6 concludes.

2 Data and Summary Statistics

This first part of this study combines three micro datasets of the same 13000 individuals.[1] The first dataset is a panel survey of consumers' purchase histories.[2] Individuals scan the barcode of every item they purchase using a portable home scanner and record the quantity purchased, purchase price and purchase channel (i.e. supermarket, convenience store, etc.) of purchased items. We use the purchase data for the two-year period covering 2012-2013, containing a total of over 33 million transactions.

The second dataset we employ is a dataset of the same 13000 individuals containing demographic, educational and financial information.[3] In particular, this dataset allows us to identify each individual's age, gender, level of education and income group.

The third and final source of data that we use is a survey about prices and inflation using the same 13000 individuals as above. The survey questions respondents about their perceptions of past prices changes, future price changes and their knowledge of economic and financial matters.

[1] All three datasets were provided by Intage, a Japanese market research firm.
[2] The SCI Survey.
[3] The Intage Profiler Dataset.

Table 1 presents sample statistics of selected key demographic, educational and financial variables used in this study. In contrast to surveys that ask respondents about their perceptions of the changes in prices *generally*, the survey employed in this study asked respondents specifically about the prices of goods that they usually buy. Respondents were asked to indicate the range in which they believed the prices of goods that they usually purchased would change over the next year. The responses from the 2014 survey are presented in Table 2.

As can be observed in Table 2, fewer than 2% of respondents expected to experience deflation in the following year. Although 22% of respondents did not expect any change in the prices of items that they purchase, two-thirds expected inflation of at least 2%, even though the official inflation rate at the time was only 1.5% and had exceeded this level only once (August-September 2008) during the previous 16 years. In fact, 9% of respondents believed that the inflation rate of prices they faced would exceed 10%.

3 Age and Inflation Expectations

Figure 1 uses the same data as Table 2 to plot the distribution of inflation expectations over age using the responses to the survey in 2014. One can observe that the proportion of respondents who believe that there prices will increase by at least 5% increases with age, while the proportion of respondents who believe that there will be deflation decreases with age. While approximately 40% of young respondents believe that they will experience deflation during the next year, only 20% of older respondents believe so. Why should there be such a large difference in the inflation expectations of young people compared to older people?

One possible reason is that people of different ages purchase their goods through different channels and therefore face different prices for the same goods. This difference in prices paid might explain the observed differences in inflation expectations across age.

To investigate this possibility we aggregate the 2012 and 2013 purchase data for 5-year age groups and construct an age-group-specific price level that includes only goods that are common to all age groups' consumption baskets. The price level is calculated as a Tornqvist index with the weight applied to each good set equal to that good's share of the age group's total consumption. Figure 2 presents the results. One can observe that younger individuals face similar prices, but that the price level begins to rise from the 40-45 year-old group onwards.

In order to isolate the effect of price differences from weight differences on the price level across age groups, we calculate an unweighted price index for each age group and plot the results in Figure 3. One can observe that while the same pattern of an increase in the price level can be observed from age 40-45 onwards, the unweighted price level falls until age 40-45. This suggests that older individuals pay the highest prices, on average, for goods in the common basket. The lowest prices are paid by middle-aged individuals, while younger individuals also tend to pay higher prices.

A second possibility for why inflation expectations vary across age groups is that people of different ages consume different baskets and thus experience different rates of inflation. As with the age-group-specific price levels above, we aggregate the purchase data for each age group to construct an age-group-specific inflation rate and plot the results in Figure 4. In addition to the age-group-specific inflation rates, we also plot the mean and median inflation rates for each age group.

While the levels are different, all three measures convey the same pattern. Firstly, the experienced rate of inflation increases with age until age 55-60. Thereafter, there appears to be a slight decline. Secondly, all age groups experienced deflation, ranging from more than 1% for the youngest group to approximately 0.4% for the 55-60 year-old group. Thus, part of the reason that older individuals expect higher rates of inflation may lie in the fact that they experience higher inflation.

4 Empirical Methods and Estimation Results

In order to investigate whether or not the positive correlation between age and inflation expectations remains after we have controlled for the fact that older individuals experience higher rates of inflation, we estimate the following ordered logit model:

$$P(y_i = j|\mathbf{c}, \mathbf{x_i}, \alpha_i) = P(c_{j-1} < y_i^* \leq c_j) = P(c_{j-1} < \text{Age}_i\beta + \mathbf{x_i}\gamma + e_i \leq c_j) \quad (1)$$

The response variable, y_i, is the range in which individual i expects the prices of goods he purchases to change during the following year, as described in Table 2. A value of 1 indicates that the individual expects an inflation rate of more than 10%, while a value of 9 would indicate the expectation of a rate of deflation of at least 10%. Our model assumes that the individual's response depends on a latent variable, y_i^*, which we assume to be the individual's expected inflation rate. This is simplest interpreted as a point estimate, but can, in theory, describe a distribution. The individual's expected inflation rate, in turn, depends on a vector of individual-specific factors and an error term.

Our key focus will be on the impact of the individual's age on his inflation expectations. Since, as we documented above, age and experienced inflation are correlated, we will need to control for the individual's experienced rate of inflation. The results from this exercise are reported in Table 3.

One can observe that the coefficient on age is precisely estimated and is always negative, implying that inflation expectations *increase* with age. Furthermore, the point estimate does not vary much as we add control variables to the model. The positive correlation between age and expected inflation appears to be robust.

A second interesting result is that the estimated coefficient on the individual inflation rate is never statistically significant. This suggests that, once we control for age, individuals' experienced inflation rate over the previous year does not affect their expected inflation rate over the following year.

A third interesting result is that knowledge of or interest in economic matters does appear to affect inflation expectations. The positive estimated coefficients suggest that, on average, those with more knowledge of Abenomics, general economic issues or the

Statistics Bureau's CPI have higher inflation expectations. Once these factors are accounted for, particular knowledge of the BOJ's 2% inflation target does not have a statistically significant effect, although the estimated coefficient is positive.

5 Disentangling Age Effects from Cohort Effects

Thus far we have observed a robust correlation between age and inflation expectations, even controlling for actual experienced inflation. What could account for this persistent correlation? One possibility is that those of the same age have shared historical experiences and what appears to be a correlation between age and inflation expectations might actually be a correlation between shared historical experiences and inflation expectations. In particular, it may be the case that experiences of high inflation affect the inflation expectations of individuals long into the future. Those who have experienced episodes of high inflation may carry with them an upward bias to their inflation expectations throughout their lives. In contrast, young Japanese, who have only ever experienced relatively low rates of inflation may underestimate the potential of higher inflation rates in the future.

Estimating the effects of age, cohort and time in a simple linear additive model is not possible because, by definition, $Age = Cohort + Time$, resulting in multicollinearity. However, McKenzie (2006) suggests a way around this problem by imposing identification restrictions and estimating both the slope and curvature of the age, cohort and time profiles non-parametrically. The inflation expectation of individual i aged a_j in time period t_k is modeled as

$$\pi^e_{ic_{j-k+1}a_jt_k} = \alpha_{c_{j-k+1}} + \beta_{a_j} + \gamma_{t_k} + \varepsilon_{ic_{j-k+1}a_jt_k} \tag{2}$$

where $a_1, ...a_A$ are the age groups into which the sample is divided and $t_1, ...t_T$ are the time periods observed. Thus cohort c_{j-k+1} describes the the individuals aged a_j in time period t_k and the total number of cohorts is give by $C = A + T - 1$. We further assume that the error term in Equation 2 can be separated into an individual fixed effect and an individual time-varying component. In other words,

$$\varepsilon_{ic_{j-k+1}a_jt_k} = \delta_{ic_{j-k+1}} + \eta_{ic_{j-k+1}a_jt_k} \tag{3}$$

with $\delta_{ic_{j-k+1}} \sim iid(0, \sigma_\delta^2)$, $\eta_{ic_{j-k+1}a_jt_k} \sim iid(0, \sigma_\eta^2)$ and $\delta_{ic_{j-k+1}}$ and $\eta_{ic_{j-k+1}a_jt_k}$ independent. McKenzie (2006) eliminates the individual fixed effect by averaging the dependent variable (in this case the household's inflation expectation over the following year) for each cohort in each time period. Thus, the unit of analysis is no longer the individual household, but rather the cohort and the model in equation 2 becomes

$$\bar{\pi}^e_{c_{j-k+1}a_jt_k} = \alpha_{c_{j-k+1}} + \beta_{a_j} + \gamma_{t_k} + \bar{\varepsilon}_{c_{j-k+1}a_jt_k} \tag{4}$$

where

$$\bar{\pi}^e_{c_{j-k+1}a_jt_k} = \frac{1}{n_{c_{j-k+1}t_k}} \sum_{i=1}^{n_{c_{j-k+1}t_k}} \pi^e_{ic_{j-k+1}a_jt_k} \tag{5}$$

and $n_{c_{j-k+1}t_k}$ is the number of individuals in cohort $c_{j-k+1}t_k$. In order to use this approach, observations of multiple cohorts in multiple time periods are required, thus preventing us from applying the strategy to the dataset used above. We thus use the *Consumer Confidence Survey*, a household-level dataset conducted monthly since 2004 by the Cabinet Office of the Japanese government. Households are surveyed for 15 months continuously before being replaced in the survey. Similarly to the survey used above, respondents are asked to provide their expectations for the change in prices of the goods that they usually buy over the following year by selecting the appropriate range. The responses to the March 2014 survey are presented in Table 4. Compared to the sample used earlier in this study, inflation expectations are higher. Table 5 compares demographic data on the two samples.

The first point to notice is that the respondents in the Consumer Confidence Survey (CCS) are older. Since the CCS is aimed at the household head, the sample displays a far greater representation of men than does the Intage data. Since the household income data are not collected in the same way it is difficult to make exact comparisons, but when we adjust the income data for the CCS to be as similar in definition as the Intage data, it appears as though the respondents in the CCS have lower income levels in general.

Thus, it appears as though two samples represent different underlying populations. To check whether or not this might create a bias when the estimate the age, cohort and time effects, we first rerun the model in Equation 1 on the CCS data and report the results in Table 6. During the sampled period, the question regarding inflation expectations changes so that during 2004-2008, the highest possible category that respondents could select what 5% or above and the lowest was -5% or below. In order to use as much of the data as possible, we convert all responses so that they are consistent with the pre-2008 definition.

The first column documents a simple positive correlation between expected inflation and age, as we observed in the Intage data. The dramatic change in the estimated coefficient on age in the second column suggests significant multicollinearity between age and cohort, as we would expect. Nevertheless, we still observe a positive correlation between expected inflation and age. Furthermore, since cohort are defined by year of birth (i.e. cohort = 1950 for those born in 1950), a negative coefficient on cohort suggests that younger cohorts have higher inflation expectations.

Adding in time dummy variables in the third column does slightly increase the estimated coefficients on age and cohort, but the qualitative results remain unchanged. Finally, controlling for household income (column 4) and geography (column 5) has no effect on the estimated coefficients on age and cohort.

One may worry that by not controlling for the actual inflation rate experienced by households we are introducing a bias into our estimates. However, the results from Table 3 suggest that once our variables of interest are included, the actual inflation experienced is uncorrelated with the expected rate of inflation and thus there ought not to be any significant bias.

We proceed to apply the McKenzie (2006) estimation strategy in order to estimate the second derivatives of the the age, cohort and time effects by using the midpoints of the categorical inflation expectations variable as the dependent variable $\pi^e_{ic_{j-k+1}a_jt_k}$. In the case of the highest inflation rate category we use an inflation rate of 6% and in the case of the lowest inflation rate category we use an inflation rate of -6%. The results are presented in Figures 5 through 7.

The graphs plot the estimated second derivatives of the age, cohort and time effects as well as 95% confidence intervals. The second derivatives of both age and cohort fluctuate around zero and suggest that these two effects are linear. On the other hand, the time profile displays much larger volatility with periods of declining effects followed by sharply increasing effects. Given that the age and cohort effects are approximately linear and that the time effects are non-linear, we can rewrite equation 2 in the following way:

$$
\begin{aligned}
\pi^e_{ic_{j-k+1}a_jt_k} &= \alpha \text{Cohort}_{ic} + \beta \text{Age}_{it} + \gamma_{t_k} + \varepsilon_{ic_{j-k+1}a_jt_k} \\
&= \alpha \left(\text{Year}_i - \text{Age}_{it}\right) + \beta \text{Age}_{it} + \gamma_{t_k} + \varepsilon_{ic_{j-k+1}a_jt_k} \\
&= \left(\beta - \alpha\right) \text{Age}_{it} + \alpha \text{Year}_{it} + \gamma_{t_k} + \varepsilon_{ic_{j-k+1}a_jt_k} \qquad (6) \\
& \qquad (7)
\end{aligned}
$$

The results of estimating Equation **??** are reported in Table 7. Columns (1) and (3) include the entire sample, while columns (2) and (4) exclude those cases where respondents said that they expected inflation to be above 5% or below -5%. Columns (3) and (4) also exclude cohorts where there are fewer than 1000 observations. In all cases, one can observe that the estimated coefficient on the age term, which corresponds to $\beta - \alpha$ in Equation 6 is positive and statistically significant, suggesting that the age effect dominates the cohort effect. Furthermore, the estimated coefficient on the year term, which corresponds to α in Equation 6 is also positive and statistically significant. These results suggest that both the age and the cohort effects are positive, but that the age effect is larger than the cohort effect. A positive age effect suggests that inflation expectations increase with age, while a positive cohort effects suggest that younger generations have higher inflation expectations.

6 Conclusion

This study uses a new dataset on inflation expectations, combined with individual-level purchase data and demographic data to construct age-group-level inflation rates. Our results show that the household inflation rate varies across age groups and that inflation rates generally rise with age.

However, even though older individuals experience higher rates of inflation, the difference in inflation rates across age-groups is not sufficient to explain the positive correlation between inflation expectations and age. Even controlling for the household's experienced rate of inflation, we continue to find a statistically significant positive correlation between age and expected inflation rates.

Using the Japanese Consumer Confidence Survey, we investigate whether this positive correlation between age and inflation expectations is due to an age effect or reflects the shared historical inflation experiences of different cohorts. In order to distinguish between these two effects we estimate the time, age and cohort effects on inflation expectations separately. We find that, since 2004, the age effect has been positive (i.e. inflation expectations rise with age), while the cohort effect has also been positive (older cohort have lower inflation expectations).

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7 Tables

Table 1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.
Age	47.36	11.886	17	69
Male	0.518	0.5	0	1
Married	0.687	0.464	0	1
Completed High School	0.259	0.438	0	1
Completed Technical High School	0.036	0.187	0	1
Completed Technical College	0.12	0.325	0	1
Completed Junior College	0.119	0.324	0	1
Completed College	0.397	0.489	0	1
Completed Graduate School	0.043	0.202	0	1
Regular Employee	0.391	0.488	0	1
Self Employed/Owner	0.074	0.262	0	1
Contract Employee	0.072	0.259	0	1
Other Employee	0.03	0.17	0	1
Part Time/Arubaito	0.155	0.362	0	1
Stay-At-Home	0.176	0.381	0	1
Student	0.012	0.11	0	1
Unemployed	0.09	0.286	0	1
Household Income < ¥4 Million	0.301	0.459	0	1
Household Income ¥4 Million-¥5.5 Million	0.203	0.402	0	1
Household Income ¥5.5 Million-¥7 Million	0.162	0.369	0	1
Household Income ¥7 Million-9 Million	0.158	0.365	0	1
Household Income > ¥9 Million	0.174	0.379	0	1
N		13384		

Table 2: Inflation Expectations

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
> 10%	0.09	0.287	0	1
5% to 10%	0.278	0.448	0	1
2% to 5%	0.298	0.457	0	1
0% to 2%	0.087	0.282	0	1
Approximately 0%	0.22	0.414	0	1
-2% to 0%	0.012	0.108	0	1
-5% to -2%	0.01	0.098	0	1
10% to -5%	0.003	0.054	0	1
< -10%	0.003	0.051	0	1
N		13384		

Table 3: Ordered Logit: Inflation Expectations and Age

	(1)	(2)	(3)	(4)
Age	-0.024***	-0.024***	-0.024***	-0.020***
	(0.001)	(0.001)	(0.002)	(0.002)
Individual Inflation Rate		-0.003	-0.004	-0.003
		(0.004)	(0.004)	(0.004)
Male			0.117**	0.224***
			(0.045)	(0.046)
Married			-0.054	-0.049
			(0.040)	(0.040)
Knows About Abenomics				0.129***
				(0.034)
Interested In Econ. Issues				0.057***
				(0.017)
Interested In CPI				0.174***
				(0.027)
Knows About BOJ Infl. Target				0.022
				(0.027)
Occupation Dummies	No	No	Yes	Yes
Education Dummies	No	No	Yes	Yes
Income Group Dummies	No	No	Yes	Yes
Observations	13384	13384	13384	13384
Pseudo R^2	0.008	0.008	0.010	0.015

Robust standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: Inflation Expectations (Consumer Confidence Survey)

Variable	Mean	Std. Dev.	Min.	Max.
> 10%	0.057	0.231	0	1
5% to 10%	0.261	0.439	0	1
2% to 5%	0.46	0.498	0	1
0% to 2%	0.132	0.338	0	1
Approximately 0%	0.046	0.209	0	1
-2% to 0%	0.018	0.135	0	1
-5% to -2%	0.018	0.131	0	1
10% to -5%	0.006	0.079	0	1
< -10%	0.003	0.052	0	1
N		5515		

Table 5: Demographic Comparisons

	CCS		Intage Survey	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Age	61.373	14.634	47.36	11.886
Male	0.782	0.413	0.518	0.5
Household Inc. < ¥4 Mil	0.578	0.494	0.301	0.459
Household Inc. ¥-¥5.5 Mil	0.142	0.349	0.203	0.402
Household Inc. ¥5.5-¥7.5 Mil (¥5.5-¥7 Mil)	0.135	0.342	0.162	0.369
Household Inc. ¥7.5-¥9.5 Mil (¥7-¥9 Mil)	0.07	0.255	0.158	0.365
Household Inc. > ¥9.5 Mil (> ¥9 Mil)	0.075	0.263	0.174	0.379
N	5674		13384	

Numbers in parentheses indicate income range for Intage Survey

Table 6: Ordered Logit: Inflation Expectations and Age (CCS)

	(1)	(2)	(3)	(4)	(5)
Household Head Age	-0.012***	-0.293***	-0.270***	-0.268***	-0.269***
	(0.000)	(0.001)	(0.003)	(0.003)	(0.003)
Cohort		-0.287***	-0.264***	-0.264***	-0.264***
		(0.001)	(0.003)	(0.003)	(0.003)
Male				0.070***	0.072***
				(0.006)	(0.006)
Time Dummies	No	No	Yes	Yes	Yes
Income Dummies	No	No	No	Yes	Yes
Area Dummies	No	No	No	No	Yes
Observations	676949	676949	676949	676579	676579
Pseudo R^2	0.003	0.076	0.093	0.093	0.094

Robust standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: Expected Inflation: Cohort vs. Age

	Full Sample		Without Small Sample Size Cohorts	
	Baseline Model	Without High and Low Inflation	Baseline Model	Without High and Low Inflation
	(1)	(2)	(3)	(4)
Age	0.008***	0.002***	0.008***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Year	0.305***	0.241***	0.306***	0.242***
	(0.004)	(0.003)	(0.004)	(0.003)
Observations	696844	600688	690142	594934
R^2	0.219	0.274	0.220	0.274

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Time dummy variables are included in all models.

Robust standard errors report in brackets

8 Figures

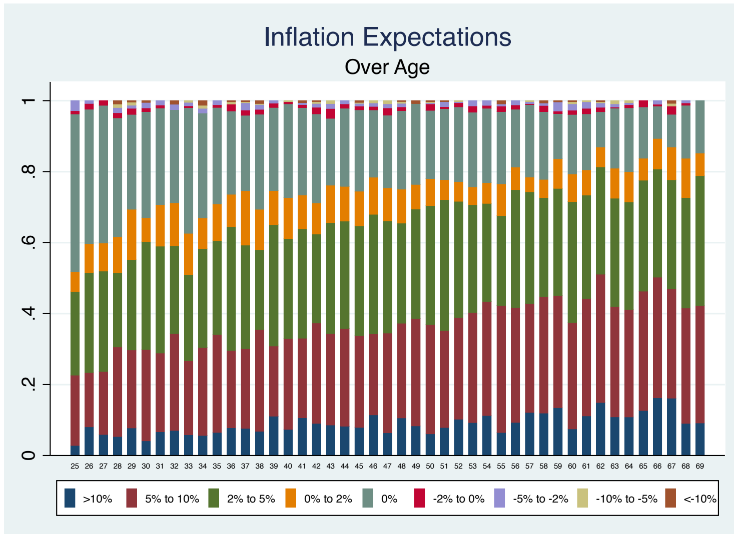

Figure 1: Distribution of Inflation Expectations Over Age

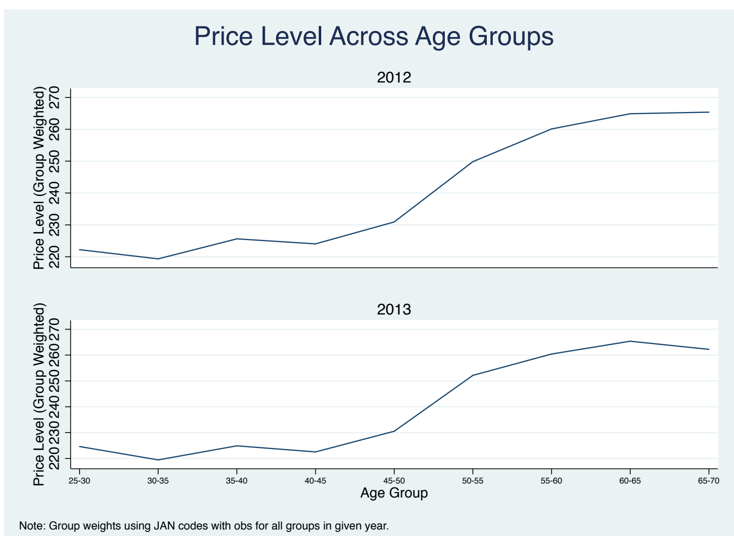

Figure 2: Weighted Price Level Of Common Basket

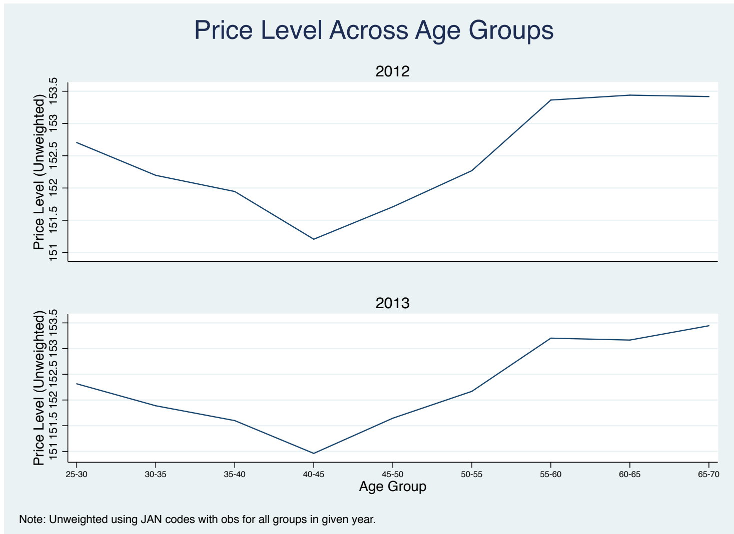

Figure 3: Unweighted Price Level Of Common Basket

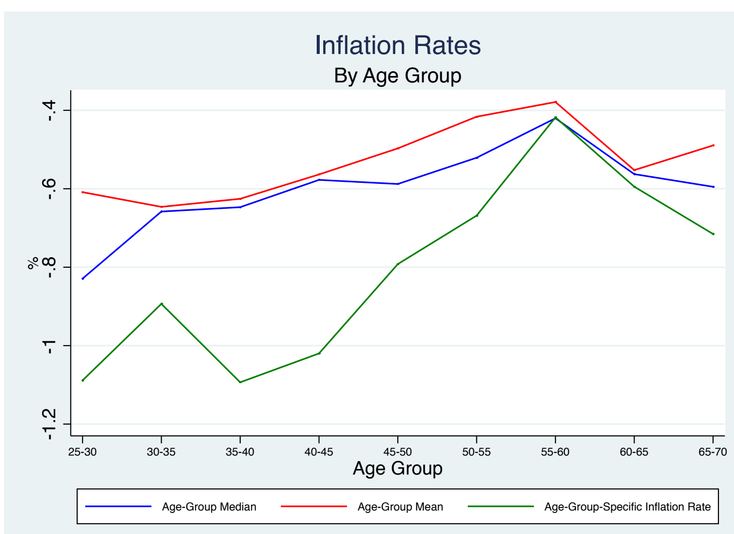

Figure 4: Inflation Rate by Age Group

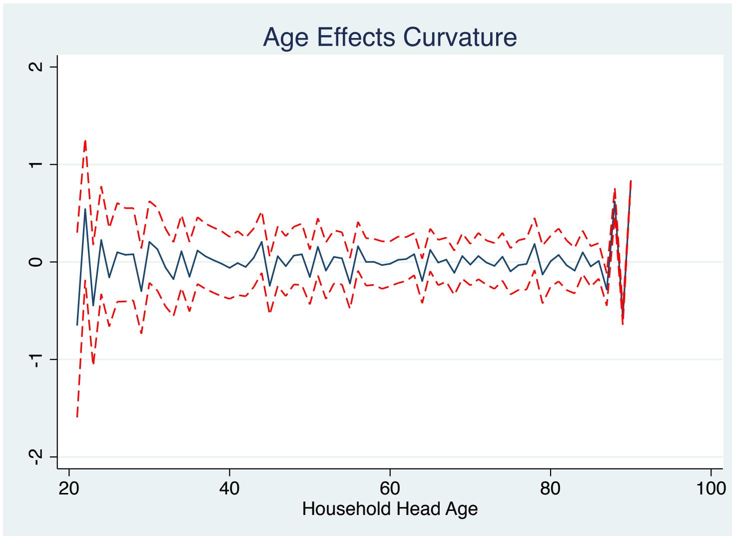

Figure 5: Age Effects

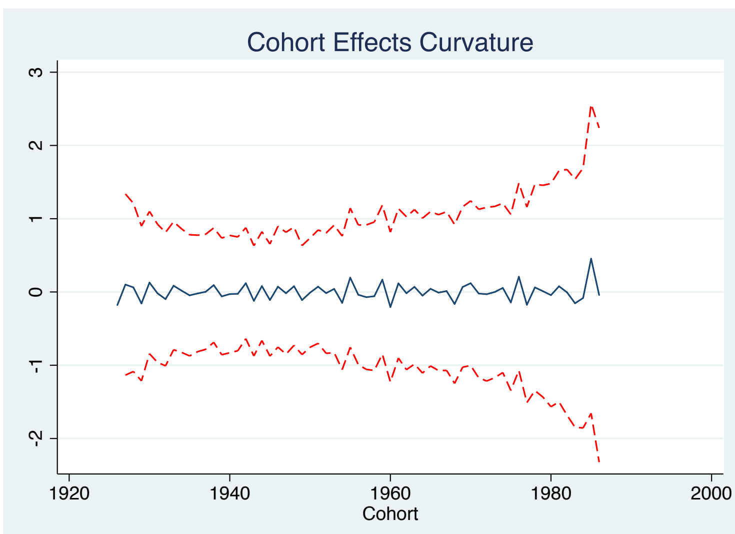

Figure 6: Cohort Effects

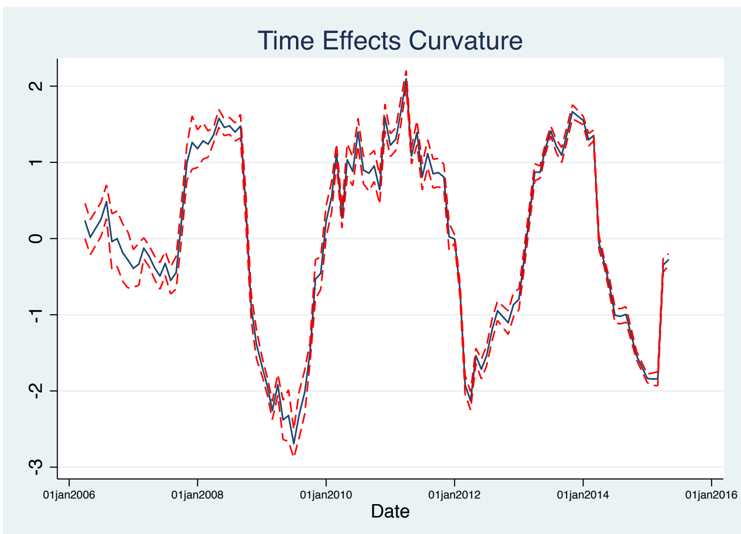

Figure 7: Time Effects