Inflation expectations of savers and borrowers*

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October 1, 2025

Abstract

Households' inflation expectations depend on their financial conditions, even after controlling demographic factors and expectations about the economic outlook. Specifically, savers report higher inflation expectations than borrowers. We establish these regularities using individual level data from the NY Fed's Survey of Consumer Expectations, the Public Policy Survey and the Household Finance Survey. We make sense of these findings in a life-cycle model in which ambiguity-averse agents are borrowers and savers at different points in their lives. The wedge in expectations naturally arises as high inflation corresponds to the worst-case scenario for savers, while the opposite is true for borrowers.

1 Introduction

The macroeconomic literature has studied the inflation expectations of households extensively (see Weber et al., 2022, for a recent review) and established some key stylized facts. One is that they are, on average, biased upwards. Moreover, they display significant dispersion. Our paper shows that some of this dispersion can be traced back to households' asset positions: the inflation expectations of savers and borrowers differ significantly and persistently. Savers report, on average, higher inflation expectations than borrowers, even

*We are grateful to Jonas Dovern, Gaetano Gaballo, Laura Gati and Sophocles Mavroeidis for helpful suggestions and discussions. We also thank participants at the seminars and conferences held at the Friedrich Alexander University in Nurnberg, University of Padova, HEC, the European Central Bank, the University of Alicante and KULeuven for insightful comments. Giovanni Signorini provided excellent research assistance for this paper.

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after controlling for individual characteristics. This can be explained by noting that inflation is costlier for savers than it is for borrowers: savings in nominal assets are eroded by high inflation (Doepke and Schneider, 2006), while the real value of a borrower's nominal debt is reduced by inflation.

We formalize this idea by showing that ambiguity-averse (Epstein and Schneider, 2003) savers act based on inflation expectations that are high relative to the rational-expectations benchmark, while the opposite is true for borrowers. We illustrate this point in a simple overlapping-generations (OLG) model in which agents live for three periods: young agents (first period) need to borrow to finance their consumption, in the second period agents work, repay the debt they accumulated, and save for when they retire in the third period. Low expected inflation increases the real value of the loans the young will have to repay next period. Conversely, the concern of the middle-aged is that inflation will erode the value of their retirement plan.

This model captures in very simple terms a "life-cycle" motivation for saving and borrowing, and ties nicely with our empirical proxies for savers and borrowers. At an empirical level, the main challenge of our analysis is to identify savers and borrowers in the data. We do so by merging various surveys administered by the Federal Reserve Bank of New York. In particular, the Public Policy Survey provides valuable information on how household welfare would respond to various hypothetical economic scenarios that relate to the saver or borrower status of a responder. This survey, which is fielded every 4 months, asks the same respondents of the monthly Survey of Consumer Expectations for their expectations about a number of economic policies – including changes in the capital gains tax rate, in the mortgage interest rate tax deduction and in student loans forgiveness. It complements this with questions that inquire how their families would be impacted by these expected changes. The combination of factual and hypothetical questions allows us to classify responders as savers or borrowers. For example, an individual saying that an increase in mortgage interest rate tax deductions will make him better off is plausibly a borrower. Similarly, a respondent reporting that an increase in capital gain taxes will affect her family negatively is classified as having savings. There are several important things to note about this classification. First, the categories are not mutually exclusive, and we are able to identify respondents that have *both* savings and loans. Second, answers to these hypothetical questions not only give us an indication of the assets and liabilities of the responders, they also inform us that they are aware of the effects of such events on their welfare. Importantly, these hypothetical macroeconomic scenarios mitigate the risk of reverse-causation. The expectations of changes in capital-gains taxes are unlikely to be caused by one's inflation expectation.

These questions allow us to peer into the economic thinking of the respondents and are a good proxy for their gross financial position. The Survey of Household Finance (HF), which is only available once a year for a shorter sample, complements our proxies and tells us whether the household in question has a mortgage or what percentage of their savings

is invested in stocks or bonds. For the years where both surveys are available, we confirm the validity of our proxies for being a borrower and a saver matching them with the actual responses from the HF survey. Our results are also robust to the inclusion of these variables directly, as well as to controlling for financial literacy and demographic features. There are around 23% of the respondents who appear to either open or extinguish a mortgage/student loan or invest or divest in stocks in our sample. This number is in line with the evidence from another New York Fed Survey, namely the Credit Access survey, and gives us enough variation to run two-way panel regressions. Our key findings hold even when we include an individual fixed effect that captures individual characteristics above and beyond any individual control we include in our specifications.

The empirical proxies for the borrower/saver status we have discussed so far mostly relate to a "life-cycle" motivation for borrowing/saving, such as getting a student loan or saving for retirement. Another common motivation for saving has to do with uninsurable individual risk, *i.e.* the risk of losing one's job or, more generally, experiencing a decrease in income (Carroll (1997),Carroll et al. (2019)). Using data from the Survey of Consumer Expectations (SCE), we find that respondents who expect to be worse off or experience a high unemployment risk tend to report higher inflation expectations. These findings are consistent with our claim that savers have, on average, higher inflation expectations, though we cannot give these coefficients a causal interpretation: it could be that savers expect to be worse off financially precisely because they expect high inflation to eat into their wealth. Nonetheless, these variables are important individual controls. Also, they suggest a possible interpretation to the households' stagflationary view of inflation, *i.e.*, the finding highlighted, for example, by Coibion et al. (2019) and Candia et al. (2023) that households tend to associate high inflation expectations to periods of high unemployment. At an aggregate level this pattern could be explained with the idea that households somehow expect supply shocks to be more prevalent. Our results suggest a different or additional interpretation, as we establish that this relationship holds at the individual level in the form of a positive association between expectations of an increased unemployment risk and the expectation of high inflation. In our OLG model with ambiguity-averse agents, any recessionary shock will tend to push up on inflation expectations, other things the same, in the measure to which it increases the risk of unemployment. Heightened unemployment risk prompts economic agents to increase their saving buffer. So long as they save, at least in part, in nominal assets, this will make inflation costly and is thus natural that their worst-case scenario is one of high inflation.

Related Literature. We contribute to the body of work that studies how inflation expectations differ across households depending on individual characteristics. For example Bruine de Bruin et al. (2010) and Binder (2015) find that more educated and wealthy respondents tend to display a smaller upward bias. Malmendier and Nagel (2015) show that older respondents have higher inflation expectations, with cohort effects relating to the ex-

periences the respondents had in their formative years – i.e. the high-inflation period in the 1970s for the older generation. Coibion and Gorodnichenko (2015) have advanced the idea that household subjective inflation expectations might be driven by prices of particularly salient goods, like gasoline. D´Acunto et al. (2021) use data from the Nielsen Consumer Panel and find that the inflation agents have observed in their own grocery bundles is indeed correlated with their expectations about future inflation.

Our finding also speak to the observed countercyclicality (or stagflationary behavior) of household inflation expectations. Many studies have found a positive correlation between unemployment expectations and subjective inflation expectations (e.g. see Coibion et al. (2023) and Bhandari et al. (2023)). This finding, which Coibion et al. (2019) refer to as "stagflationary" expectations, is at odds with a standard Phillips curve and a relevant role for demand shocks, which imply a negative realtionship between inflation and unemployment. It can, however, be rationalized if we consider that agents will tend to increase their saving buffer when they expect a deterioration in the economic outlook.

Our use of surveys combines questions eliciting plain expectations about the future with more hypothetical questions inquiring about *what ifs?*, e.g. what if mortgage interest rate deductions were to rise? This relates to recent papers by Andre et al. (2022), Binetti et al. (2024), Stantcheva (2024), that go beyond the use of survey to infer expectations but inquire about the economic agents' understanding of the working of the economy and their preferences. In this sense, our analysis also relates to recent work by Michelacci and Paciello (2024), who provide evidence that expectations are related to agents' preferences over outcomes. Michelacci and Paciello (2024) use data from the UK's Bank of England's Survey of Inflation Attitudes, which asks respondents about preferences of outcome as well as expectations and find that households who dislike inflation have higher expected inflation than households who like inflation. Relative to Michelacci and Paciello (2024) we do not have information about a responder's preferences regarding monetary policy, but can exploit the panel structure of the data to control for any observed individual characteristics.

Our model relates to the literature on the effects of ambiguity aversion (see Ilut and Schneider, 2023, for a review). In previous work (Masolo and Monti, 2021) we have shown that ambiguity about monetary policy can generate a positive bias in inflation expectations and that the bias is larger for patient agents, who are savers in equilibrium. In this paper we establish that this insight is not restricted to ambiguity about monetary policy: it holds in the data irrespective of the monetary policy stance and can be rationalized in a life-cycle model of saving and borrowing. In particular, the same economic agent will typically be a borrower, and thus expect relatively low inflation, when young, and become a saver, who has higher inflation expectations, over the course of her life. This echoes the findings of Malmendier and Nagel (2015) and suggests that observed differences in inflation expectations across age groups are not only the result of different experiences – we control for age – but the inherently different objectives of economic agents at different points in their lifecycle.

The next section presents the various surveys we exploit in our empirical analysis, which is reported in Section 3. Section 4 describes the model in detail.

2 The data

The backbone of our analysis is the SCE survey, which collects expectations from a rotating panel of household heads. Along with the main SCE survey, the New York Fed administers some special survey modules that cover topics such as housing, labor market conditions, housing, public policy, and credit access. From 2014 to 2019 it also collected, once a year, very detailed information about households' financial situation: their total wealth, their liabilities, a breakdown of their assets in different categories. We exploit the Public Policy Survey and the Household Finance to recover granular information about the individual respondents' financial situation, by merging them with the SCE and imputing the latest available responses to lower-frequency surveys so that we can work at monthly frequency.[1]

Survey of Consumer Expectations. The SCE (see Armantier et al., 2017, for an overview) is a monthly nationally-representative survey of roughly 1300 households, which gathers information about consumer expectations of inflation – point forecast and probabilistic forecasts – at different horizons. Launched in June 2013, it is administered online and respondents participate in the panel for up to twelve months, with an approximately equal number rotating in and out each month. Our sample spans the period from June 2013 to May 2023[2] with one year and includes 154,582 individual observations.

The survey includes questions on respondents' expectations about their own economic situation in the future and about their views on the economy. In our empirical specification we use information concerning: their current employment status; the risk of becoming unemployed in the next 12 months; expectations about a household's own income over the next 12 months; households' expectations of whether they will be financially better or worse off in the next 12 months; the probability that stock prices will rise in the next 12 months; the probability that the unemployment rate will increase in the next 12 months; the probability that US interest rates will go up in the next 12 months. We also use the detailed demographic information reported in the survey, which includes respondents' education, income, age, and state of residence. This enables us to control for demographic characteristics that are known to correlate with inflation expectations. The survey also assesses the respondents' level of financial literacy by asking five questions of varying level of difficulty. We focus on the following one, which requires understanding percentages and compounding, to discriminate between respondents with low vs. high financial literacy.

[1] The rationale for this is that while inflation expectations can and do vary from month to month, the households' financial situation – e.g. if they have a mortgage or own stocks – is unlikely to change several times within the 4 month period considered.

[2] The data is made available on the New York Fed's website with one year's delay.

Let's say you have $200 in a savings account. The account earns ten per cent interest per year. Interest accrues at each anniversary of the account. If you never withdraw money or interest payments, how much will you have in the account at the end of two years?

	All respondents	Trimmed	Financially literate
Mean	6.2	5.9	4.4
Std	48.1	9.4	6.2
Min	-100	-25	-25
25%	2	2	2
50%	3	3.2	3
75%	7	7	5
Max	11200	60	60
Obs	154,582	151,830	78,702
Sample	2013M6 - 2023M5		

Table 1. Summary statistics for $\mathbb{E}_t^j \pi_{t,t+12}$, inflation expectations over the next 12 months. This table reports the mean, variance, extreme values and quartiles for one-year ahead inflation expectations for the whole sample (column 1), the trimmed sample obtained dropping the observations in the first and 99th quantiles (column 2), the financially literate sample (column 3).

In our sample, 50.9% of the observations are associated with individuals that have high financial literacy, *i.e.* individuals who are able to answer correctly to the question above. Table 1 reports some summary statistics for inflation expectations over the next 12 months: the first column refers to all the respondents, the second column reports the statistic when the first and the 99^{th} percentile of the responses – the most extreme outliers – are dropped from the sample, while the third column reports the statistics only for the subsample respondents with high financial literacy.

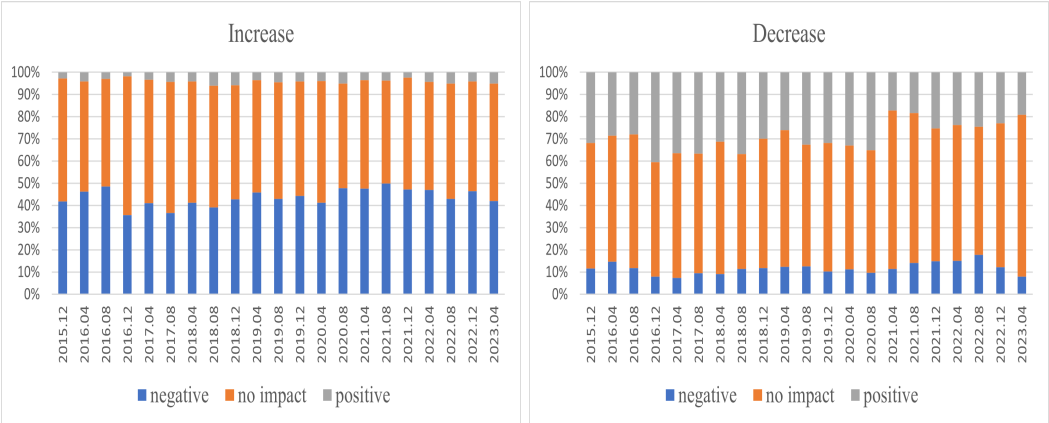
Survey of Household Finance. The survey of Household Finance (HF), fielded yearly between 2014 and 2019, collected very detailed information on the households' financial situation and the composition of their assets and liabilities. For example, from it we gather whether a household has a mortgage and what share of their savings is in a checking account, in TBills, in bonds or in stocks. It also provides information on the size of the mortgage as well as the households' evaluation of the value of their home, if they own one. The annual frequency means that, when we merge it with the SCE, we cannot exploit the panel dimension of the inflation expectations data.

Public Policy Survey. The Public Policy Survey started in November 2015 and is fielded every four months as a rotating module of the Survey of Consumer Expectations (SCE). It asks households their expectations about the direction of change of different public policies

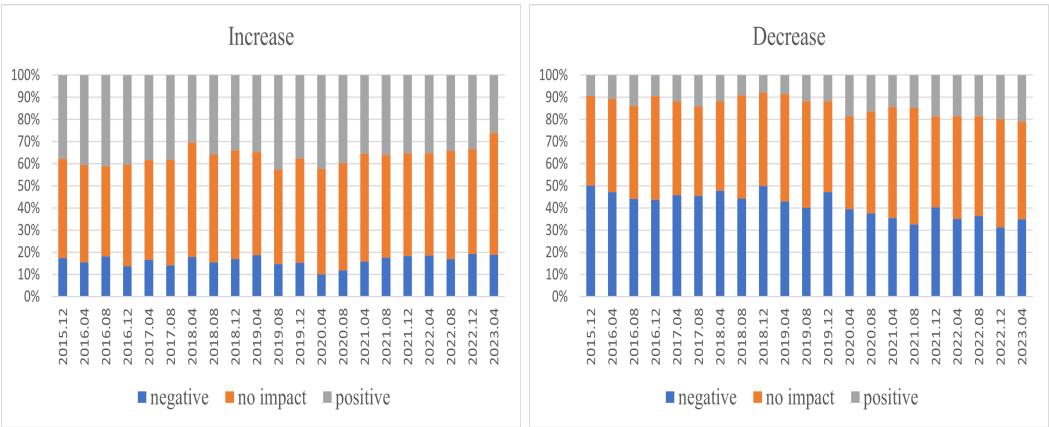
in the next 12 months, including the capital gain tax rate, the mortgage interest tax deduction and the level of student debt forgiveness. The respondents are then asked how the expected increase/decrease in that policy will affect their household. We use these answers, summarized in Figure 1, as proxies for the households holding assets, having a mortgage and/or student debt according to the following criteria:

- If a respondent answers that an increase (decrease) in the mortgage interest tax deduction will impact their household positively (negatively), then we infer that this household has a mortgage. 38.3% of the responses are from people who have a mortgage, 42.1% of the financially literate.
- If a respondent answers that an increase (decrease) in the student debt forgiveness will impact their household positively (negatively), then we infer that this household has student loans. 20.1% of the responses are from people who have assets, 19.4% when we only focus on the financially literate.
- If a responder answers that an increase (decrease) in the capital gains tax rate will impact their household negatively (positively), then we infer that this household owns stocks. 38.2% of the overall responses are from people who have assets, 42.2% when we only focus on the highly financially literate.

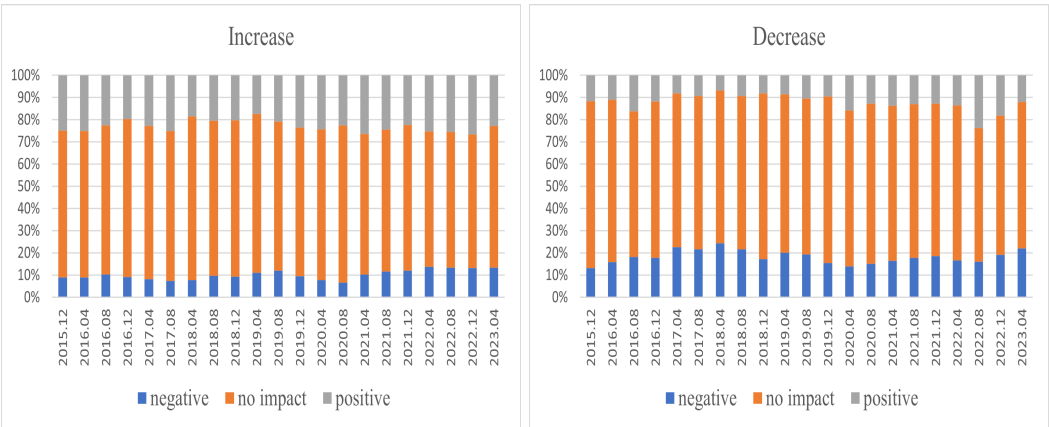
We label people with stocks as savers and people with a mortgage and/or a student loan as borrowers. Considering the respondents that have a mortgage and/or a student loan jointly, we classify 49.1% of the responses as coming from borrowers (51.1% among financially literate). Obviously these represent gross asset positions. People can have assets and debt at the same time, and therefore be, at the same time, savers and borrowers. Among respondents that we identify as savers – i.e. those who would be affected by changes in the capital gain tax rate – there are 50.3% who are also borrowers: 42.4% are affected by changes in the mortgage interest rate tax deduction, 15.6% by changes in the degree of student debt forgiveness, and, among these groups, some will be affected by both. Importantly, we observe some changes in these characteristics at the individual level, i.e. some survey participants change their status as borrowers/savers. There are 23% of the respondents who change status in our sample – meaning that the might take on or extinguish a mortgage and/or invest or divest in stocks – and the average frequency of switching is once during the survey period. This variation is enough to enable us to estimate two-way panel regressions, in which a time fixed effect controls for the macro environment and individual fixed effects account for unobserved individual characteristics. It is also in line with findings from the Credit Access Survey of the New York Fed, which, among other questions, asks respondents if they have taken up a mortgage in the past 12 months or if they plan to take one up in the next 12 months: 8% of the respondents have done so in the last year and another 9% plan to do so in the next year.



(a) Capital Gains Tax Rate



(b) Mortgage Interest Tax Deduction



(c) Student Debt Forgiveness

Figure 1. Household impact for expected policy change, conditional on an increase (left panel) or decrease (right panel) (a) the capital gain tax rate, (b) the mortgage interest rate tax deduction and (c) student debt forgiveness.

In the years for which we have both the Public Policy Survey and the Household Finance survey, we can validate these proxies with direct answers on having a mortgage (17459 responses) and having savings in shares (14779 responses overall). In particular, we find that 70% of respondents who indicate they have a mortgage in the HF survey would be flagged as having a mortgage by the proxy, while 81% of those identified as mortgagers by the proxy declare having a mortage in the HF survey. [3] Similar results are found for people that declare having some savings in shares in the HF survey, 58% of whom are flagged as savers by the 'saver proxy.' This percentage grows with the amount of savings, so that 72% (87%) of people with a with \$200k (\$ 1mln) in savings are identified as savers by the 'saver proxy.' If we focus on those who are flagged as having stocks by the proxy, we find that the share of savings held in stock doubles with respect to the overall number of respondents to the HF survey.

3 Empirical Analysis

Our baseline regression specification is as follows:

$$\mathbb{E}_t^j \pi_{t,t+12} = \mu_j + \mu_t + \underline{x}'_{j,t}\underline{\beta} + \varepsilon_{j,t} \tag{1}$$

where the dependent variable is $\mathbb{E}_t^j \pi_{t,t+12}$, an individual's expectation of inflation for the next 12 months, and $\underline{x}_{j,t}$ is a vector of regressors comprising controls such as responders' subjective risk of being unemployed in the next 12 months, their income expectations for the same period, and an indicator variable for whether they expect to be worse off in the next year. It also includes respondents' expectations about the state of the economy – namely the probability they assign to unemployment, stocks and interest rates going up – and the following demographic variables, which are added to the regression when we do not include individual fixed effects: age, income bracket, education level and employment status. μ_t is a time fixed-effect, which we always include to capture changes in the macroeconomic landscape, and μ_j an individual fixed effect that we include in some of our specifications – as reported in the tables below.

In our baseline specification, we will use the trimmed sample for inflation expectations, i.e. the one that excludes the observations in the 1^{st} and 99^{th} percentile (see Table 1 for details about the inflation expectations data). The first and second columns of Table 2 report the results of regression (1) that include as regressors individual demographic characteristics and fixed time effects, including or excluding as a control the individuals' perception of their own unemployment risk, a variable relevant for our analysis, but which affects the sample

[3] We also estimated a pooled probit model in which we estimate the probability of an agent reporting she is a mortgagor, given our proxies based on her responses regarding the impact mortgage interest tax deductions and capital gains taxes. The results of this regression imply that a responder we identify as borrower in light of our MIDTBorrower Proxy is 37 percent more likely to have a mortgage. One we identify as saver is some 8 percent less likely to have a mortgage.

Dependent variable: $\mathbb{E}_t^j \pi_{t,t+12}$		(1)	(2)	(3)	(4)
	unemp. risk		0.013***	0.005	0.006**
			(0.003)	(0.004)	(0.003)
	income expectations	-2.2e^{-6}**	0.003**	0.001*	0.0008
		(8.6e^{-7})	(0.0014)	(0.0007)	(0.0006)
	worse off	1.48***	1.19***	0.84***	0.76***
		(0.12)	(0.16)	(0.16)	(0.15)
	unemployment up	0.066***	0.057***	0.038***	0.017***
		(0.002)	(0.002)	(0.003)	(0.002)
Economic	stocks up	-0.02***	-0.02***	0.016***	0.001
Controls		(0.002)	(0.002)	(0.003)	(0.003)
	interest rate up	0.003	-0.002	0.006***	0.001
		(0.002)	(0.002)	(0.002)	(0.002)
Individual	full time	-0.70***	-0.49***	-0.14	-0.88**
Controls		(0.11)	(0.17)	(0.39)	(0.38)
	Other individual characteristics	Yes	Yes		
	Fixed effects	Time	Time	Time	Time
				Entity	Entity
	Sample	Trimmed	Trimmed	Trimmed	Fin. literate
	Observations	148745	88511	89295	47332

Table 2. Regression results using only SCE data. This table collects the results of regressing $\mathbb{E}_t^j \pi_{t,t+12}$ on variable in the SCE that relate to people's propensity to save – expecting to be worse off, unemployment risk and own income expectations – along with various controls for expectations about the state of the economy, time fixed effects and either controls for the individual characteristics (columns 1 and 2) or individual fixed effects (column 3 and 4) for the full sample and the sample that only includes financially literate respondents. White's heteroschedasticity robust estimator is used to obtain the parameter standard errors that appear in parentheses. Asterisks denote significance at the 10% (*), 5% (**), and 1% (***) levels.

size substantially. The results for the regression with both time and entity fixed effects are reported in the third and fourth column, for the baseline sample in column (3) and the financially literate only in column (4).

There is a positive strongly significant correlation between inflation expectations and expectations for overall unemployment, even after controlling for time and individual fixed effects, confirming the findings in Coibion et al. (2019) and Bhandari et al. (2023). There is also a largely significant positive correlation between one-year ahead inflation expectations and the respondents' perception of their individual unemployment risk. In this sense the "stagflationary" view of inflation has an important individual dimension to it. These results hold in the full sample as well as when considering only the respondents with high financial literacy. It is possible to make sense of this result if one considers that unemployment risk increases a person's desire to save. If there is ambiguity about expected inflation and the respondents are ambiguity averse, then their expectations will reflect the scenario with

respect to which they want to be robust, which, in the case of savers, is higher inflation, as in the model in Section 4.

Dependent variable: $\mathbb{E}_t^j \pi_{t,t+12}$		(1)	(2)	(3)	(4)	(5)
	borrower	-0.30***	-0.18*	-0.35**		
		(0.08)	(0.10)	(0.16)		
	mortgagor				-0.23*	-.23
					(0.14)	(0.17)
	student loans				-0.008	-0.01
					(0.20)	(0.25)
	saver	0.25***	0.28***	0.52**	0.28*	0.51**
		(0.08)	(0.10)	(0.22)	(0.15)	(0.22)
	worse off	1.62***	1.49***	0.87***	0.96***	0.87***
		(0.13)	(0.16)	(0.17)	(0.15)	(0.17)
Own	income	$-5.5e^{-7}$	0.008**	0.004	$-2.2e^{-6}$***	0.004
situation	expectations	$(3.6e^{-7})$	(0.003)	(0.003)	$(7.3e^{-7})$	(0.003)
	unemp. risk		0.009***	0.003		0.003
			(0.003)	(0.004)		(0.004)
	unemp rate ↑	0.03***	0.03***	0.02***	0.02***	0.02***
		(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Economic	stocks ↑	-0.02***	-0.03***	-0.005*	-0.004*	-0.005*
outlook		(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
	interest rate ↑	-0.01***	-0.01***	0.004**	0.004	0.003
		(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Indiv.	full time (FT)	0.04	-0.11	-0.65*	0.19	-0.65**
Controls		(0.13)	(0.20)	(0.35)	(0.30)	(0.35)
	Other characteristics	Yes	Yes	No	No	No
	Fixed effects	Time	Time	Time Entity	Time Entity	Time Entity
	Observations	46444	28193	28460	47011	28460

Table 3. Regression results using SCE data plus proxies from the Public Policy Survey. This table collects the results of regressing $\mathbb{E}_t^j \pi_{t,t+12}$ of the financially literate respondents on all regressors from the previous regressions plus the proxies for borrower and saver status extracted from the Public Policy Survey. White's heteroschedasticity robust estimator is used to obtain the parameter standard errors that appear in parentheses. Asterisks denote significance at the 10% (*), 5% (**), and 1% (***) levels.

Similarly, one could argue that the same logic applies to agents reporting that they expect to be worse off going forward. Indeed, there is a positive connection between the expectation of being worse off and inflation expectations. This is bound to be a two-way relationship, though. An economic agent with nominal assets in her portfolio could reasonably expect to be worse off as a consequence of her expectation of high inflation, which will reduce the real value of its portfolio. We can however exploit the answers to the Public Policy Survey to

disentangle the two effects, because expectations of changes in tax policies and their effects on the household at the aggregate level are not endogenous to individual one-year ahead inflation expectations. We report results from specifications that include them in Table 3.

As discussed in the previous section, we identify as savers respondents who indicate that their household will be negatively (positively) affected by an expected increase (decrease) in the capital gains tax rate. Similarly we identify as borrowers respondents who indicate that i) an expected increase (decrease) in the mortgage interest tax deduction affects their household positively (negatively) and/or ii) that an expected increase (decrease) in student debt forgiveness affects their household positively (negatively). Households can have both borrower and saver status at the same time and we can account separately for the effect of either of these characteristics. Table 3 report the result of regression (1) for inflation expectations of financially literate individuals[4] when we add these indicators of borrower and/or saver status to all the regressors we considered in Table 2. Having a mortage and/or student debt (borrower row in Table 3) leads to lower one-year-ahead inflation expectations while having stocks (saver row in Table 3) is associated with higher inflation expectations. This is true regardless of the sample considered, both when accounting for time fixed effects only and when considering both time and entity fixed effects. The significance of the effect of having loans decreases when considering separately the two types of borrowing (having a mortgage and/or student debt), but it remains the case that savers display significantly higher inflation expectations than the rest of the population, including borrowers.

The wedge between the inflation expectations of savers and borrowers is robust to including data on the financial situation of the respondents collected in the Household Finance Survey, specifically: the portion of savings that is sensitive to inflation (namely, in a checkings account, in T-Bills or in bonds); the portion of savings in stocks; whether the household has a mortgage or not; and whether the household has negative housing wealth, i.e. expected house price lower than the value of the mortgage. The annual nature of the survey prevents us from including individual fixed-effects in these regressions. We report these results in Table 4. Mortgagors report significantly lower inflation expectations. The one puzzling find is that households with a negative housing wealth appear to report higher-than-average inflation expectations. That applies only to respondents with low levels of financial literacy, which leads to believe it may relate to an under-appreciation of the effect of inflation on the real value of mortgage payments. When we restrict the attention to the financially literate this puzzling finding disappears.

[4]We focus on the financially literate to highlight that the findings are not driven by a lack of basic financial literacy. In Table A.1 in the Online Appendix we show the results for the sample that includes all the observations for inflation expectations other than those in the 1st and 99th percentiles, which are even stronger than for the financially literate respondents.

Dependent variable: $\mathbb{E}_t^j \pi_{t,t+12}$		(1)	(2)	(3)	(4)
	mortgage		-0.71***		-0.32***
			(0.15)		(0.12)
	no mortgage	0.70***		0.32***	
		(0.15)		(0.12)	
	negative housing wealth		1.88***		-0.28
			(0.37)		(0.24)
	inflation sensitive assets (share)	-0.003	-0.003	-0.007	-0.007
		(0.008)	(0.008)	(0.013)	(0.013)
	stocks (share of overall savings)	-0.002	-0.003	-0.007	-0.008
		(0.009)	(0.009)	(0.13)	(0.013)
	worse off	0.85***	0.84***	0.51***	0.50***
		(0.26)	(0.26)	(0.17)	(0.17)
	income expectations	0.0015**	0.0015**	0.0009**	0.0009**
		(0.007)	(0.007)	(0.0004)	(0.0004)
	unemployment up	0.04***	0.04***	0.02***	0.02***
		(0.003)	(0.003)	(0.002)	(0.002)
Economic Controls	stocks up	-0.01***	-0.01***	-0.008**	-0.008**
		(0.003)	(0.003)	(0.003)	(0.003)
	interest rate up	-0.02***	-0.02***	-0.009***	-0.01***
		(0.003)	(0.003)	(0.002)	(0.002)
	house price evaluation	$1.2e^{-7}$	$1.4e^{-7}$	$-9.9e^{-8}$**	$-1.0e^{-7}$*
		$(1.0e^{-7})$	$(1.0e^{-7})$	$(5.3e^{-8})$	$(5.3e^{-8})$
Individual Controls	full time	-0.22	-0.27	0.29	-0.29
		(0.25)	(0.25)	(0.25)	(0.25)
	other individual characteristics	Yes	Yes	Yes	Yes
	fixed effects	Time	Time	Time	Time
	sample	Trimmed	Trimmed	Fin. literate	Fin. literate
	observations	21242	21233	13081	13081

Table 4. Regression results using SCE data plus proxies from the Household Finance Survey. This table collects the results of regressing $\mathbb{E}_t^j \pi_{t,t+12}$ on all regressors from the previous regressions plus data from the Household Finance Survey. White's heteroschedasticity robust estimator is used to obtain the parameter standard errors that appear in parentheses. Asterisks denote significance at the 10% (*), 5% (**), and 1% (***) levels.

4 A Model of Savers' Expectations

The observed wedge between the inflation expectations of savers and borrowers appears naturally if we model them as ambiguity averse. A saver whose wealth is, at least in part, held in nominal assets, will be worse off if the future level of inflation increases. Conversely a borrower will see the real value of the sums he owes reduced by future high inflation. Low inflation thus represents his worst-case scenario.

We present a very simple overlapping-generations model to study the life-cycle behavior of

borrowing and saving and its impact on inflation expectations under ambiguity aversion. The economy comprises a continuum of agents i who live for three periods. In each period t a third of the agents will be young (y), a third will be middle-aged (m), and a third old (o). At the end of the period old agents die out and are replaced by a new cohort of young. Within each cohort, agents will have the same wealth and make the same decisions. So we ultimately only need to model a representative agent for each cohort. We assume log utility for simplicity.

It is easiest to start by considering the problem of an old agent, who will maximize:

$$\begin{aligned} V_{o,t}\left(a_{m,t-1}\right) &= \max_{c_{o,t},a_{o,t}} \log\left(c_{o,t}\right), \\ \text{s.t.} \quad & c_{o,t} + a_{o,t} \leq \frac{1+i_{t-1}}{e^{\pi_t}} a_{m,t-1}, \\ & a_{o,t} \geq 0. \end{aligned} \tag{2}$$

An old consumer starts the period off with wealth $a_{m,t-1}$, i.e. the savings of a middle-aged agent from period $t-1$. The old consumer's income equals those savings plus the accrued real interest rate $\frac{1+i_{t-1}}{e^{\pi_t}} a_{m,t-1}$, where i_{t-1} is the nominal rate from the previous period[5] and π_t the inflation rate.[6] The old representative consumer can either consume ($c_{o,t}$) her income or potentially save it ($a_{o,t}$). She cannot borrow in the last period of her life. It will also never be optimal to save either, insofar as she does not care for her descendants. So the solution to her optimization problem is trivial, with $c_{o,t} = \frac{1+i_{t-1}}{e^{\pi_t}} a_{m,t-1}$ and $a_{o,t} = 0$. Ambiguity aversion does not play any role in the decision of an old agent because her decision is not forward looking. Importantly, though, an old agent's utility is decreasing in the level of inflation π_t.

A middle-aged consumer faces the following problem:

$$\begin{aligned} V_{m,t}\left(a_{y,t-1}\right) &= \max_{c_{m,t},a_{m,t}} \log\left(c_{m,t}\right) + \beta \min_{\mu_t \in [-\overline{\mu},\overline{\mu}]} \mathbb{E}_t V_{o,t+1}\left(a_{m,t}\right), \\ \text{s.t.} \quad & c_{m,t} + a_{m,t} \leq \frac{1+i_{t-1}}{e^{\pi_t}} a_{y,t-1} + w_t - T_t, \\ & a_{m,t} \geq -\overline{d}. \end{aligned} \tag{3}$$

A type-m consumer decides her consumption level ($c_{m,t}$) and savings ($a_{m,t}$) based on her start-of-the-period wealth ($a_{y,t-1}$) and her labor income w_t net of the lump-sum taxes she pays to finance the production subsidy. Middle-aged agents provide one unit of labor inelastically. They are subject to a borrowing constraint $-\overline{d}$, for some $\overline{d} > 0$. Their optimization problem includes the continuation value represented by the expected utility of

[5] We assume the interest rate follows $i_t = \phi \pi_t$.

[6] We actually model the log of inflation as it naturally comes out of a linearized Phillips curve. Which is why we express headline inflation as e^{π_t}, which rests on the maintained assumption of zero steady state inflation.

an old agent in period $t+1$. In this model (the log of) inflation follows a simple autoregressive process in equilibrium:

$$\pi_t = \rho_\pi \pi_{t-1} + u_t, \quad 0 < \rho_\pi < 1, \tag{4}$$

where $u_t \sim \mathcal{N}\left(0, \sigma_u^2\right)$ is a cost-push shock. Agents entertain a family of distributions for u_{t+1}, with different means, $u_{t+1} \sim \mathcal{N}\left(\mu_t, \sigma_u^2\right)$ and they cannot attach a prior probability to μ_t over the interval $[-\overline{\mu},\ \overline{\mu}]$, for some $\overline{\mu} > 0$, *i.e.* they face ambiguity. Agents act as if inflation evolved according to $\tilde{\pi}_{t+1} = \rho_\pi \pi_t + u_{t+1} + \mu_t$. Being ambiguity averse, they solve a min-max problem. They act under the assumption that μ_t takes on the value that makes them worst off, over the interval $[-\overline{\mu},\ \overline{\mu}]$.[7]

The solution to the minimization problem for middle-aged agents is trivial. $a_{m,t}$ will always optimally be chosen to be strictly positive, since the marginal utility of consumption, $c_{o,t+1}^{-1}$, converges to infinity as the consumption of the old-type goes to zero. Therefore $\mathbb{E}_t V_{o,t+1}\left(a_{m,t}\right)$ will be strictly decreasing in the level of future inflation and the worst case scenario will correspond to $\mu_t = \overline{\mu} > 0$. We have thus established that the middle-aged type will be a saver ($a_{m,t} > 0$) and that her inflation expectations, *i.e.* the expectations according to which she makes her decisions, will exceed a purely rational benchmark.

As for the maximization, consumption and savings of the middle-aged are pinned down by the following Euler equation:

$$c_{m,t}^{-1} = \beta \mathbb{E}_t \frac{1 + i_t}{e^{\tilde{\pi}_{t+1}}} c_{o,t+1}^{-1}, \tag{5}$$

where we have used the envelope condition $\frac{\partial V_{o,t}}{\partial a_{m,t-1}} = \frac{1+i_{t-1}}{e^{\pi_t}} c_{o,t}^{-1}$ and used the worst-case process for inflation $\tilde{\pi}_t$. Combining this with the budget constraint obtains the level of assets and consumption as a function of the disposable income of the middle aged:

$$a_{m,t} = \frac{1}{1 + \beta^{-1} e^{\overline{\mu}}} \left(\frac{1 + i_{t-1}}{e^{\pi_t}} a_{y,t-1} + w_t \right), \tag{6}$$

$$c_{m,t} = \frac{\beta^{-1} e^{\overline{\mu}}}{1 + \beta^{-1} e^{\overline{\mu}}} \left(\frac{1 + i_{t-1}}{e^{\pi_t}} a_{y,t-1} + w_t \right). \tag{7}$$

An ambiguity-averse household will save less and consumer more of her disposable income than a purely rational one as $e^{\overline{\mu}} > 1$. Importantly, the wealth she enters the period with $(frac1 + i_{t-1} e^{\pi_t} a_{y,t-1})$ is increasing in the level of inflation so long as she borrowed while young ($a_{y,t-1} < 0$).

Young agents enter the economy with zero wealth and no income and face the following

[7] Our findings do not require the interval to be symmetric around zero.

problem:

$$\begin{aligned} V_{y,t}(0) &= \max_{c_{y,t},a_{y,t}} \log(c_{y,t}) + \beta \min_{\mu_t \in [-\overline{\mu},\overline{\mu}]} \mathbb{E}_t V_{m,t+1}(a_{y,t}), \\ \text{s.t.} \quad & c_{y,t} + a_{y,t} \leq 0 \\ & a_{y,t} \geq -\overline{d}. \end{aligned} \tag{8}$$

Clearly, a young agent will borrow, as her marginal utility goes to infinity as her consumption level approaches zero. This means that her expected disposable income as a middle-aged person is increasing in the level of expected inflation. So her worst-case scenario correspoands to $\mu_t = -\overline{\mu}$. We will maintain that the borrowing constraint is sufficiently tight to be binding ($a_{y,t} = -\overline{d}$).

The supply side is deliberatly simple. A continuum of firms $f \in [0,1]$ compete monopolistally and face the following demand function: $Y_{f,t} = \left(\frac{P_{f,t}}{P_t}\right)^{-\epsilon} Y_t$, where $P_{f,t}$ is the price they set, P_t the aggregate price index, and Y_t aggregate demand. Firms are subject to a Rotemberg (1982) quadratric price adjustment cost $\Gamma_{f,t} = -\frac{\vartheta}{2}\left(\frac{P_{f,t}}{P_{f,t-1}} - 1\right)^2 Y_{f,t}$, with $\vartheta > 0$ a parameter. Production is linear in labor ($N_{f,t}$) , with production function $Y_{f,t} = A_t N_{f,t}$. Labor supply is fixed and the real wage set to $w_t = A_t$. Each firm's marginal cost, net of the production subsidy, is $MC_{f,t} = (1-\tau_t)\frac{W_t}{A_t} = (1-\tau_t)$. We model $(1-\tau_t)$ as a exogenous process around its optimal value, or $(1-\tau_t) = (1-1/\epsilon)\Xi_t$, where $\xi_t = \log(\Xi_t)$, $\xi_t = \rho_\xi \xi_{t-1} + u_t^\xi$. Marginal cost is exogenous and proportional to Ξ_t, so the log-linear Phillips curve can be expressed as:

$$\pi_t = \kappa \xi_t + \beta \mathbb{E}_t \pi_{t+1}. \tag{9}$$

Which implies that $\pi_t = \frac{\kappa}{1-\beta\rho_\xi}\xi_t$. By setting $\rho_\pi = \rho_\xi$ and $\sigma_u = \frac{\kappa}{1-\beta\rho_\xi}\sigma_{u^\xi}$, the AR(1) process for inflation presented above obtains.

The model is closed by the resource constraint, $Y_t(1-\Gamma_t) = \frac{1}{3}(c_{o,t} + c_{m,t} + c_{y,t})$, and by clearing on the asset market, $a_{y,t} + a_{m,t} + a_{o,t} = 0$, which pins down $a_{m,t} = \overline{d}$.

The model we presented highlights in the simplest of terms that a debtor's future wealth is decreasing in his inflation expectations. It is thus just natural that an ambiguity-averse debtor will act as if inflation will be lower than rational expectations would imply. The opposite is true for a saver. Importantly, what matters is that at least part of one's wealth is held in nominal assets. The exact reason for saving/borrowing is not central to our argument. It could well be that agents save not exclusively in anticipation of retirement but also to hedge some idiosyncratic unemployment risk. A similar argument would apply, in line with our empirical findings suggesting that most every proxy for savers associates to higher inflation expectations.

5 Conclusions

Rich individual-level survey data from the New York Fed's surveys of consumers allows to establish that savers report higher inflation expectations that borrowers, on average. Our findings are generally robust regardless of the level of financial literacy of the respondents, and are confirmed after controlling for the usual demographic factors and other plausible drivers of inflation expectations, such as the respondents' expectations about the economic outlook. The results hold even when exploiting the panel structure of the data and introducing two-way fixed effects to account for unobserved heterogeneity at the individual level and in the macroeconomic environment.

This wedge in expectations between savers and borrowers can be explained by modeling agents as ambiguity averse and assuming they are uncertain, in a Knightian sense, regarding the future path for inflation. High inflation will be bad for savers, so a min-max (ambiguity averse) saver will report higher inflation expectations relative to a rational benchmark. Conversely, a borrower's worst-case scenario is one in which inflation will turn out to be too low, as the real cost of servicing his debt will rise. An ambiguity-averse borrower will thus act as if inflation will be lower (relative to a rational benchmark) in the future.

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