Inflation Expectations and Readiness to Spend: Cross-Sectional Evidence*

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Abstract

There have been suggestions for monetary policy to engineer higher inflation expectations to stimulate spending. We examine the relationship between expected inflation and spending attitudes using the micro data from the Michigan Survey of Consumers. The impact of higher inflation expectations on the reported readiness to spend on durables is generally small, outside the zero lower bound often statistically insignificant, and inside of it typically significantly negative. In our baseline specification, a one percentage point increase in expected inflation during the recent zero lower bound period reduces households' probability of having a positive attitude towards spending by about 0.5 percentage points.

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1 Introduction

There have recently been suggestions by economists and policy-makers alike to engineer higher private sector inflation expectations with the goal of stimulating current spending.[1] Increased inflation expectations might lower real interest rates and thus boost interest-sensitive components of aggregate demand, particularly in an environment in which nominal interest rates are constrained from below. Increased inflation expectations also mean expected wealth gains for debtors. To the extent that debtors have on average higher propensities to spend out of wealth than creditors, increased inflation expectations might lead to higher current aggregate spending.[2] There are, however, other economic channels that make the sign of the relationship between expected inflation and spending theoretically ambiguous. Inflation is a tax on the holders of highly liquid assets and hence may function as a tax on economic activity, to the extent to which these assets are used as a medium of exchange.[3] Higher expected inflation may also be viewed as a sign of incertitude on the part of policy-makers, signaling bad times ahead.[4]

The objective of this paper is to provide some econometric evidence on both the sign and the magnitude of the relationship between inflation expectations and spending. We do so using micro-level cross-sectional data on individual inflation expectations and spending attitudes from the Michigan Survey of Consumers. Using cross-sectional data to study the relationship between expected inflation and spending has at least four advantages over studying aggregate data. First, by eliciting inflation expectations and spending readiness from the same person they help us identify the link between inflation expectations and spending at the level of actual decision-makers. Second, cross-sectional variation allows us to study whether the relation between inflation expectations and spending is different at the zero lower bound compared to normal times, as many standards models suggest. Given that in U.S. post-war history zero lower bound regimes have been rare occurrences (they are in point of fact a singular event), it is difficult with only aggregate data to investigate empirically the link between inflation expectations and the readiness to spend at very low nominal policy interest rates. Third, the average expected inflation rate and aggregate spending are presumably determined simultaneously, making it difficult to isolate the causal relationship between one and the other. Micro data, in contrast,

[1] Ken Rogoff (in Ydstie, 2011): "They need to be willing, in fact actively pursue, letting inflation rise a bit more. That would encourage consumption. It would encourage investment"; Naryana Kocherlakota (in WSJ.com, 2010): "To a limited extent, this should be a good thing in some sense, to have more expected inflation"; and Christina Romer (in *New York Times*, 2011): "In the current situation, where nominal interest rates are constrained because they can't go below zero, a small increase in expected inflation could be helpful. It would lower real borrowing costs, and encourage spending on big-ticket items like cars, homes, and business equipment." See also Romer (2013) for a reiteration and elaboration of this idea.

[2] Doepke and Schneider (2006) provide an empirical investigation of this channel.

[3] Aruoba and Schorfheide (2011) study this channel quantitatively and find it to be important.

[4] Paul Volcker (2011) and John Taylor (in Ydstie, 2011) have expressed this view informally.

is less likely to be fraught with this simultaneity issue, as cross-sectional variation in individual spending decisions should not have an impact on the evolution of aggregate prices. Fourth, cross-sectional data allow us to study potentially interesting heterogeneities in the nexus between inflation expectations and spending.

The Michigan Survey of Consumers collects cross-sectional data on quantitative inflation expectations over one and five-to-ten year horizons and qualitative measures of spending attitudes. The latter are gathered from the responses to qualitative questions about whether it is a good or bad time to buy a variety of goods, such as durable household items, cars, and houses. We will frequently refer to these questions as measuring "readiness to spend".[5]

Given the discrete and qualitative nature of many of the survey questions at the micro level, to analyze the data formally we employ ordered probit models to investigate the relationship between expected inflation and readiness to spend. This empirical specification allows us to estimate the effect of increased inflation expectations on the probability of answering that it is a good time to spend. We also control for a number of aggregate and idiosyncratic factors. These controls are meant to ensure that the identifying variation in expected inflation is unrelated to other factors which impact spending attitudes. Our econometric model also allows for state-dependence so as to investigate whether the link between inflation expectations and the reported readiness to spend is different at the zero lower bound compared to normal times.

Overall, we find that the impact of inflation expectations on the reported readiness to spend on durables is small, outside the recent zero lower bound episode often statistically insignificant, and inside of it typically significantly negative. In the baseline estimate, which makes use of the whole cross-section, a one percentage point increase in expected inflation during the recent zero lower bound episode is associated with a reduction in households' probability of having a positive attitude towards spending by about 0.5 percentage points. These basic results for inflation expectations obtain in a variety of different robustness checks and specifications. In contrast, the current financial situation of the household, its expectations about business and labor market conditions in the future, or its trust in economic policy have much larger and significantly positive impacts on household attitudes towards spending on durables.

How should one interpret our reduced-form results? In what sense can they matter for the conduct of monetary (or fiscal) stabilization policy? We show that the small, essentially zero effect of inflation expectations on spending persists across most age groups, birth cohorts, education levels, and income quintiles. This relationship is also rather stable over time. These findings together at least suggest that the reduced-form relationship between inflation expec-

[5] In a very recent working paper, Burke and Ozdagli (2013), take up the question we have been posing in this paper, and use a panel data set from the New York Fed with both quantitative inflation expectations and spending decisions, which, however, covers only a short and recent period of time and which has now been discontinued, and find results for durable goods spending similar to ours.

tations and spending we uncover is somewhat structural, and tell a cautionary tale for policies designed to engineer inflation expectations in order to generate greater spending.

The one group for which there does exist a positive relationship between expected inflation and spending attitudes is those households which are "good" inflation forecasters, in a sense to be formalized below. Presumably, households that are "good" forecasters are well-informed and follow macroeconomic developments closely. Based on the Michigan Survey, however, they represent only a relatively small fraction of total households. Therefore, at the very least, our results suggest that policy makers would likely face a difficult communication and education challenge when advocating inflationary policies.

Our empirical work fits into a growing literature which focuses on the role of expected inflation in stabilization policy. For the case of monetary policy, Krugman (1998), Eggertson and Woodford (2003), and Eggertson (2006) have advocated for central banks to promise higher future inflation as a means of expansionary policy during periods in which nominal interest rates have hit their lower bound. For the case of fiscal policy, Eggertson (2010), Christiano, Eichenbaum and Rebelo (2011), and Woodford (2011) show in standard New Keynesian models that the government spending multiplier may be large when the zero lower bound for nominal interest rates binds, where the extra stimulus obtains due to the interaction between inflation expectations and the real interest rate. Eggertson (2008) argues that it was a mix of fiscal and monetary policies designed to generate inflation expectations that led to the recovery from the Great Depression, while Romer and Romer (2013) argue that it was monetary-policy-induced deflation expectations that caused the Great Depression in the first place. Farmer (2012) claims that the recent unconventional monetary policy operations have kept inflation expectations up and that this constitutes successful stabilization policy.

Economic theory is nevertheless not clear in suggesting that higher expected inflation must lead to more spending. Indeed, economists like Edward Leamer (in Leamer, 2011) have polemicized against using inflation expectations as a tool for stabilization policy. Paul Volcker (in Volcker, 2011) and John Taylor (in Ydstie, 2011) view the engineering of higher inflation expectations as dangerous and, ultimately, as a sign of incertitude on the part of policy-makers that portends bad times ahead; a related idea has recently been formalized in an imperfect information model by Wiederholt (2012). Inflation functions as a tax on the holders of cash and other highly liquid assets, and hence might be a tax on economic activity, so higher expected inflation might depress spending by functioning like a tax. In environments with pervasive nominal wage rigidities, higher inflation might result in wealth losses for households. Also, to the extent that higher inflation expectations are driven partially by higher gas price expectations, they might constitute negative wealth shocks. Finally, calls for promising higher future inflation to stimulate spending rest on the presumption that consumer spending reacts strongly to fluctuations in real interest rates. However, Mackowiak and Wiederholt (2012) and Gabaix (2012) argue that,

in boundedly rational environments, economic decision-makers may not pay much attention to real interest rates.

On the empirical front, there is an older literature that investigates the relationship between consumer spending and inflation / inflation expectations. Using aggregate time series data on spending and inflation expectations, Juster and Wachtel (1972) find that higher inflation expectations lead to lower durable goods spending, and Burch and Werneke (1975) find that higher expected inflation is associated with increases in the national savings rate. They interpret their results through a similar policy-confidence lens as Paul Volcker and John Taylor.

More recently, Wieland (2014) documents that temporary negative supply shocks are contractionary during episodes of low policy interest rates. These negative supply shocks raise expected inflation but, by their temporary nature, have limited wealth effects. The standard Fisher relationship logic of most New Keynesian models predicts that these shocks should be expansionary at the zero lower bound because they work to lower real interest rates. Wieland's (2014) results (and ours) potentially point to some failure of the basic Fisherian logic which is present in most modern macro models. He attributes his findings to a decline in asset prices, a decline in net worth, and financial frictions. Our results point to another potential explanation: nominal interest rate illusion. We find that spending attitudes are significantly impacted by expected movements in nominal interest rates in the direction predicted by standard theory. That expected inflation has very little effect on spending attitudes perhaps suggests that a majority of households do not understand the distinction between nominal and real rates of interest.

Ours is one of only a few papers to have made use of the underlying micro data of the Michigan survey. Souleles (2004) uses these data to test the rationality of individual forecasts. Coibion and Gorodnichenko (2012) use the micro level inflation forecasts to examine how disagreement about inflation reacts to different shocks as a test of competing models of informational rigidities. Their line of research – informational frictions – also presents a theoretical justification of the existence and persistence of cross-sectional heterogeneity in inflation expectations, which we exploit in this paper. Malmendier and Nagel (2013) use the inflation expectation questions to study how inflation expectation formation is governed by the actual inflation experiences that various cohorts have gone through. A recent paper by Carvalho and Nechio (2013) uses the Michigan survey data to test whether agents understand Taylor rules. Finally, Dräger and Lamla (2013) use the Michigan inflation expectation data to study the anchoring of inflation expectations both in the cross-section and over time.

The remainder of this paper is organized as follows: Section 2 sketches a formal framework for the empirical investigation. Section 3 describes the micro data. Section 4 explains the ordered probit empirical design and Section 5 presents the results for household durables. A final section concludes. An online appendix provides detailed information on the survey questions used in the paper, more raw data analysis, and the estimation results for cars and houses.

2 Expenditure on Durables and Inflation: Theory

Many who call for higher expected inflation to stimulate spending base their logic on two assumptions: first, that expenditure is inversely related to the real interest rate; and second, that higher expected inflation lowers the real interest rate, holding the nominal rate fixed. The former is typically motivated via an Euler equation, while the latter results from the Fisher relationship that the real rate (approximately) equals the nominal rate less expected inflation. The conventional Euler equation argument is based on nondurable consumption. As our focus is on durable consumption expenditures, below we briefly sketch some theory to relate the level of inflation to durable expenditures in an optimizing framework.

Suppose that a household receives flow utility from nondurable consumption, C_t, and a stock of durable goods, X_t: $U(C_t, X_t)$. The flow utility function has standard properties, and the future is discounted by the factor $0 < \beta < 1$. The household receives a flow of real income each period, Y_t, and enters the period with a stock of nominal financial assets, A_t, which offer gross return R_t. Let P_t denote the nominal price of goods. The stock of durables depreciates at rate $0 < \delta < 1$. The flow budget constraint is:

$$P_t C_t + A_{t+1} + P_t (X_t - X_{t-1}) + \delta P_t X_t \leq P_t Y_t + R_t A_t \tag{1}$$

For ease of exposition, we assume that there is no uncertainty. Letting λ_t denote the Lagrange multiplier on the constraint, the first order conditions with respect to the optimal choices of C_t, A_{t+1}, and X_t are, respectively:

$$\beta^t U_C(C_t, X_t) = \lambda_t P_t \tag{2}$$

$$\lambda_t = \lambda_{t+1} R_{t+1} \tag{3}$$

$$\beta^t U_X(C_t, X_t) = P_t \lambda_t - P_{t+1} \lambda_{t+1} (1 - \delta) \tag{4}$$

Defining $\Pi_t \equiv \frac{P_t}{P_{t-1}}$ as the gross inflation rate, with $\frac{R_{t+1}}{\Pi_{t+1}}$ being the standard Fisher relationship relating the nominal return and expected inflation to the real return, the multiplier can be eliminated:

$$U_C(C_t, X_t) = \beta U_C(C_{t+1}, X_{t+1}) \frac{R_{t+1}}{\Pi_{t+1}} \tag{5}$$

$$U_X(C_t, X_t) = \beta U_C(C_{t+1}, X_{t+1}) \left(\frac{R_{t+1}}{\Pi_{t+1}} - (1 - \delta) \right) \tag{6}$$

The first expression is the familiar Euler equation for nondurable consumption, while the second is an Euler equation governing the tradeoff between durables and nondurables. Sup-

pose that shocks are sufficiently short-lived so that the future marginal utility from nondurables can be treated as fixed. This means that, holding the nominal return, R_{t+1}, fixed, an increase in inflation between t and $t+1$, Π_{t+1}, lowers the real return. This means that both nondurable consumption and expenditure on durables should increase. Furthermore, one can combine the Euler equations to get:

$$\frac{U_X(C_t, X_t)}{U_C(C_t, X_t)} = \left(1 - (1-\delta)\frac{\Pi_{t+1}}{R_{t+1}}\right) \tag{7}$$

From this expression, one sees that an increase in Π_{t+1} must lower $\frac{U_X(C_t,X_t)}{U_C(C_t,X_t)}$. Under certain assumptions on preferences (for example, a log-log-specification), this would imply an increase in $\frac{X_t}{C_t}$. This means that an increase in anticipated inflation, holding the nominal return fixed, would not only lead to an increase in both nondurable and durable consumption, but it would also result in a relative increase in durable to nondurable expenditures. Put differently, durable consumption expenditures would be more interest sensitive than nondurables. This is consistent with Christina Romer's statement in Footnote 1 as well as earlier empirical findings in the literature, e.g. Hamburger (1967) and Mankiw (1983). Because inflation affects the real interest rate through the Fisher relationship, this framework shows that durables are in fact the most suitable expenditure category for our research inquiry.

3 Data Description and Analysis

This section provides a detailed description of the inflation expectations and buying attitudes data from the Michigan Survey of Consumers.

3.1 Data Sources

We use the underlying micro data from the Survey of Consumers conducted by the Survey Research Center at the University of Michigan. These data are available at a monthly frequency and cover (depending on the empirical specification, at most) the period 1984:01 to 2012:12.[6] Each month, about 500 interviews are carried out via random telephone dial and the samples are designed to be representative of all American households. There is a rotating panel component to the survey, where each month about 60 percent of interviews are first time respondents while 40 percent are households who were interviewed six months prior. In our baseline we will focus on first time interviews, which allows us to treat the data as coming from repeated cross-sections, though we will make use of the panel aspect of the survey in some robustness checks in Section 5.2

[6] Part of the publicly available data set goes back to 1978, but we focus on this particular subsample in order to avoid a possible structural break in the conduct of monetary policy during the Volcker era.

We focus on the following two questions in our baseline scenario:[7]

Q 1 *"About the big things people buy for their homes – such as furniture, a refrigerator, stove, television, and things like that. Generally speaking, do you think now is a good or a bad time for people to buy major household items?"*

Q 2 *"By about what percent do you expect future prices to go (up/down) on the average, during the next 12 months?"*

Responses to (Q1) take on three different qualitative categories: good, bad, and neutral, while the responses to (Q2) are quantitative and expressed in percentage points. The survey only asks about spending conditions for durables, not about nondurables and services. While durables are usually a relatively small part of the current spending budget of households, they are also the most sensitive to both idiosyncratic and aggregate economic conditions, especially interest rates (see the argument in Section 2).

While we believe that one-year ahead inflation expectations cover the right time horizon for smaller household consumer durables and are also more precisely answered by survey participants, we include, as a robustness check, specifications with five-to-ten-years ahead inflation expectations that the survey started to ask about in 1990.

Q 3 *"By about what percent per year do you expect prices to go (up/ down) on the average, during the next 5 to 10 years?"*

As an alternative to consumer durables, we also consider questions about the readiness to buy cars and houses, the results of which are presented in the online appendix to this paper.

In addition to those listed above, the Michigan Survey asks several other questions about expectations for both idiosyncratic and aggregate economic outcomes. Among these are questions about the expected change in the household's financial situation over the next year (Q4), the expected change in household real income (Q5), expected movements in nominal interest rates (Q6), expected overall aggregate business conditions over both a twelve month (Q7) and a five-year horizon (Q8), the expected movement in the aggregate unemployment rate (Q9), and assessments of the overall economic policy of the government (Q12). The exact wording of these questions is presented in the online appendix to this paper. Similarly to the buying conditions questions, responses to these questions are generally coded into three qualitative categories: good/up, indifferent/no change, or bad/down. The survey also contains fairly rich demographic information on the respondents, including information on sex, age, race, education, marital status, household size, geographic location, income, and homeownership status.

[7] A18 and A12b, respectively, of the Survey of Consumers.

3.2 Basic Data Analysis

In this subsection we present summary statistics on both the buying conditions and inflation expectations questions. For this and all subsequent exercsises in the paper, we omit all month-household observations with inflation expectation observations that are larger than 20 percent in absolute value to ensure that our results are not affected by extreme outliers. Figure 1 plots the relative score for (Q1), defined as the fraction of respondents with a favorable outlook on current buying conditions for durable household goods minus those with an unfavorable outlook. The shaded gray regions are recessions, as identified by the NBER. This series is clearly procyclical, with a particularly large drop during the Great Recession.

We next investigate to what extent the reported readiness to spend on durable goods is correlated with aggregate consumer spending on durables from the NIPA accounts. Given that we want to learn from the micro data whether increased inflation expectations are indeed associated with greater consumer spending, it is crucial that there exists a link between what people report in the Michigan survey about their readiness to spend and what actually shows up in the data. For this purpose, we compare the aforementioned aggregate index of spending readiness with detrended real aggregate consumer spending on durables at a monthly frequency. We apply an HP-filter (with smoothing parameter $\lambda = 129,600$) to the natural logarithm of the actual aggregate spending series in order to obtain a measure for the cyclical component of consumer spending. Figure 2 shows a scatter plot of the two series. There is a clear positive correlation between the average reported readiness to spend on durables and aggregate durables consumption, with a contemporaneous correlation among the series of 0.53. Figure 3 displays the dynamic correlogram between the reported readiness to spend in the survey and the actual aggregate spending series. The correlations stay at a similar level until a lead of the readiness series of 6 months. Overall, we conclude that the reported readiness to spend on durables is a reasonable proxy (or predictor) for movements in aggregate durables consumption.

The left panel of Figure 4 plots the average of the one-year ahead expected inflation rate across individual responses at each point in time together with the actual one year ahead inflation rate. The shaded gray regions represent +/- one standard deviation of the survey responses. The actual inflation rate is the corresponding 12 months ahead rate as measured by the headline CPI, and has thus been brought into sync with the time horizon for inflation expectations. Overall, it appears that the one-year inflation expectations from the Michigan Survey track the actual inflation rate reasonably well. The graph also suggests that we have sufficient variation across households in inflation expectations to learn from a cross-sectional analysis of the data. The right panel plots the five-to-ten-years-ahead inflation expectations. Even for longer horizon inflation expectations we have a substantial amount of cross-sectional heterogeneity that

should help us identify the link between long-term inflation expectations and spending.[8]

In addition, we present in the online appendix to this paper some basic raw correlations between the one-year-ahead inflation expectations and the qualitative measures of readiness to spend (five-to-ten-years-ahead inflation expectations for the "readiness to spend on cars" question). The correlation coefficient between expected inflation and the readiness to spend on durable goods is -0.047 when pooling observations across respondents and across time. This correlation is not only negative but also small. In comparison, the correlation between the reported readiness to spend and other idiosyncratic variables, expected aggregate business conditions, the current financial situation of the households, unemployment expectations, and economic policy trust, are not only of the expected sign but also much larger in absolute value. These results are stable across a variety of demographic groups and over time.

Finally, the online appendix also analyzes more closely the reasons households give in the survey why they think it is a good or a bad time to buy household durables, cars, or houses. This analysis reveals that future price increases or decreases as factors influencing the households' spending decisions always pale in comparison to current prices or whether the households have the impression that the market is currently particularly buyer- or seller-friendly.

4 Empirical Setup

The discrete nature of the responses to the qualitative buying attitudes questions presents some challenges that render conventional linear regression specifications inappropriate. We assume that there exists an unobserved, continuous measure of readiness to spend, $y^*_{i,t}$. We model the evolution of this continuous measure of readiness to spend as:

$$y^*_{i,t} = \beta_1 \pi^e_{i,t} + \beta_2 \pi^e_{i,t} \times D_{ZLB} + x_{i,t}\gamma + \epsilon_{i,t} \tag{8}$$

$\pi^e_{i,t}$ is the amount of inflation (expressed in percentage points) that household i expects in the 12 months subsequent to date t and D_{ZLB} is a dummy variable for the zero lower bound period, which takes on unity from 2008:12 to 2012:12 (and zero otherwise). $x_{i,t}$ is a vector of controls. It includes the dummy variable D_{ZLB} as well as a number of different idiosyncratic and aggregate controls which we discuss in more detail below. β_1 measures the partial effect of an increase

[8] Figure 4 shows that a non-negligible fraction of households apparently have deflation expectations, which may raise concerns about the reliability of the inflation expectation data in the Michigan survey. Interestingly, however, Fleckenstein, Longstaff and Lustig (2013) find, using data on the market prices of inflation swaps and options, that the market places substantial probability weight on deflation scenarios in which prices decline by more than 10 to 20 percent over extended horizons. To the extent that the respondents in the Michigan survey have inflation expectations consistent with the support of the market distribution of inflation, the substantial cross-sectional heterogeneity of inflation expectations in the Michigan survey may thus be not too surprising.

in expected inflation on the willingness to spend, holding all factors in $x_{i,t}$ constant. The interaction term between expected inflation and the dummy, D_{ZLB}, allows this relationship to be different when the nominal interest rate is close to zero, with the partial effect of more expected inflation on readiness to spend given by $\beta_1 + \beta_2$. γ is the coefficient vector on the controls.

The latent variable $y^*_{i,t}$ is not observable, but the discrete survey responses, $y_{i,t}$, are. The survey responses are coded in such a way that three outcomes are possible: '1' indicating that now is a good time to buy household consumer durables, '-1' meaning that now is bad time to buy, and '0' saying that now is neither a good nor a bad time to buy. We model the relationship between $y^*_{i,t}$ and $y_{i,t}$ as:

$$y_{i,t} = \begin{cases} -1 & \text{if } \; y^*_{i,t} \leq \alpha_1 \\ 0 & \text{if } \; \alpha_1 < y^*_{i,t} \leq \alpha_2 \\ +1 & \text{if } \; \alpha_2 < y^*_{i,t} \end{cases}$$

with threshold values α_1 and α_2. We estimate this model as an ordered probit, using the observations on y to estimate $(\beta_1, \beta_2, \gamma)$ as well as α_1 and α_2 via maximum likelihood.

To be able to interpret β_1 and $\beta_1 + \beta_2$ as the "causal" effect of expected inflation on desired spending the regression specification needs to control for determinants of spending which may be correlated with expected inflation. These covariates can be both cross-sectional or aggregate in nature. For example, one might imagine that certain demographic characteristics are correlated with both buying attitudes and inflation expectations. The vector of controls therefore includes a rich set of demographic factors. We include a dummy which takes on unity for female respondents and zero for males ('Sex'), a dummy which switches on if the respondent is married and otherwise not ('Married'), and a dummy which takes on unity in case the respondent holds a college degree and zero otherwise ('College'). We also add dummies for each race, except for non-Hispanic Caucasians, i.e., 'African American', 'Hispanic American', 'Native American', and 'Asian American' as well as for each census region, except for North Central, i.e., 'West', 'Northeast', and 'South'. We also consider the family size of the respondent and add polynomials of the age of the respondent ('Age', 'Age^2', and 'Age^3') to account for possible changes in life-cycle behavior. We address seasonality by including a set of monthly dummies. Finally we include the natural logarithm of reported current real income of the household.[9]

There may be other cross-sectional covariates imperfectly related to demographics which are nevertheless also correlated with both inflation expectations and buying attitudes. For example, one might worry that some people are naturally optimistic (or pessimistic) by nature.

[9]We use the survey question on the current nominal household income (in U.S. dollars) and deflate it with the consumer price index (CPIAUCSL) from the St. Louis Federal Reserve Bank data base FRED.

An optimist might on average express positive buying attitudes and lower than average expected inflation. Failing to control for this characteristic would induce a negative correlation between expected inflation and the error term. Alternatively, one could imagine that a respondent is "bullish" about the aggregate economy, thinking that now is a relatively good time to buy durable goods but expects that this high demand will lead to future price increases. Not controlling for this attitude about the aggregate state would tend to induce a positive correlation between expected inflation and the error term.

Fortunately, the Michigan Survey contains a rich set of information on idiosyncratic expectations and attitudes for which we can control in our regression specifications. We include in our set of controls (qualitative) *idiosyncratic expectations* about the *idiosyncratic situation* of the household: its expected change in financial situation (Q4) and the expected trajectory of its real income (Q5). Next, we include *idiosyncratic expectations* about the *aggregate economic situation*: the expected (qualitative) changes in the nominal interest rate (Q6) and the expected (qualitative) aggregate business conditions in one year (Q7) as well as in five years (Q8). Moreover, we add the expected (qualitative) change in the unemployment rate (Q9). We include the current financial situation of the household relative to the previous year (Q10) and a question, (Q12), which asks whether the government is doing a good job, a fair job, or a poor job in fighting inflation and unemployment to measure the respondents' trust in U.S. economic policy. We surmise that households with a lack of trust in economic policy will be reluctant to commit themselves to major purchases and may be more concerned about high future inflation. As with the buying attitudes question, the responses to all these questions are coded in one of three discrete categories: up, down, or "about the same". The inclusion of idiosyncratic expectations (about either idiosyncratic or aggregate conditions) is meant to combat the "optimist/pessimist" problem, while the inclusion of idiosyncratic expectations about aggregates is meant to deal with the second potential endogeneity problem whereby respondents who expect a strong economy may also anticipate future price increases.

Finally, the control vector also needs to account for purely aggregate covariates. Similarly to the logic discussed above, a strong economy may be positively correlated with current buying attitudes but also with expected future inflation. We therefore include several aggregate controls. These aggregate controls also serve as a validation exercise concerning the survey data. Economic theory makes predictions about how different aggregate controls ought to impact buying attitudes; to the extent to which our regressions confirm these effects, we gain additional confidence that the survey data are measuring what they intend to measure. Another way to control for aggregate conditions is to simply include time dummies, which we do in a robustness check in Table 3 below.

As aggregate controls we use (Q7) to construct an index of *aggregate expectations* about the *aggregate economic situation*: the index measures the share of respondents saying that the U.S. as a whole will have good business conditions during the next 12 months minus the share of those respondents answering that the country will have bad business conditions. This index is normalized in [-100, 100]. We also include the cross-sectional standard deviation of expected inflation for each month to measure the degree of dispersion as a proxy for time-varying idiosyncratic inflation uncertainty. In order to proxy for the overall amount of uncertainty in the economy, we consider Bloom's volatility index (see Bloom, 2009).[10] We also include the federal funds rate, the civilian unemployment rate, and the current inflation rate (percentage year-over-year change in the consumer price index), all three denoted in percentage points.[11] Moreover, we add a rolling 12-months forward-looking window estimate of inflation volatility as a proxy for aggregate inflation uncertainty. Lastly, we consider regional relative durable goods prices, according to the census region in which the respondent resides: West, North Central, Northeast, and South. We use the all urban consumers CPI for durables per region from the U.S. Bureau of Labor Statistics divided by the all items CPI for that region. Prior to January 1987 both series are available at a bi-monthly frequency only and we interpolate the series by assuming no change between months. Before calculating relative prices, we seasonally adjust both series. We finally take natural logs and linearly detrend the relative durable goods price. The inclusion of the relative price of durables ensures that the coefficient on expected inflation is not being driven by changes in the relative price of durables.[12]

In our baseline exercises, we restrict attention to those data points which constitute first interviews, which means that the baseline data set is truly a set of repeated cross-sections. This leaves us with a sample of about 68,000 observations.

5 Results

This section presents results from ordered probit specifications as laid out in the previous section. Subsection 5.1 presents the baseline results, while subsection 5.2 conducts a variety of robustness checks and extensions to our baseline exercise.

[10] Specifically, we use the VXO (CBOEVXO) series from Datastream from 1986 onwards and fill in the first 24 months with the numbers from Bloom (2009).

[11] The series are from the St. Louis Federal Reserve Bank data base FRED. We use FEDFUNDS, UNRATE and CPIAUCSL.

[12] We also experimented with a specification where we included the cyclical component of one to five year lagged aggregate real durable consumption spending from NIPA data in order to capture a potential durable goods cycle. We indeed find that lags two to five years of aggregate durable consumption expenditures have a negative influence on readiness to spend on durables today. However, the inflation expectation results are unaltered by this inclusion.

5.1 Baseline Results

This section presents the main results of the paper. For our baseline specification we focus on buying conditions for durable goods and expected inflation over a one-year horizon. The results for this baseline specification (except for the demographic controls) are shown in Table 1. The results for cars and houses are relegated to the online appendix.

Table 1 shows the estimated coefficients as well as marginal effects evaluated for "normal" times, when the federal funds rate was larger than zero ($D_{ZLB} = 0$), and at the zero lower bound ($D_{ZLB} = 1$).[13] The marginal effects have the economic interpretation as the change in the probability of having a favorable outlook on buying durable goods for a one percentage point increase in expected inflation. When calculating marginal effects, we set the remaining variables to their means conditional on $D_{ZLB} = 0$ and $D_{ZLB} = 1$, respectively.[14] In each case we document the point estimates together with standard errors in parentheses underneath, and denote significance at the 1 percent, 5 percent, and 10 percent level by '***', '**', and '*', respectively. The baseline estimates for the demographic controls are shown in Table 2. They show that young, male, non-Hispanic Caucasians without a college degree are, everything else equal, most favorably disposed to buying durable goods.

With respect to the coefficients on the economic control variables, we obtain for the most part plausible and significant estimates, which makes us confident that the Michigan data do indeed measure the underlying economic variables of interest reasonably well. As one would expect, the expected financial situation of the household and its real income, the expected business conditions (idiosyncratic and aggregate), the current financial situation, and the current real household income all have significantly positive effects on the reported spending readiness. In addition, a positive judgement of U.S. economic policy also affects spending dispositions positively. Moreover, an expected increase in *future* nominal interest rates makes people want to spend more *today*, while higher economic uncertainty in the form of stock market volatility, inflation volatility and higher unemployment rates (both current and expected) decrease the probability that people find buying conditions favorable. Higher cross-sectional dispersion in expected inflation also has negative effects and is thus consistent with the interpretation of

[13] We report the marginal effects for the probability of the highest outcome, i.e., $p_1 = P\left(y = 1|\boldsymbol{z}\right)$ with $z = (\pi^e, \pi^e \times D_{ZLB}, \boldsymbol{x})$, and thus for the case that households find buying conditions favorable. Let $\phi(\cdot)$ denote the first derivative of the normal density function $\Phi(\cdot)$ and $\delta = \left(\beta_1, \beta_2, \gamma\right)$. The marginal effect for inflation expectations at $D_{ZLB} = 1$ is calculated as $\partial p_1(\boldsymbol{z}) / \partial \pi^e = \left(\beta_1 + \beta_2\right) \phi\left(\alpha_2 - \bar{\boldsymbol{z}}_{|D_{ZLB}=1} \delta\right)$, where $\bar{\boldsymbol{z}}_{|D_{ZLB}=1}$ denotes the mean of $\boldsymbol{z}$ within the zero lower bound regime. Accordingly, $\partial p_1(\boldsymbol{z}) / \partial \pi^e = \beta_1 \phi\left(\alpha_2 - \bar{\boldsymbol{z}}_{|D_{ZLB}=0} \delta\right)$ is the corresponding marginal effect at $D_{ZLB} = 0$. The marginal effect with respect to a control variable x_k is $\partial p_1(\boldsymbol{z}) / \partial x_k = \gamma_k \phi\left(\alpha_2 - \bar{\boldsymbol{z}}_{|D_{ZLB}=1} \delta\right)$ within the zero lower bound regime and $\partial p_1(\boldsymbol{z}) / \partial x_k = \gamma_k \phi\left(\alpha_2 - \bar{\boldsymbol{z}}_{|D_{ZLB}=0} \delta\right)$ when interest rates are away from it. See also Wooldridge (2002), Chapter 15.

[14] We have also calculated marginal effects at more percentiles of the inflation expectation distribution, i.e., at the 10th, 25th, 50th, 75th, and 90th percentiles, and found similar values.

time-varying inflation dispersion as a measure of time-varying idiosyncratic inflation uncertainty. The coefficient on the zero lower bound dummy is positive and significant, suggesting that households were more likely to have a favorable attitude about buying durables in the period 2008-2012. This may seem puzzling, but recall that this coefficient measures the effect of the zero lower bound regime holding all other control variables fixed. One interpretation of this positive coefficient is that non-standard policy actions, particularly in the form of bailouts and fiscal stimulus, led households to have more optimistic buying attitudes than otherwise would have been warranted given observed economic conditions.

For the expected one-year inflation rate, we obtain a negative coefficient ($\beta_1 = -0.0009$), which is even more negative when the economy is at the zero lower bound for nominal interest rates ($\beta_2 = -0.0112$). The former is statistically not significantly different from zero, while the latter is significant at the 1 percent level. Moreover, the marginal effect of expected inflation on spending is equal to -0.0002 for times of positive interest rates, meaning that a 1 percentage point increase in expected inflation approximately lowers the probability that households have a positive attitude towards spending by 0.02 percentage points. The adverse effect of inflation expectations on willingness to spend is larger and statistically significant when evaluated at the zero lower bound (the marginal effect is -0.47 percentage points). This violates standard Fisherian logic; it is, however, consistent with the results from Van Zandweghe and Braxton (2013), who argue that in recent times the real interest rate sensitivity of durables purchases has declined, which would mean that whatever positive effect expected inflation might have on durables spending through the interest rate channel might have been weakened in recent times and other, negative effects might have become stronger.[15]

Whether the zero lower bound binds or not, the impact of inflation expectations on desired spending is small in absolute value. To quantify the implied effect of higher expected inflation on aggregate spending, we estimate a bivariate VAR with the aggregate index for buying conditions for durable goods (see Figure 1) and the cyclical component of the natural logarithm of aggregate real durable consumption expenditure (see Figure 2). We order the buying conditions index first. Figure 5 shows the impulse response of real durable consumption expenditure to a shock to the buying conditions index, where the size of this shock is computed from the estimated marginal effects of a one percentage point increase in expected inflation from our baseline regression (see Table 1), either outside (left panel) or inside (right panel) the zero lower bound. In periods of positive interest rates, there is essentially no effect of higher expected inflation on aggregate real durable consumption expenditure. Inside the zero lower bound the impact effect is -0.1 percent. Though statistically significant, this effect is tiny given the overall volatility of monthly real durable consumption expenditure of 3.7 percent.

[15]The fourth panel of Table 3 shows that this result is not driven by us imperfectly controlling for aggregate effects, because a specification with month fixed effects and no aggregate controls yields essentially identical results.

The impact of inflation expectations on desired spending is also small when compared to the impact of other variables. For example, if the household reports a good one-year ahead business outlook versus a neutral one, the probability of reporting a positive attitude towards spending on durable households goods increases by almost 4 percentage points outside the zero lower bound episode, and by 5 percentage points inside it. Similarly important are the current financial situation of the household relative to the previous year and the overall trust in economic policy. It is important to point out that these three variables maintain their positive influence and statistical significance across all specifications and data cuts we study, even when sample sizes are considerably smaller than in the baseline. This means that the main robust impact factors for spending decisions on durables are idiosyncratic expectations about both idiosyncratic and aggregate economic conditions as well as the trust of the households in the competence of economic policy makers.

The fact that these other putatively important idiosyncratic determinants of spending decisions show up consistently and significantly the way economic theory predicts is a strong argument against the view that in survey data people just do not respond accurately. Rather, our results suggest that they do and that inflation expectations are really different from the other impact factors. Either inflation expectations are reported truthfully, but do not matter for spending decisions, or they are reported inaccurately, because they are unimportant to households. Either way, they do not seem to be very important for economic decision making for the households in the Michigan Survey of Consumers.

Furthermore, the expected change in nominal interest rates has a significant impact on spending attitudes with a sign that conforms to standard intuition – when households expect interest rates to rise in the future, they are about 1.3 percent more likely to report a positive attitude toward buying durable goods in the present. This warrants some explanation: as the discussion of buying reasons for durables in the online appendix shows, the question about future interest rates is framed in a way that low current interest rates are good for spending now, whereas declining future interest rates are bad for current spending. The idea is that if households can borrow at lower interest rates later they may postpone their spending until this lower interest rate can be locked in. Implicit here is a violation of an arbitrage condition connecting current long term interest rates with expected future short term rates; otherwise lower future interest rates should lead to lower long term interest rates in the present, which should foster current spending, not hinder it. However, if this arbitrage condition is violated in the real world, as the wording in the survey seems to suggest, the sign that we find in the baseline regression is to be expected. Households understanding (at least qualitatively) how nominal interest rates impact the real margin of substitution between today's and tomorrow's consumption, while apparently not understanding how inflation expectations change this margin, may point to a

lack of understanding of the concept of real interest rates for many households. In other words, households may suffer from nominal illusion with respect to interest rates.

5.2 Robustness and Extensions

This subsection considers a number of robustness checks and extensions to the baseline specification, described in detail below.

5.2.1 Excluding Idiosyncratic Expectations Controls

We re-run our baseline probit model and successively omit different idiosyncratic expectations control variables. Our objective in doing so is to try to gain some insight into the various channels that may be at work connecting expected inflation and spending attitudes.

In a first variation on the baseline specification (see the upper panel of Table 3), we exclude the economic policy trust variable from (Q12) to gauge whether higher inflation expectations work through the "policy distress" channel advocated by Paul Volcker and John Taylor and described in the Introduction. If this were the case the marginal effects should become more negative when the economic policy trust variable is left out of the regression model. We indeed find this decline in the marginal effects, but not in a statistically significant way. Of course, in this specification we still control for other idiosyncratic expectations variables, like expected business conditions, which are likely to be positively correlated with economic policy trust.

Therefore, we proceed in dropping all idiosyncratic expectations from the probit model as controls (see the third panel of Table 3); i.e., in addition to the economic policy trust variable, we also leave out the expected financial situation of the household (Q4), its expected real income (Q5), the expected change in the nominal interest rate (Q6), the expected unemployment rate (Q9), and both the one-year and five-year expected aggregate business conditions (Q7 and Q8, respectively). One might be concerned that in general equilibrium inflation expectations really work through growth or unemployment expectations – when one household expects higher inflation, others might expect higher inflation, resulting in greater spending, more demand, and greater future income. Thus, controlling for expectations about the future state of the economy might be preventing higher expected inflation from showing up with a positive effect on spending attitudes. The third panel of Table 3 shows, however, that the impact of increased inflation expectations on the reported readiness to spend on durable consumption goods becomes even more negative when idiosyncratic expectations controls are excluded from the empirical model. Moreover, the coefficient on expected inflation ($\beta_1 = -0.0086$) becomes significantly different from zero, which is also the case for both marginal effects (-0.0027 at $D_{ZLB} = 0$ and -0.0075 at $D_{ZLB} = 1$).

This means that increased inflation expectations appear to be negatively impacting spending attitudes because in part they signal bad economic times and potentially uncertain stabilization policy stances ahead. This is at least consistent with, if not dispositive of, a Volcker-Taylor policy distress channel of inflation. When we include the policy trust variable and the other idiosyncratic expectation variables, we effectively control for this effect and the coefficient on inflation expectations comes out close to zero and statistically insignificant, at least during normal times.

5.2.2 Gas Price Expectations, Home Ownership, and Subjective Job Loss Probabilities

As a next robustness check, we add the expected one-year change in the price of gasoline in cents per gallon, based on (Q15), to our baseline model. It might be the case that households' primarily have gas price changes in mind when asked about their expected inflation rate and not controlling for gas price expectations might thus contaminate our results. We also add a dummy which takes on unity if the respondent owns a house and zero if not ('Home Owner') as an additional demographic control in order to proxy for the wealth level of the household. Finally, we also include the subjective probabilities for real income gains (Q13) and job loss (Q14), denoted in percentage points. The latter addition is potentially important, since it allows us to control for general idiosyncratic optimism and pessimism in a more continuous way than with the largely qualitative controls in the baseline specification. Furthermore, the question on the probability of a job loss during the next 5 years is particularly interesting since we have not included a measure for the individual job situation (as opposed to the overall unemployment rate) so far. While the data on gas price expectations and homeownership are available from 1990 on, the questions on subjective probabilities for real income gains and job loss were introduced into the survey only from 1998 on. We present the specification with all four additional controls, i.e., on a sample from 1998:01 onwards.

In the fourth panel of Table 3 we show that the one-year gas price expectations have a negative impact on the reported readiness to spend on durables, statistically significantly so, both inside and outside the zero lower bound. This is consistent with a negative supply/wealth shock view of higher gas prices. With respect to the effect of increased inflation expectations on the reported readiness to spend on durables, our baseline results of essentially no effect outside the zero lower bound and a mildly negative impact during the zero bound are qualitatively the same. Interestingly, the effects get weaker relative to the baseline estimation, which means that part of the negative effect we are picking up in the baseline specification might indeed be driven by gas price expectations and their negative supply/wealth effects.

In terms of the other new controls in this specification, the impact of home ownership is negative, which is perhaps counterintuitive. However, the impact of home ownership is not

significantly different from zero and measures the effect of home ownership after controlling for current and expected household income. The probability that households report a positive attitude towards spending increases with the probability of real income gains and decreases with the probability of a job loss, as expected.

5.2.3 Five-to-Ten-Years Inflation Expectations

We show the estimation results for the specification were we replace one year ahead expected inflation with the five-to-ten-year inflation expectations in the sixth panel of Table 3. There is a possibility that longer-term inflation expectations conform better with the time horizon for the buying decision on some consumer durables. Because of the availability of the long-term inflation expectations only from 1990:4 on, we have to estimate this specification on a somewhat smaller sample. In line with our baseline findings, we estimate a near-zero effect for the expected five-to-ten year inflation rate on the reported readiness to spend on durables for the time before the zero lower bound period, and a statistically significant (at the 10 percent level) negative marginal effect during the recent months (-0.0026).

5.2.4 Results Using the Panel Component of the Michigan Survey of Consumers

While including a wide range of idiosyncratic expectations should help control for idiosyncratic optimism and pessimism directly, in this subsection, we make use of the overlapping panel dimension of the data as an alternative. As described in Section 2, many of the households interviewed in the Michigan Survey are interviewed again six months later. This means that, for most households, we have a set of observations at two different points in time.[16]

Some results making use of the panel component are shown in Table 4. In a first specification, we keep the left hand side ordinal readiness to spend variable the same, but replace the level of expected inflation on the right hand side with its first difference across interviews. This means that the identifying variation in expected inflation is across time (for an individual), and is not driven by level differences in expected inflation in the cross-section. We indeed do observe a small change in the results in that *outside* the zero lower bound there is a small and statistically significant positive effect running from the change in expected inflation to readiness to spend. In particular, households that experience a one percentage point higher increase in

[16]Roughly 75 percent of households are interviewed twice. The reason this differs from the 60 percent new, 40 percent second interview nature of the sample described in Section 3 is because of a stock/flow distinction. Each month, about 285 households are new, while 215 are households were interviewed six months prior. This generates an approximate 60/40 flow split in any month, but $215/285 \approx 75$ percent of all households end up being re-interviewed. This means that the sample size focusing on households who are interviewed twice should be roughly 75 percent as large as when we focused on first time interviews only in Table 1. This is indeed the case: there are approximately 52,000 observations in Table 4 and 68,000 in Table 1.

expected inflation than the average household are about 0.1 percent more likely to report that now is a good time to buy durables. *Inside* the zero lower bound the point estimate remains negative (though statistically insignificant). In other words, the result from our baseline specification that expected inflation has a lower (less positive, or more negative) impact on buying attitudes at the zero lower bound still obtains.

In a second specification, we difference both the left and right hand side variables of interest – that is, the (ordinal) *change* in buying attitudes is on the left hand side and the *change* in expected inflation is on the right hand side. Here the results are almost identical to our baseline analysis. In particular, the estimated effect of expected inflation on buying attitudes during times of positive interest rates is negative, but small and statistically insignificant. At the zero lower bound, the impact of higher expected inflation on buying attitudes is more strongly negative (in both the economic and statistical senses). Taken together, these results are somewhat mixed, but in our view do not make the case for an important inflation expectation management channel, particularly given the conventional wisdom that the effect of more expected inflation on spending should be larger at the zero lower bound, not smaller.

In the online appendix to this paper we make another use of the panel dimension of the Michigan Survey of Consumers where we run a control function approach with past inflation expectations as instruments for current inflation expectations.[17] The concern here is that one might be worried that reporting or measurement error in expected inflation induces an attenuation bias. We do find some evidence for this effect: the marginal effects of higher expected inflation both inside and outside the zero lower bound are estimated to be more negative than in our baseline analysis. Economically, the estimated effects are nevertheless still quite small.

5.2.5 Cross-sectional Heterogeneity

In the next set of results we explore whether our main findings differ across demographic groups: (i) "old" vs. "young", split at the mean age of respondents in the sample of 48; (ii) college degree vs. no college degree; (iii) "rich" vs. "poor" (reported income in the top twenty percent for that year vs. in the bottom twenty percent); and (iv) "accurate" (in an ex post sense) or "reasonable" (in an ex ante sense) inflation forecasters vs. those with poor forecasts. For the latter, we successively run our baseline specification on those respondents who (a) remained within a band of plus/minus one time series standard deviation of the realized annual inflation rate for which they were forecasting (128 basis points); (b) remained in their two interviews within one time series standard deviation of the actual annual inflation rate, in order to ensure that there is some consistency and not mere luck to their inflation expectations accuracy; (c) remained within a

[17] The so-called "control function" approach is the standard way of using instrumental variables in a nonlinear regression model, such as an ordered probit.

band of plus/minus 50 basis points of the actual annual inflation rate; (d) remained within a band of plus/minus 128 basis points of the average one-year inflation expectation in the Michigan Survey of Consumers; (e) remained within a band of plus/minus 128 basis points of the average one-year inflation expectations in the Survey of Professional Forecasters.[18] Specifications (a) to (c) are meant to focus on those respondents with ex post accurate inflation expectations, while specifications (d) and (e) focus on ex ante reasonable inflation expectations.

The estimation results are shown in Table 5. Except for the case of inflation expectation accuracy and reasonableness, the coefficients on expected inflation in each specification turn out to be very similar to one another and close to the baseline estimates – the coefficients are usually negative and always small in an absolute sense. The differences in the coefficients across groups are negligible, both statistically and economically. When we split the sample into those respondents who have been ex post close (or even close twice) to the actual inflation rate for the time period for which they gave a forecast ("accurate inflation expectations"), or into respondents who are close to the average expectation in the Michigan survey ("reasonable inflation expectations"), we indeed find a positive effect from inflation expectations to spending, which is larger in the zero lower bound episode.[19] These effects are not statistically significant, except for the case of ex post very good inflation expectations that remained within a band of plus/minus 50 basis points of the actual annual inflation rate, where the marginal effect of inflation expectations on spending readiness is 3.8 percentage points.[20] Interestingly, as Table 5 also shows, having good inflation expectations is not strongly correlated with education, at least given the coarseness with which the latter is observed in the Michigan Survey. Over the entire baseline sample, 40.5 percent of respondents report having a college degree; conditional on having an ex post accurate inflation expectation there is not a large difference in this fraction (43.9 percent).[21]

Table 6 presents the results from the baseline ordered probit run separately on seven different birth cohorts. We define a birth cohort as a decade from 1920-1929, 1930-1939, etc. Additionally, we look at, respectively, respondents born before 1920 and after 1970. This is to test whether the relationship between inflation expectations and spending is different for households that have lived through or were collectively influenced by very different inflationary episodes. The answer is negative: just as for the pooled sample, spending inclinations on household durables are negatively related to inflation expectations for almost all birth cohorts, especially during the zero lower bound period, and the effect is always small in absolute value.

[18] We get this quarterly time series from the Federal Reserve Bank of Philadelphia and simply impose the quarterly observation equally on the three months within that quarter to be consistent with our baseline monthly frequency.

[19] For those that are close to the Survey of Professional Forecasters the baseline results do not change.

[20] Table 5 also reports that the complement sample, those that stayed outside a band of plus/minus 50 basis points of the actual annual inflation rate, behaves essentially like the unsplit baseline sample.

[21] Here, we measure ex post accuracy as having remained within a band of plus/minus 50 basis points of the actual annual inflation rate.

Finally, Table 7 splits our baseline sample into four inflation expectation quartiles. The inflation expectation quartiles are computed for each month in the sample, then a pooled ordered probit is run on each of these four groups.[22] The average inflation expectation in the lowest quartile is -0.19%, 2.64% in the second quartile, 4.70% in the third, and 9.98% in the highest quartile. While the results for quartiles two to four are similar to the baseline results – essentially no effect of inflation expectations on spending readiness – the results for the lowest quartile are different, at least outside the zero lower bound episode. For these households, who on average expect deflation, a one percent increase in expected inflation in the period before 2007 *raises* the probability to have a positive attitude towards spending by about 0.7 percentage points. This result is statistically significant. For households that on average expect deflation, a little more inflation, i.e., a development back towards price stability, evidently is a good economic sign that stimulates demand, at least in normal times. However, during the recent zero lower bound episode, even for this group increased expected inflation has very little effect on spending attitudes.

Together, these results by age, education, income, inflation expectation accuracy / reasonableness, birth cohort and inflation expectation quartile show that the baseline results are not driven by a specific education group, the ability to borrow (proxied with the results by income), or a specific collective historical inflation experience. It seems to be the case, however, that households that are good or reasonable inflation forecasters – likely those that follow economic news and keep on tap with macroeconomic developments – respond with somewhat bullish buying attitudes to an increase in expected inflation, as would be predicted via the standard Euler equation argument in Section 2. These households, however, comprise a relatively small fraction of all households in the survey.

5.2.6 Time Variation

As a further check, we investigate whether our results change over time. To that end, we estimate our baseline specification with one-year inflation expectations and household durables for each year between 1984 and 2012 and report in Figure 6 the time-varying coefficient on expected inflation (upper panel) as well as its time-varying marginal effect (lower panel). The figures show the point estimates/marginal effects (solid line) together with a 95 percent confidence interval (gray shaded area). The coefficients and marginal effects are rather stable over time. The estimates are always small in absolute value and rarely significantly different from zero. Consistent with our baseline estimates, in most years the coefficient and marginal effect

[22] We have also run a version of the baseline specification where we included the square of the inflation expectations term and its interaction with D_{ZLB}, but found almost exactly the same marginal effects as in the baseline specification.

are negative. Interestingly, at the end of the sample (well into the zero lower bound period), if anything the relation between expected inflation and spending readiness has become more negative.

The fact that our results are robust within time periods is comforting. When pooling cross-sectional data across time, one might be concerned that regression coefficients are identified off of "across" time variation rather than "within" time variation. For example, one might worry that respondents in the early part of the sample had, on average, high expected inflation and poor buying attitudes, while in the later part of the sample buying attitudes were better on average and expected inflation lower. This "across" period time series variation would tend to push the estimated correlation between expected inflation and spending attitudes negative, even if the true "within" period correlation were positive. That we find very similar effects focusing on purely "within" time period variation suggests that our results are not plagued by this kind of problem.

6 An Interpretation of the Results and Conclusion

Naturally, caution is in order when using reduced-form results to draw policy conclusions. However, our result that buying attitudes for durable goods are largely unrelated (or negatively related, particularly during the recent zero lower bound period) to expected inflation is pervasive and robust across the majority of U.S. households. In particular, this result is robust across a variety of socio-demographic indicators, such as age, education and income. It also obtains across birth cohorts, suggesting that having lived through different periods of inflation levels and volatility as well as different monetary policy regimes does not affect the underlying relationship between inflation expectations and spending readiness. A similar conclusion can be drawn from the fact that our results are stable across time. The one exception are the results split by ex post inflation expectation accuracy and ex ante inflation expectation reasonableness, which perhaps suggest that households that are macroeconomically informed behave according to the inflation expectation spending nexus that the Euler equation argument predicts.

Two observations as to the economic mechanisms behind our findings are worth noting: expected future nominal interest rates have a significantly positive effect on spending today, but inflation expectations have a zero to small negative effect. Also, as the online appendix shows, car loan rates and mortgage rates have a significantly negative effect on the readiness to buy cars and houses, respectively. We interpret this as consistent with a lack of understanding of the connection between real interest rates, nominal rates, and expected inflation on the part of households, apparently pervasively through education, income, and most other demographic groups. Attanasio and Weber (1993) argue that consumption expenditures do react mildly to

real interest rates in micro data. Their analysis does not decompose real interest rates into the nominal rate and expected inflation, however. We do find that buying attitudes are significantly influenced by nominal interest rates (and expectations thereof) in the direction predicted by basic theory, at least in a qualitative sense. Hence, one interpretation of our results is that they point to the possibility of nominal illusion with respect to interest rates.

However, this does not mean that inflation expectations are not relevant for the spending attitudes of households: when we no longer control for the other idiosyncratic expectations, including the economic policy trust variable, inflation expectations do impact households' spending attitudes significantly in the negative direction, both inside and outside the zero lower bound. This is at least consistent with, if not dispositive of, a Volcker-Taylor view that high inflation portends bad and uncertain economic times.

To the extent that we find significantly negative effects from inflation expectations to spending attitudes, our results are also consistent with a negative wealth effect from an expected inflation tax a la Aruoba and Schorfheide (2011), or nominal wage rigidities that are pervasive enough to cause negative wealth effects through inflation, which are not completely controlled for by the expectation variables in the Michigan survey. Also, it seems to be the case that inflation expectations for the overall population are partially driven by their gas price expectations, the increase of which would work like a negative supply/wealth shock.

All these results taken together at least intimate that the lack of a positive relationship between inflation expectations and spending readiness for a large number of U.S. households is perhaps indeed a structural property of the U.S. economy. While we are of course aware that our reduced-form results are potentially subject to the Lucas critique, using the best data available we nevertheless think that these results tell a cautionary tale about the notion that stabilization policy at the zero lower bound should attempt to generate inflation expectations to lower real rates and stimulate spending. At the very least, they suggest that the monetary authority would have to overcome a tough communication or education problem, in that it would have to convince the (on average uninformed) public that higher inflation for the foreseeable future is actually a good macroeconomic development. It would have to convince the public that higher inflation is associated with better business conditions and lower unemployment in the future, both factors that we do find to matter substantially for spending attitudes.

Finally, it should be noted that our results do not invalidate per se the underlying macroeconomic models, in particular the canonical Fisher and Euler equations, on which the policy recommendations in favor of engineering higher inflation expectations are based. For example, it could very well be that consumers have not yet understood the new policy regime at the zero lower bound, having a conventional forward-looking Taylor rule in their minds when they think about the consequences of higher expected inflation. A recent paper that applies our methodol-

ogy to the case of Japan, an economy with a much longer experience with zero nominal policy interest rates, indeed finds more support for a positive nexus between inflation expectations and spending (see Ichiue and Nishiguchi, 2013). Also, the U.S. economy has now for some time experienced a period of low inflation and low inflation volatility, which means that what we interpret as nominal illusion with respect to interest rates could really be the result of a lack of salience of inflation for most economic decision-makers, perhaps due to limited information processing capacities and rational inattention. This view is at least consistent with our results about the macroeconomically (un)informed. In other words, it could be that if monetary policy actually inflated and continued to credibly commit to higher inflation in the future, not only would inflation expectations readjust, but also the usual Fisherian logic might reappear. A final possibility could be that the envisioned channel – inflation expectations generating aggregate demand – works through investment rather than consumption expenditures, perhaps because decision makers in firms are better informed about macroeconomic developments than private households.

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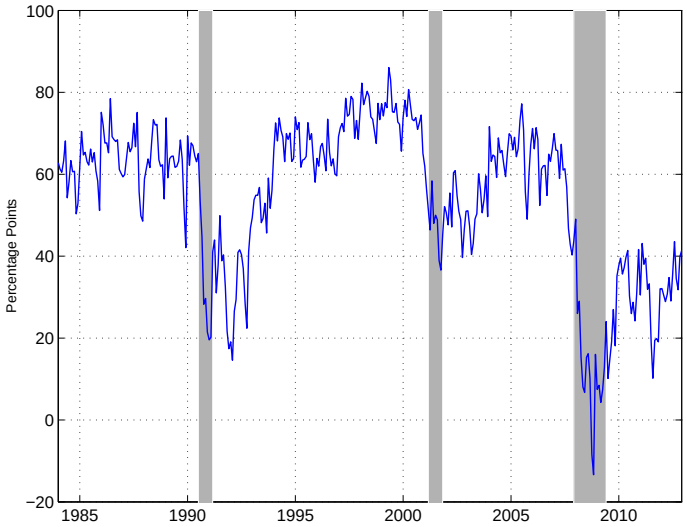
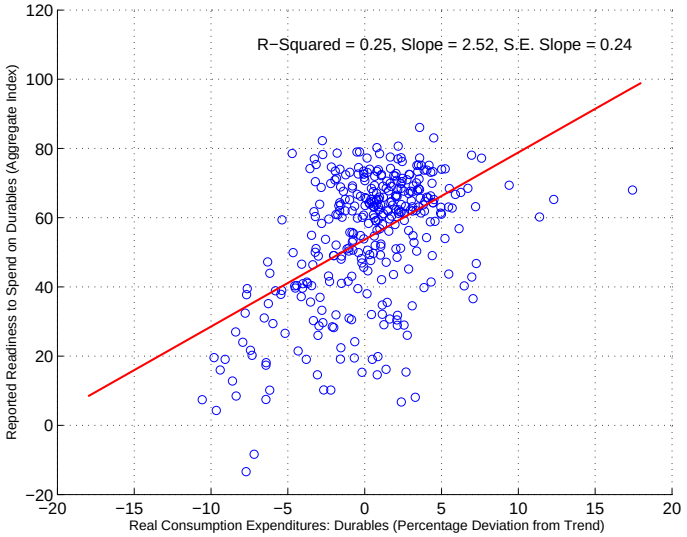
Figure 1: Buying Conditions for Durable Goods - Aggregate Index



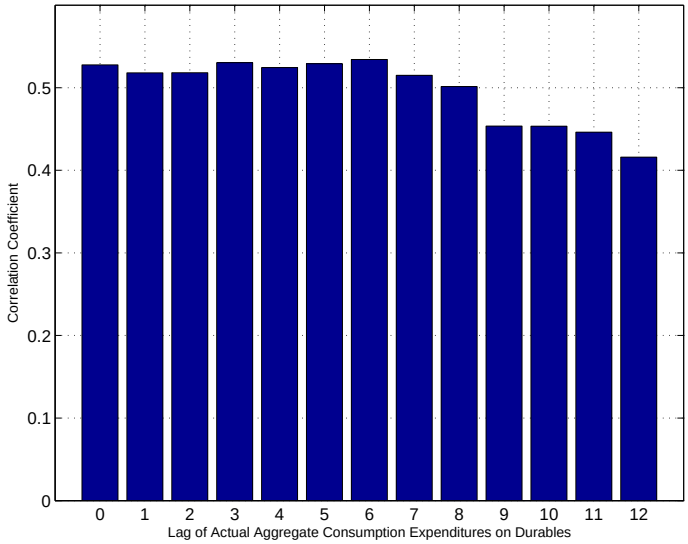
Notes: This figure shows the monthly time series of the fraction of people saying that now is a good time to buy durable goods minus those responding that now is a bad time to buy (solid line) together with U.S. recessions as dated by the NBER (gray shaded area). This aggregate index is based on (Q1). We have removed from the sample all month-household observations with inflation expectation observations that are larger than 20 percent in absolute value. The sample period is 1984:01 to 2012:12.

Figure 2: Relationship between Aggregate Actual Consumption Expenditures on Durables and the Reported Readiness to Buy Durables



Notes: This figure shows a scatter plot between the reported readiness to spend on durables (aggregate index, see notes to Figure 1) and the detrended actual aggregate spending series together with a fitted regression line. We use the monthly series on Real Personal Consumption Expenditures: Durables (DDURRA3M086SBEA) from the Federal Reserve Economic Database (FRED). We take the natural logarithm and apply an HP-filter (with smoothing parameter $\lambda = 129{,}600$) to the actual aggregate spending series in order to obtain a measure for the cyclical component of consumer spending. The sample period is 1984:01 to 2012:12.

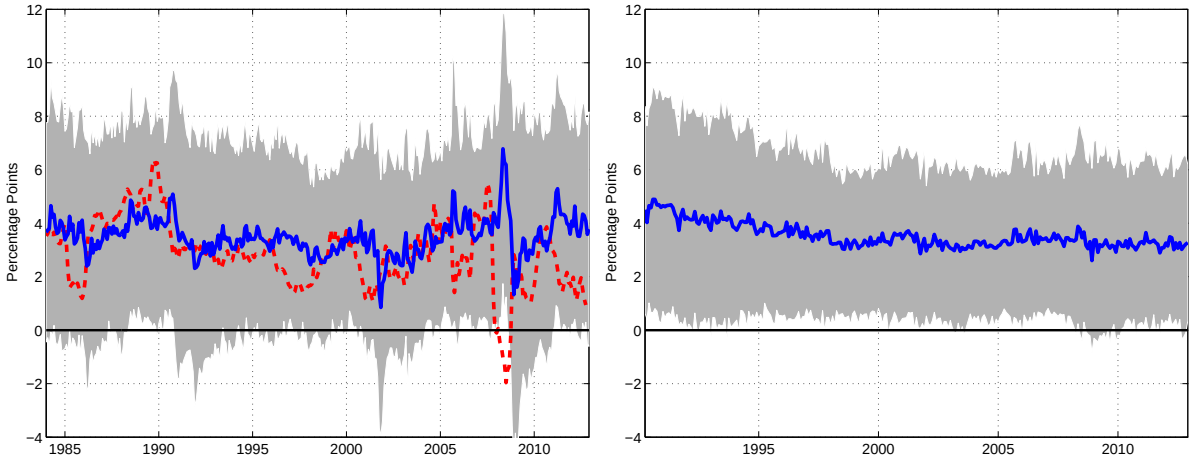
Figure 3: Dynamic Correlogram between Aggregate Actual Consumption Expenditures on Durables and the Reported Readiness to Buy Durables



Notes: See notes to Figure 2. This figure shows a dynamic correlogram between the reported readiness to spend on durables (aggregate index) and the detrended actual aggregate spending series.

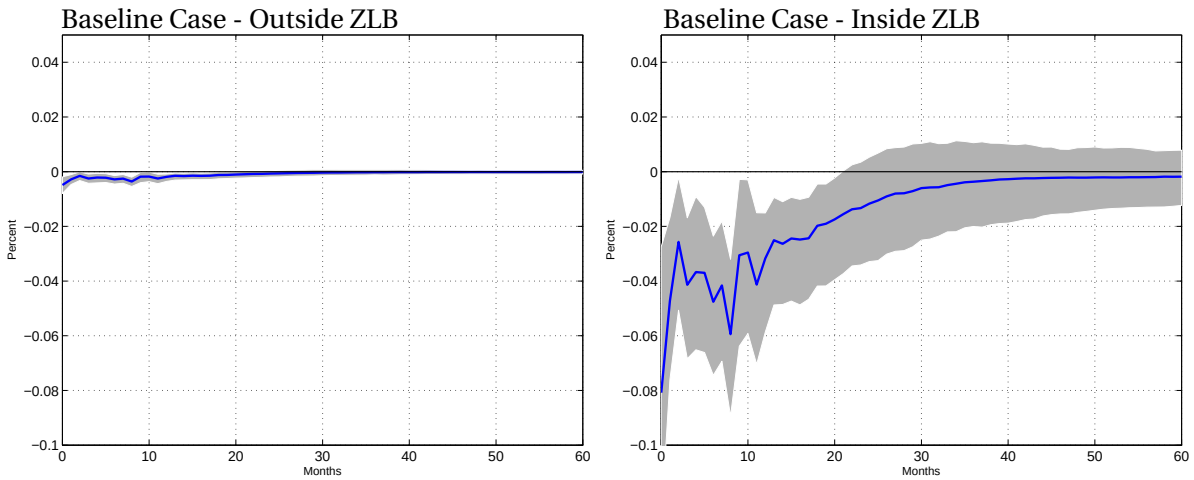
Figure 4: Inflation Expectations

One Year Ahead: Five-Ten Years Ahead:



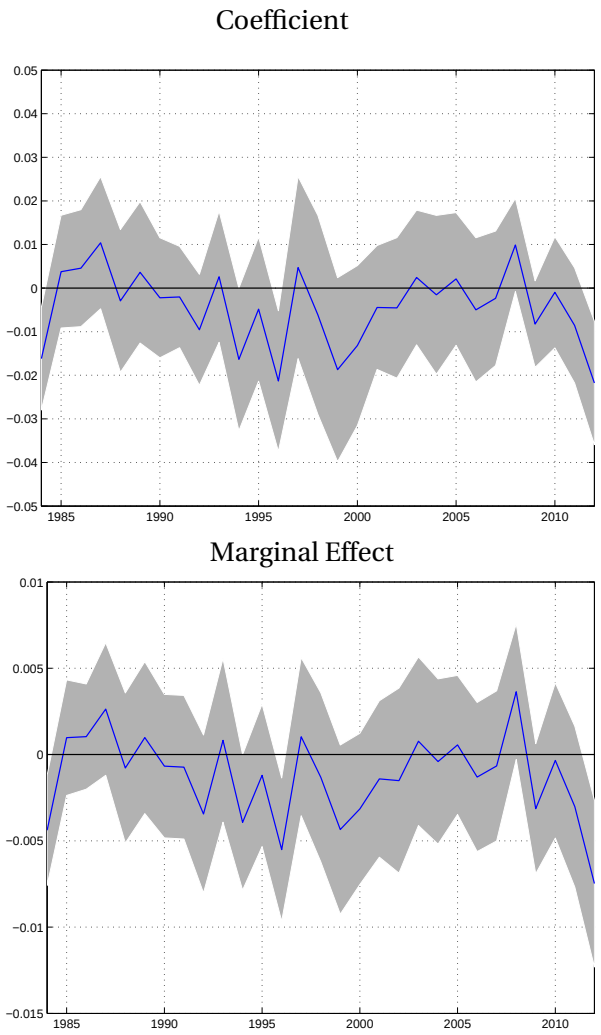
Notes: The left panel, labeled "One Year Ahead", plots the average one-year inflation expectations (solid line) together with the actual one-year-ahead inflation (dashed line) and a cross-sectional one standard deviation interval (gray shaded area). Inflation expectations in this panel are based on survey question (Q2). We have removed all month-household observations with inflation expectation observations that are larger than 20 percent in absolute value. Actual inflation, the timing of which has been brought in sync with the point in time for which inflation expectations were uttered, is based on the headline CPI (series CPIAUCSL from the St. Louis Federal Reserve Bank data base FRED). The sample period is 1984:01 to 2012:12. The last two inflation observations for November and December 2013 are missing. The right panel, labeled "Five-Ten Years Ahead", shows the average five-to-ten year annual inflation expectations together with the cross-sectional one standard deviation interval. Inflation expectations in this panel are based on survey question (Q3). We have removed all month-household observations with inflation expectation observations that are larger than 20 percent in absolute value.

Figure 5: Impulse Response Functions on Real Durable Consumption Expenditures



Notes: This figure shows the impulse response of real durable consumption expenditures from a bivariate VAR with the aggregate index for the buying conditions for durable goods (see Figure 1) ordered first and the HP-filtered (with smoothing parameter $\lambda = 129,600$) natural logarithm of real durable consumption expenditures (see Figure 2) ordered second, where the size of the innovation to the aggregate index is computed, respectively, from the marginal effects of a one percentage point increase in inflation expectations from the baseline scenario (see Table 1) outside and inside the zero lower bound. The sample period is 1984:01 to 2012:12.

Figure 6: Time-Varying Coefficient on Expected Inflation (1Y) in the Baseline Specification



Notes: The upper panel plots the estimated coefficient on one-year inflation expectations (β_1) in the baseline specification together with a 95 percent confidence interval for each year, and the lower panel plots the associated marginal effect, along with the 95 percent confidence interval. The marginal effects are computed conditional on the means of the included control variables within that year. We have removed all month-household observations with inflation expectation observations that are larger than 20 percent in absolute value. The sample period is 1984:01 to 2012:12.

Table 1: Baseline Specification: Readiness to Spend on Durables and 1Y Inflation Expectations

Dependent Variable: Buying Conditions for Durables Number of observations: 67855	Sample: 1984:01 to 2012:12 Pseudo R^2: 0.0671		
		Marginal Effects	
Independent Variables	Coefficients	at $D_{ZLB}=0$	at $D_{ZLB}=1$
Inflation Expectations (1Y)	−0.0009	−0.0002	−0.0047***
	(0.0015)	(0.0004)	(0.0011)
ZLB Dummy Interacted with Expected Inflation (1Y)	−0.0112***		
	(0.0031)		
ZLB Dummy	0.1017***	0.0306***	
	(0.0315)	(0.0095)	
Expected Financial Situation of Household	0.0263***	0.0079***	0.0101***
	(0.0091)	(0.0027)	(0.0035)
Expected Real Household Income	0.0211**	0.0064**	0.0081**
	(0.0083)	(0.0025)	(0.0032)
Expected Change in Nominal Interest Rate	0.0436***	0.0131***	0.0168***
	(0.0074)	(0.0022)	(0.0029)
Expected 1Y Aggregate Business Conditions (Idiosyncratic)	0.1300***	0.0392***	0.0500***
	(0.0068)	(0.0020)	(0.0026)
Expected 5Y Aggregate Business Conditions (Idiosyncratic)	0.0623***	0.0188***	0.0240***
	(0.0068)	(0.0020)	(0.0026)
Expected Unemployment	−0.0652***	−0.0196***	−0.0251***
	(0.0089)	(0.0027)	(0.0034)
Current Financial Situation	0.1189***	0.0359***	0.0458***
	(0.0067)	(0.0020)	(0.0026)
Economic Policy Trust (Idiosyncratic)	0.1119***	0.0337***	0.0431***
	(0.0088)	(0.0026)	(0.0034)
Expected 1Y Aggregate Business Conditions (Index)	0.0016***	0.0005***	0.0006***
	(0.0003)	(0.0001)	(0.0001)
Cross-sectional Dispersion in Expected Inflation (1Y)	−0.0810***	−0.0244***	−0.0312***
	(0.0150)	(0.0045)	(0.0058)
VXO	−0.0047***	−0.0014***	−0.0018***
	(0.0008)	(0.0002)	(0.0003)
Federal Funds Rate	0.0230***	0.0069***	0.0088***
	(0.0036)	(0.0011)	(0.0014)
Civilian Unemployment Rate	−0.0504***	−0.0152***	−0.0194***
	(0.0065)	(0.0020)	(0.0025)
Current Inflation Rate	−0.0236***	−0.0071***	−0.0091***
	(0.0061)	(0.0018)	(0.0024)
Current Inflation Volatility	−0.0221***	−0.0067***	−0.0085***
	(0.0067)	(0.0020)	(0.0026)
Relative Price of Durable Goods	0.0015	0.0004	0.0006
	(0.0016)	(0.0005)	(0.0006)

Notes: This table shows the results from the ordered probit baseline estimation. '***', '**', and '*' denote significance at the 1 percent, 5 percent, and 10 percent level, respectively. Standard errors are in parentheses. The Zero Lower Bound (ZLB) Dummy takes on unity from 2008:12 to 2012:12 (and zero otherwise). Marginal effects measure the effect of a particular variable on the probability that households find buying conditions favorable in percentage points; evaluated inside and outside the ZLB regime with the remaining variables set at their respective conditional means. We have removed all month-household observations with inflation expectation observations that are larger than 20 percent in absolute value. The baseline specification has been run on the subsample of first interviews.

Table 2: Baseline Specification: Demographic Controls

Dependent Variable: Buying Conditions for Durables	Sample: 1984:01 to 2012:12		
Number of observations: 67855	Pseudo R^2: 0.0671		
		Marginal Effects	
Independent Variables	Coefficients	at $D_{ZLB} = 0$	at $D_{ZLB} = 1$
Sex	-0.0692^{***}	-0.0208^{***}	-0.0266^{***}
	(0.0109)	(0.0033)	(0.0042)
Married	-0.0014	-0.0004	-0.0005
	(0.0133)	(0.0040)	(0.0051)
College Degree	-0.0294^{**}	-0.0089^{**}	-0.0113^{**}
	(0.0120)	(0.0036)	(0.0046)
African American	-0.0116	-0.0035	-0.0045
	(0.0200)	(0.0059)	(0.0075)
Hispanic American	-0.1167^{***}	-0.0352^{***}	-0.0450^{***}
	(0.0248)	(0.0075)	(0.0096)
Native American	-0.0436	-0.0131	-0.0168
	(0.0551)	(0.0166)	(0.0212)
Asian American	-0.1473^{***}	-0.0444^{***}	-0.0567^{***}
	(0.0390)	(0.0118)	(0.0150)
Census Region: West	-0.0384^{**}	-0.0116^{**}	-0.0148^{**}
	(0.0158)	(0.0048)	(0.0061)
Census Region: Northeast	-0.0102	-0.0031	-0.0039
	(0.0161)	(0.0048)	(0.0062)
Census Region: South	-0.0145	-0.0044	-0.0056
	(0.0139)	(0.0042)	(0.0054)
Family Size	-0.0209^{***}	-0.0063^{***}	-0.0081^{***}
	(0.0047)	(0.0014)	(0.0018)
Age	-0.0197^{***}	0.0002	0.0007^{**}
	(0.0071)	(0.0002)	(0.0003)
Age^2	0.0004^{**}		
	(0.0001)		
Age^3	-0.0000^{**}		
	(0.0000)		
Current Real Household Income (in logs)	0.0525^{***}	0.0159^{***}	0.0202^{***}
	(0.0081)	(0.0025)	(0.0031)

Notes: See notes to Table 1. The demographic controls include a dummy which takes on unity for female respondents and zero for males ('Sex'); a dummy which takes on unity if the respondent is married and zero if not ('Married'); a dummy which takes on unity if the respondent holds a college degree and zero if not ('College'). Moreover, we include dummies for each race, except for non-Hispanic Caucasians, i.e., 'African American', 'Hispanic American', 'Native American', and 'Asian American' as well as for each census region, except for North Central, i.e., 'West', 'Northeast', and 'South'. We also add the family size, polynomials of the age of the respondent ('Age', 'Age^2', 'Age^3'), and a set of month dummies (not reported).

Table 3: Baseline Specification: Robustness Checks

Specification	Independent Variables	Coefficients	Marginal Effects at $D_{ZLB}=0$	Marginal Effects at $D_{ZLB}=1$
w/o Idiosyncratic Economic Policy Trust				
(N = 68535, Sample: 1984:01 to 2012:12)	Exp. Inflation (1Y)	−0.0017	−0.0005	−0.0049***
		(0.0014)	(0.0004)	(0.0011)
w/o Idiosyncratic Expectations				
(N = 81406, Sample: 1984:01 to 2012:12)	Exp. Inflation (1Y)	−0.0086***	−0.0027***	−0.0075***
		(0.0013)	(0.0004)	(0.0010)
w/ Gas Price Exp., Home Ownership, & Subjective Probabilities				
(N = 16828, Sample: 1998:01 to 2012:12)	Exp. Inflation (1Y)	0.0050	0.0014	−0.0029***
		(0.0037)	(0.0010)	(0.0011)
	Prob. of Job Loss	−0.0016***	−0.0004***	−0.0006***
		(0.0006)	(0.0001)	(0.0002)
	Prob. of Real Income Gains	0.0007	0.0002	0.0003
		(0.0007)	(0.0001)	(0.0002)
	Exp. Change in Gas Price (1Y)	−0.0007**	−0.0002**	−0.0003**
		(0.0003)	(0.0001)	(0.0001)
	Home Owner	−0.0248	−0.0068	−0.0095
		(0.0304)	(0.0084)	(0.0116)
Month Fixed Effects, No Aggregate Controls				
(N = 67860, Sample: 1984:01 to 2012:12)	Exp. Inflation (1Y)	−0.0012	−0.0004	−0.0037***
		(0.0015)	(0.0005)	(0.0010)
5Y Inflation Expectations				
(N = 47271, Sample: 1990:04 to 2012:12)	Exp. Inflation (5Y)	−0.0012	−0.0004	−0.0026*
		(0.0022)	(0.0007)	(0.0016)

Notes: This table displays a variety of robustness checks on the baseline specification, described in the column "Specification". All of the standard controls from the baseline specification are included in each regression, but their coefficients and standard errors are omitted in the table. Marginal effects at $D_{ZLB}=1$ are calculated based on the interaction coefficient between expected inflation and the ZLB dummy, which is omitted in the table. The number N in parentheses below each specification description is the number of observations used in the estimation of that specification; the time horizon of the various samples is also specified there. Like the baseline specification all these regressions have been run on the subsample of first interviews only. See also notes to Table 1.

Table 4: Results Using the Twice Interviewed Households

Dependent Variable: Buying Conditions for Durables Number of observations: 51607	Sample: 1984:01 to 2012:12 Pseudo R^2: 0.0748		
		Marginal Effects	
Independent Variables	Coefficients	at $D_{ZLB}=0$	at $D_{ZLB}=1$
Change in Inflation Expectations (1Y)	0.0031^{**}	0.0009^{**}	-0.0009
	(0.0015)	(0.0004)	(0.0010)
ZLB Dummy Interacted with Change in Expected Inflation (1Y)	-0.0057^{*}		
	(0.0032)		
Dependent Variable: Change in Buying Conditions for Durables Number of observations: 49547	Sample: 1984:01 to 2012:12 Pseudo R^2: 0.0081		
		Marginal Effects	
Independent Variables	Coefficients	at $D_{ZLB}=0$	at $D_{ZLB}=1$
Change in Inflation Expectations (1Y)	-0.0009	-0.0002	-0.0017^{***}
	(0.0013)	(0.0003)	(0.0006)
ZLB Dummy Interacted with Change in Expected Inflation (1Y)	-0.0059^{**}		
	(0.0029)		

Notes: For this table we use the sample of households that are interviewed twice. In the upper panel we replace inflation expectations with the change in inflation expectations between interviews. In the lower panel we, in addition, change the dependent variable by creating a new dummy variable: '+1', if the household increased its readiness to spend, '0', if it had the same qualitative level of readiness to spend and '-1', if it decreased it.

Table 5: Baseline Specification: Cross-sectional Heterogeneity

			Marginal Effects	
Specification	Independent Variables	Coefficients	at $D_{ZLB}=0$	at $D_{ZLB}=1$
Age > 48				
(N = 27775, Sample: 1984:01 to 2012:12)	Exp. Inflation (1Y)	−0.0008	−0.0002	−0.0052***
		(0.0024)	(0.0007)	(0.0014)
Age < 48				
(N = 40080, Sample: 1984:01 to 2012:12)	Exp. Inflation (1Y)	−0.0019	−0.0006	−0.0026**
		(0.0018)	(0.0005)	(0.0017)
College Degree				
(N = 27466, Sample: 1984:01 to 2012:12)	Exp. Inflation (1Y)	0.0022	0.0007	−0.0049***
		(0.0027)	(0.0008)	(0.0016)
No College Degree				
(N = 40389, Sample: 1984:01 to 2012:12)	Exp. Inflation (1Y)	−0.0026	−0.0008	−0.0039***
		(0.0017)	(0.0005)	(0.0014)
Top 20 % Income				
(N = 17341, Sample: 1984:01 to 2012:12)	Exp. Inflation (1Y)	0.0018	0.0005	−0.0057**
		(0.0034)	(0.0010)	(0.0025)
Bottom 20 % Income				
(N = 8638, Sample: 1984:01 to 2012:12)	Exp. Inflation (1Y)	−0.0053	−0.0016	−0.0048*
		(0.0034)	(0.0010)	(0.0026)
"Accurate" and "Reasonable" Inflation Expectations				
Within one time series std of actual inflation				
(N = 20814, Sample: 1984:01 to 2012:12)	Exp. Inflation (1Y)	0.0084	0.0025	0.0057
		(0.0097)	(0.0029)	(0.0083)
Within one time series std of actual inflation, 2x				
(N = 6551, Sample: 1984:01 to 2012:12)	Exp. Inflation (1Y)	0.0157	0.0044	0.0222
		(0.0184)	(0.052)	(0.0157)
Within 0.5 percentage points of actual inflation				
(N = 8577, Sample: 1984:01 to 2012:12)	Exp. Inflation (1Y)	0.0019	0.0006	0.0379**
		(0.0190)	(0.0056)	(0.0177)
Outside 0.5 percentage points of actual inflation				
(N = 59278, Sample: 1984:01 to 2012:12)	Exp. Inflation (1Y)	−0.0010	−0.0003	−0.0048***
		(0.0015)	(0.0004)	(0.0011)
Within 1.28 percentage points of mean inflation expectations				
(N = 22439, Sample: 1984:01 to 2012:12)	Exp. Inflation (1Y)	0.0040	0.0012	0.0019
		(0.0126)	(0.0038)	(0.0098)
Within 1.28 percentage points of mean SPF inflation expectations				
(N = 22061, Sample: 1984:01 to 2012:12)	Exp. Inflation (1Y)	−0.0218	−0.0066	−0.0200
		(0.0142)	(0.0044)	(0.0122)

Notes: This table displays estimation results, for a variety of subsamples, described in the column "Specification", using the baseline empirical specification. All of the standard controls from the baseline specification are included in each regression, but their coefficients and standard errors are omitted in the table. Marginal effects at D_{ZLB} = 1 are calculated based on the interaction coefficient between expected inflation and the ZLB dummy, which is omitted in the table. The number N in parentheses below each specification description is the number of observations used in the estimation of that specification; there the time horizon of the various samples is also specified. The time series standard deviation of the actual inflation rate (series CPIAUCSL from the St. Louis Federal Reserve Bank data base FRED) over the sample horizon 1984:01 to 2012:12 is 1.28 percentage points. Like the baseline specification all these regressions have been run on the subsample of first interviews only. See also notes to Table 1.

Table 6: Baseline Specification: By Birth Cohort

		Marginal Effects	
Birth Cohort	Coefficient	at $D_{ZLB} = 0$	at $D_{ZLB} = 1$
< 1920 ($N = 2470$)	0.0004	0.0001	0.0090
	(0.0066)	(0.0010)	(0.0195)
1920-1929 ($N = 4822$)	0.0031	0.0008	0.0066
	(0.0051)	(0.0013)	(0.0047)
1930-1939 ($N = 6946$)	−0.0060	−0.0018	−0.0062*
	(0.0048)	(0.0014)	(0.0034)
1940-1949 ($N = 12478$)	−0.0037	−0.0011	−0.0074***
	(0.0036)	(0.0011)	(0.0026)
1950-1959 ($N = 17413$)	−0.0018	−0.0005	−0.0067***
	(0.0029)	(0.0009)	(0.0022)
1960-1969 ($N = 14771$)	−0.0001	−0.0000	−0.0045*
	(0.0032)	(0.0010)	(0.0023)
> 1970 ($N = 8955$)	−0.0006	−0.0002	−0.0013
	(0.0041)	(0.0011)	(0.0023)

Notes: This table presents separate regressions using only observations from individuals in a particular birth cohort. All of the standard controls from the baseline specification were included in the estimation, but omitted in the table. The number N in parentheses refers to the number of observations in each cohort. The sample runs from 1984:01 to 2012:12, just as in the baseline specification. Like the baseline specification all these regressions have been run on the subsample of first interviews only. See also notes to Table 1.

Table 7: Baseline Specification: By Quartile of Inflation Expectation

		Marginal Effects	
Inflation Expectation Quartile	Coefficient	at $D_{ZLB} = 0$	at $D_{ZLB} = 1$
1. Quartile, $0-25\%$ ($N = 20606$)	0.0238^{***}	0.0067^{***}	-0.0002
	(0.0045)	(0.0012)	(0.0027)
2. Quartile, $25-50\%$ ($N = 18607$)	0.0014	0.0004	-0.0080
	(0.0174)	(0.0052)	(0.0126)
3. Quartile, $50-75\%$ ($N = 16447$)	0.0206	0.0062	-0.0055
	(0.0168)	(0.0051)	(0.0150)
4. Quartile, $75-100\%$ ($N = 12195$)	-0.0037	-0.0012	-0.0075^{**}
	(0.0038)	(0.0012)	(0.0030)

Notes: This table presents separate regressions using only observations from individuals in a particular inflation expectation quartile. The inflation expectation quartiles are computed for each month in the sample, then a pooled ordered probit is run on each of these four groups. When the boundary of a quartile was the answer of many respondents, all these respondents were put into the same quartile, which explains the different number of observations, N, across quartiles. All of the standard controls from the baseline specification were included in the estimation, but omitted from the table. The sample runs from 1984:01 to 2012:12, just as in the baseline specification. Like the baseline specification all these regressions have been run on the subsample of first interviews only. See also notes to Table 1.

Online Appendix for:

"Inflation Expectations and Readiness to Spend: Cross-Sectional Evidence"

Rüdiger Bachmann, Tim O. Berg, and Eric R. Sims

A Survey Questions Used

Q 1 *(A18)*[23] *"About the big things people buy for their homes – such as furniture, a refrigerator, stove, television, and things like that. Generally speaking, do you think now is a good or a bad time for people to buy major household items? "*

Q 2 *(A12b) "By about what percent do you expect future prices to go (up/down) on the average, during the next 12 months? "*

Q 3 *(A13b) "By about what percent per year do you expect prices to go (up/ down) on the average, during the next 5 to 10 years?"*

Q 4 *(A3) "Now looking ahead – do you think that a year from now you (and your family living there) will be better off financially, or worse off, or just about the sam as now? "*

Q 5 *(A14) "During the next year or two, do you expect that your (family) income will go up more than prices will go up, about the same, or less than prices will go up? "*

Q 6 *(A11) "No one can say for sure, but what do you think will happen to interest rates for borrowing money during the next 12 months – will they go up, stay the same, or go down? "*

Q 7 *(A4) "Now turning to business conditions in the country as a whole – do you think that during the next 12 months we'll have good times financially, or bad times, or what? "*

[23] The IDs beginning with the letter "A" are those used by the Michigan Survey.

Q 8 *(A8) "Looking ahead, which would you say is more likely – that in the country as a whole we'll have continuous good times during the next 5 years or so, or that we will have periods of widespread unemployment or depression, or what? "*

Q 9 *(A10) "How about people out of work during the coming 12 months – do you think that there will be more unemployment than now, about the same, or less? "*

Q 10 *(A2) "We are interested in how people are getting along financially these days. Would you say that you (and your family living there) are better off or worse off financially than you were a year ago? "*

Q 11 *"To get a picture of people's financial situation we need to know the general range of income of all people we interview. Now, thinking about (your/ your family's) total income from all sources (including your job), how much did (you/ your family) receive in the previous year? "*[24]

Q 12 *(A9) "As to the economic policy of the government – I mean steps taken to fight inflation or unemployment – would you say the government is doing a good job, only fair, or a poor job?"*

Q 13 *(A23a) "What do you think the chances are that your (family) income will increase by more than the rate of inflation during the next five years or so?"*

Q 14 *(A23b) "During the next 5 years, what do you think the chances are that you (or your husband/ wife) will lose a job that you wanted to keep?"*

Q 15 *(A20c) "About how many cents per gallon do you think gasoline prices will (increase/ decrease) during the next twelve months compared to now?"*

Q 16 *(A19) "Speaking now of the automobile market – do you think the next 12 months or so will be a good time or a bad time to buy a vehicle, such as a car, pickup, van or sport utility vehicle?"*

Q 17 *(A20a) "About how many cents per gallon do you think gasoline prices will (increase/ decrease) during the next five years compared to now?"*

[24] This question does not have an ID in the Michigan survey.

Q 18 *(A16) "Generally speaking, do you think that now is a good time or a bad time to buy a house?"*

Q 19 *(A22b) "What do you think will happen to the prices of homes (like yours) in your community over the next 12 months? Will they increase at a rapid rate, increase at a moderate rate, remain about the same, decrease at a moderate rate, or decrease at a rapid rate?"*

B Basic Correlational Analysis

In this appendix we explore some basic raw correlations between the one-year-ahead inflation expectations and the qualitative measures of readiness to spend (five-to-ten-years-ahead inflation expectations for the "readiness to spend on cars" question).[25] This is a more model-free look at the data, which, as we will show, supports the econometric analysis in the main body of the paper. The results are reported in Table 8. The correlation coefficient between expected inflation and the readiness to spend on durable goods is -0.047 when pooling observations across respondents and across time. This correlation is negative and small. In comparison, the bottom of the table shows the correlation between the reported readiness to spend and other idiosyncratic variables: expected aggregate business conditions, the current financial situation of the households, unemployment expectations and economic policy trust. These correlations are of the expected sign and are much larger in absolute value. In particular, the correlation between readiness to spend and expected aggregate business conditions (see Q7) is 0.222. As with buying attitudes about durable goods, the correlations between expected inflation and readiness to spend on cars and houses are also negative (-0.049 and -0.093, respectively), but still small in comparison to the correlations between readiness to spend and other idiosyncratic variables.

The remainder of Table 8 reports correlations between readiness to spend and expected inflation conditional on a variety of different demographic factors. These correlations are quite similar across groups, and with few exceptions range from -0.01 to -0.06 for readiness to spend on durables, similarly for readiness to spend on cars, and -0.08 to -0.10 for houses. Any differences between the magnitudes of the correlation coefficients appear to be quantitatively small and statistically indistinguishable.

Figure 7 plots the correlations between expected inflation and readiness to spend on durables, cars, and houses across time. The correlations are constructed by pooling the monthly observations within each year; the shaded gray regions are the 95 percent confidence intervals. The annual correlations typically range between 0 and -0.1 for all three spending categories and are, with few exceptions, significantly (in the statistical sense) negative. Importantly, the correlations for all three spending categories are quite stable, showing no obvious trend over time nor any clear relationship with the state of the business cycle. The notable exception is the recent zero lower bound episode, which, if anything, has seen a small decline of the already negative correlation coefficient, undermining somewhat the standard intuition of how inflation expectations ought to influence spending readiness during times of low interest rates.

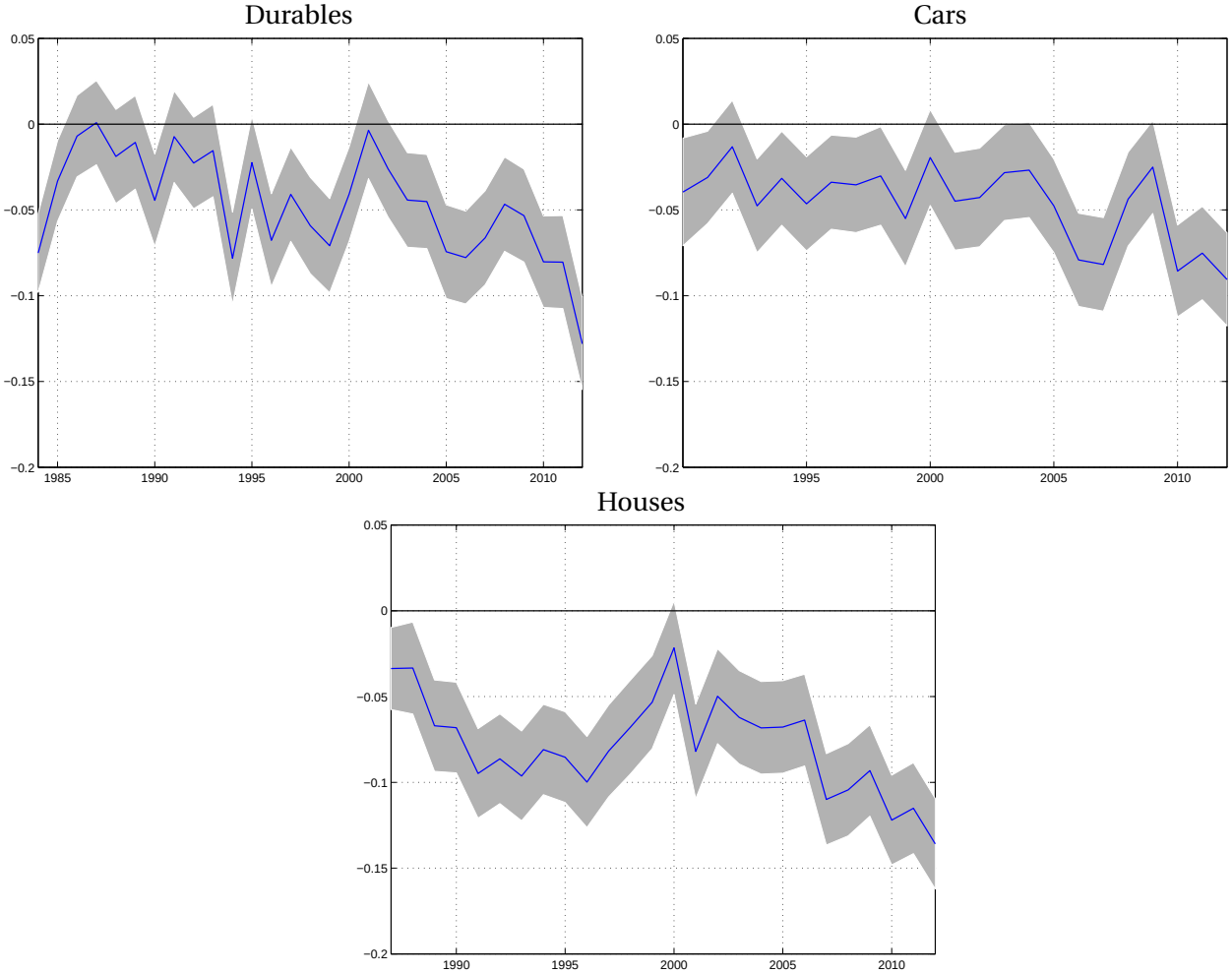
[25] Notice that the survey in Q16 asks households whether *the next twelve months or so* will be a good or a bad time to buy a car, in contrast to the questions about household durables and houses, where the reference time is *now*. Given the wording of the question, we need to ensure that inflation expectations lie strictly in the future relative to the purchasing horizon. We thus account for the fact that the question asks not whether *now* is a good time to buy a car but instead refers to the *next 12 months or so* by pairing up the "readiness to spend on cars" question only with expected inflation over a five-to-ten-years horizon.

Table 8: Correlation Between Reported Readiness to Spend and Expected Inflation

		Reported Readiness to Spend on		
		Durables	Cars	Houses
All Respondents		−0.047	−0.049	−0.093
Gender	Female	−0.044	−0.042	−0.094
	Male	−0.041	−0.052	−0.083
Age	Younger than 48 Years	−0.038	−0.048	−0.094
	Older than 48 Years	−0.059	−0.052	−0.092
Race	African American	−0.040	−0.027	−0.100
	Hispanic American	−0.041	−0.041	−0.090
	Native American	−0.038	−0.031	−0.074
	Asian American	−0.010	−0.040	−0.100
	Non-Hispanic Caucasian American	−0.048	−0.050	−0.090
Education	College Degree	−0.047	−0.047	−0.076
	No College Degree	−0.047	−0.045	−0.100
Marital Status	Married	−0.050	−0.055	−0.090
	Not Married	−0.042	−0.040	−0.092
Family Size	Single Person	−0.046	−0.043	−0.082
	Two Persons	−0.050	−0.050	−0.093
	Three Persons	−0.045	−0.055	−0.091
	Four and More Persons	−0.045	−0.049	−0.104
Census Region	West Region	−0.033	−0.041	−0.081
	Northeast Region	−0.038	−0.051	−0.086
	South Region	−0.061	−0.049	−0.107
	North Central Region	−0.045	−0.054	−0.091
Income Quintile	Top 20 Percent Income Distribution	−0.026	−0.045	−0.073
	60 to 80 Percent Income Distribution	−0.044	−0.045	−0.082
	40 to 60 Percent Income Distribution	−0.045	−0.045	−0.081
	20 to 40 Percent Income Distribution	−0.048	−0.041	−0.085
	Bottom 20 Percent Income Distribution	−0.048	−0.041	−0.083
Homeownership	Home Owner	−0.062	−0.052	−0.097
	Not Home Owner	−0.049	−0.042	−0.095
Birth Cohort	Born before 1920	−0.033	−0.008	−0.064
	Born between 1920 and 1929	−0.030	−0.015	−0.059
	Born between 1930 and 1939	−0.063	−0.053	−0.105
	Born between 1940 and 1949	−0.061	−0.059	−0.099
	Born between 1950 and 1959	−0.051	−0.067	−0.109
	Born between 1960 and 1969	−0.038	−0.051	−0.085
	Born after 1970	−0.038	−0.035	−0.099
Pooled Correlation of Other Idiosyncratic Expectations With Reported Readiness to Spend				
Expected 1Y Aggregate Business Conditions (Idiosyncratic)		0.222	0.177	0.161
Expected 5Y Aggregate Business Conditions (Idiosyncratic)		0.168	0.174	0.161
Current Financial Situation		0.162	0.114	0.101
Expected Unemployment		−0.139	−0.135	−0.126
Economic Policy Trust		0.169	0.154	0.126

Notes: This table shows the correlation coefficients between inflation expectations and the reported readiness to spend on durables, cars and houses - pooled across all respondents as well as conditional on various demographics. We use one-year inflation expectations (Q2) for durables and houses, and five-to-ten-years inflation expectations (Q3) for cars. We have removed all month-household observations with inflation expectation observations that are larger than 20 percent in absolute value. This table also shows the correlation coefficients between the reported readiness to spend on durables, cars and houses - pooled across all respondents - and the idiosyncratically expected (1Y) aggregate business conditions, based on (Q7), the idiosyncratically expected (5Y) aggregate business conditions, based on (Q8), the current financial situation, based on (Q9), the expected unemployment situation, based on (Q10), and the trust of the household in current economic policy, based on (Q12). The sample period is 1984:01 to 2012:12.

Figure 7: Time-Varying Correlation between Expected Inflation and Reported Readiness to Spend on Durables, Cars as well as Houses



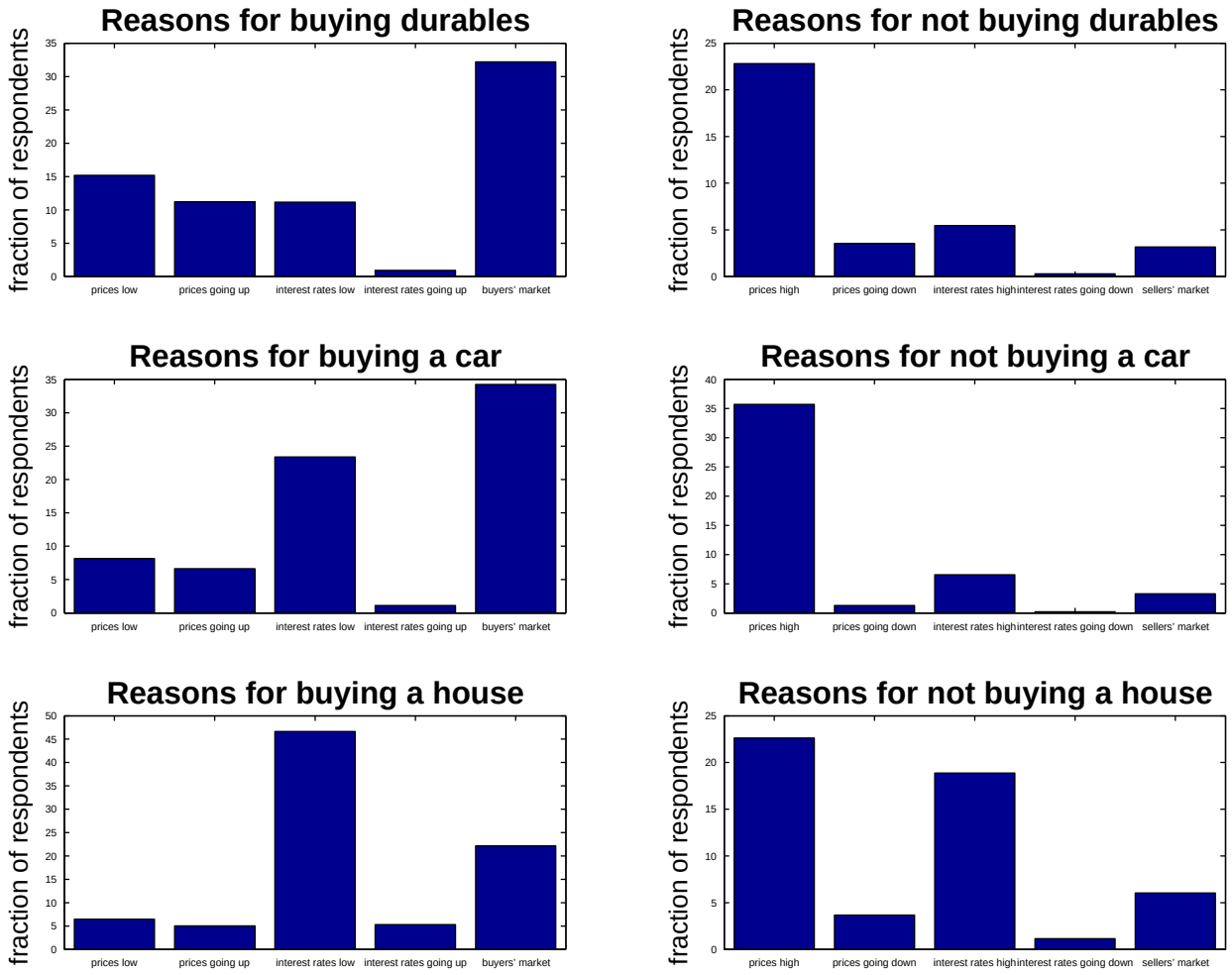
Notes: This figure shows the correlation coefficient between the reported readiness to spend on durables, cars, or houses (Q1, Q16, Q18) and inflation expectations (solid line) together with a 95 percent confidence interval (gray shaded area) year-by-year, where the monthly data were pooled within a year. We use one-year inflation expectations (Q2) for durables and houses, and five-to-ten-years inflation expectations (Q3) for cars. We have removed all month-household observations with inflation expectation observations that are larger than 20 percent in absolute value. The sample period is 1984:01 to 2012:12.

C Reasons for (Not) Buying Durables, Cars, Houses

In addition to asking about the readiness to spend on household durables, cars, and houses, the Michigan Survey of Consumers also asks households about their reasons for answering that it is a "good time" or a "bad time" to buy.[26] Reasons for answering "good time" can be: "prices low", "prices going up", "interest rates low", "interest rates going up" and "good buys available" (which we rendered as "buyers' market" in Figure 8 below). Reasons for answering "bad time" can be: "prices high", "prices going down", "interest rates right", "interest rates going down" and "sellers' market". As explained in the main text, the survey, and apparently respondents, view increasing interest rates as a potential reason to spend now, if in the future loans can only be taken out at a higher cost to the households; the converse holds for declining interest rates as a potential reason not to spend now. In practice, neither forward-looking variable, prices nor interest rates, are particularly important for the readiness to spend, which is mainly explained by current prices and current interest rates and whether the households have the impression that they get generally good products that can be acquired with good services attached and low hassle. Figure 8 below documents this very clearly. Focusing on the future prices reason, Figure 9 shows that, if anything, during the zero lower bound episode this reason loses importance in almost all six cases (durables, cars, houses and good / bad times), the exception being houses and why it is a bad time to buy them, where households in recent times indeed expected further house price deflation and simply waited.

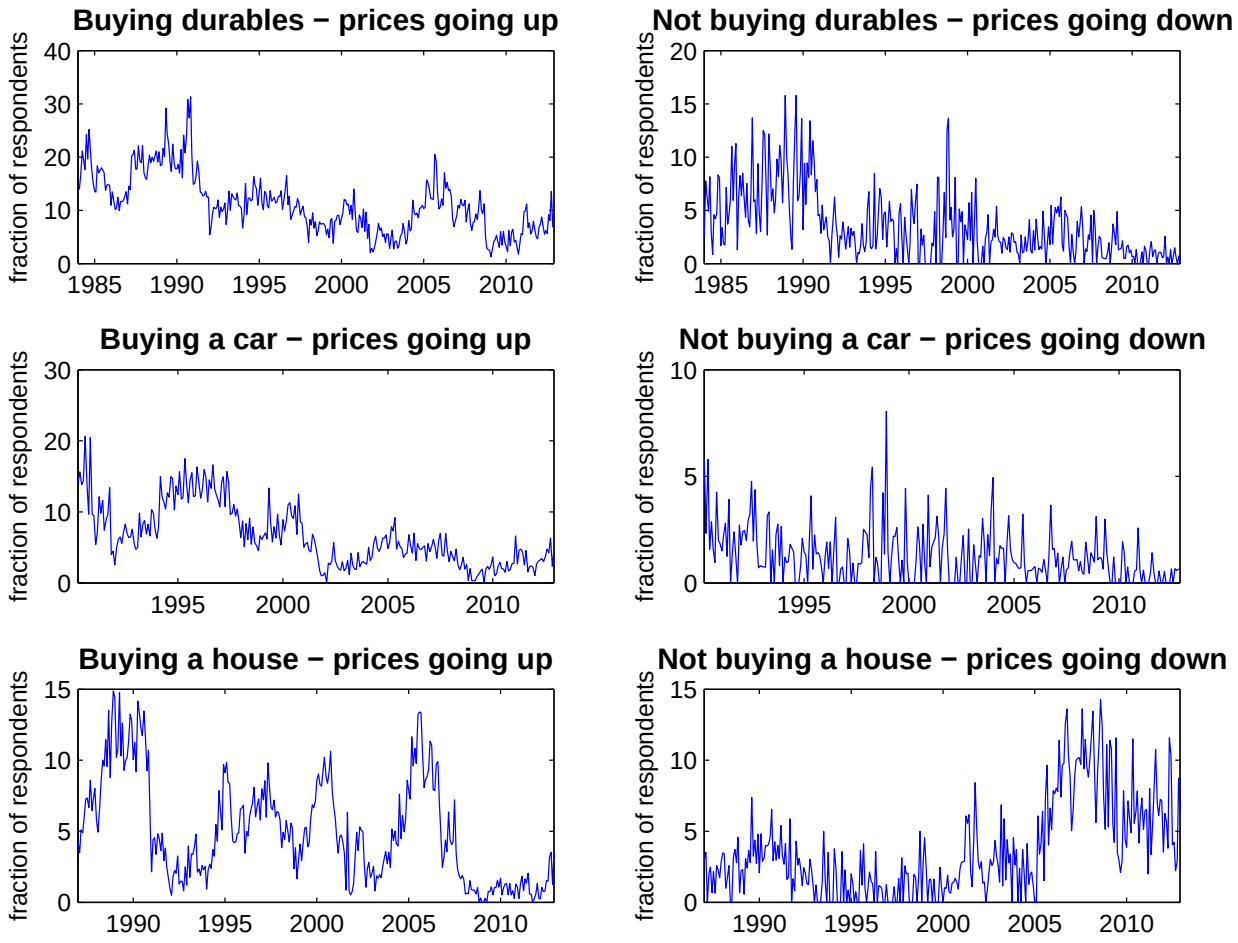
[26] Respectively, in survey questions *(A18a)* for durables, *(A19a)* for cars, and *(A16a)* for houses.

Figure 8: Average Frequency of Reasons for (Not) Buying Durables, Cars, Houses



Notes: This figure plots the time series average of the fraction of respondents in each of the five categories of reasons for buying durables, cars and houses ("prices low", "prices going up", "interest rates low", "interest rates going up" and "good buys available", which we rendered as "buyers' market"), and the five categories for reasons for not buying them ("prices high", "prices going down", "interest rates right", "interest rates going down" and "sellers' market"). The sample period is 1984:01 to 2012:12.

Figure 9: Time Series of the Frequency of Prices Going Up / Down



Notes: See notes to Figure 8. This figure plots the time series of the fraction of respondents for "prices going up" as a reason for buying durables, cars and houses, and the fraction of respondents for "prices going down" as a reason for not buying them.

D Ordered Probit Results for the Readiness to Spend on Cars and Houses

In this appendix we consider two extensions to our baseline estimation. In the first we use the responses to the "buying conditions for cars" question (Q16) instead of readiness to spend on durable household items; in the second we use buying attitudes about houses as the dependent variable (Q18). As with durable goods, both cars and houses are "big-ticket" purchases that ought to be sensitive to real interest rates and household wealth. Since the two main channels which proponents of "inflation-induced demand" point to are lowering real borrowing costs and devaluing existing debt, it is important to examine whether inflation expectations have effects on cars and houses.

Table 9 shows the results for cars, where we use the five-to-ten-years inflation expectations.[27] In addition to all the baseline controls (plus the 'Home Owner' dummy), we also include as independent variables the expected change in gasoline prices over the next five years in cents per gallon (Q17) and an aggregate measure of the car loan rate, in percentage points.[28] Qualitatively, the results are similar to those for durable household items. Increased five-to-ten-years inflation expectations reduce the probability that households report a positive attitude towards spending on cars. The effect is significantly negative at the zero lower bound, the marginal effect is 0.5 percentage points. Outside of the zero lower bound, the effect is essentially zero. For both additional controls, we obtain significant and plausible coefficient estimates and marginal effects. An increase in expected gasoline prices reduces the probability that households find buying conditions for cars favorable. Moreover, higher car loan rates are associated with a smaller probability that households have a positive attitude towards spending on cars.

As a second extension, we consider the question on buying conditions for houses, which asks whether *now* is a good or a bad time to buy a house (Q18). In addition to our standard set of controls, we add an aggregate measure of the 30-year mortgage rate (in percentage points) to the model to control for financing costs.[29] Moreover, we include the S&P Case-Shiller 10-City Home Price Index from FRED, expressed relative to the CPI. We take the natural logarithm of the series and then linearly detrend. This index is available only from 1987 onwards.

[27] Notice that the survey in Q16 asks households whether *the next twelve months or so* will be a good or a bad time to buy a car, in contrast to the questions about household durables and houses. Given the wording of the question, we need to ensure that inflation expectations lie strictly in the future relative to the purchasing horizon. We thus account for the fact that the question does not ask whether *now* is a good time to buy a car but instead refers to the *next 12 months or so* by pairing up the "readiness to spend on cars" question only with expected inflation over a five-to-ten-years horizon.

[28] We obtain the car loan rate series from the Federal Reserve Board of the Governors: "Terms of Credit at Commercial Banks and Finance Companies - New car loans at auto finance companies". It appears not to have been updated beyond 2010:12, which is why we use this time horizon for this specification.

[29] The mortgage rate series is from the Federal Reserve Board of the Governors. The series ID is MORTG.

The results for the baseline specification with the "buying conditions for houses" question as the dependent variable are shown in the upper panel of Table 10. As one might expect, the mortgage rate and the level of current house prices both have significantly negative effects on buying attitudes about houses. Furthermore, the coefficient on the zero lower bound dummy is quite negative, which makes sense given that the period of the zero lower bound coincides with the collapse of the housing market. The coefficient on expected inflation is negative and statistically significant at the one percent level; the coefficient on the interaction term between expected inflation and the ZLB dummy is also negative. This is reflected in the estimated marginal effects: outside of the zero lower bound regime, expecting one percentage point more inflation over the next year is associated with a reduction in the probability of finding the present a good time to buy houses by 0.32 percentage points. At the zero lower bound this effect is even larger at 0.56 percentage points.

We consider two alternative specifications for the estimation with buying attitudes for houses. The results are shown in the second and third panels of Table 10. In the first, we measure inflation expectations over a five-to-ten-years horizon, which reduces the size of the available sample somewhat by restricting the start date to 1990:04. Houses are significantly more long-lived than household durable goods, and hence expected inflation over a longer time horizon than one year may be more relevant for buying attitudes. The results are nonetheless fairly similar to the baseline – the coefficient on expected inflation is negative, though a little smaller in absolute value than in the benchmark. The marginal effect is negative both inside and outside of the zero lower bound regime, but is only significant during the zero lower bound regime.

The second alteration we consider is to include qualitative survey responses on subjective expectations about future house price changes. The data on one-year house price expectations (Q19) are not available for the period prior to May 2007.[30] We also include as control variables the subjective probabilities of job loss and real income gains. The results are in the bottom panel of Table 10. The estimated coefficient and marginal effects of expected inflation are quite similar to what obtains in the full sample results shown in the upper panel. Increases in expected inflation make households less likely to report having a positive attitude towards buying a house, and this effect is even stronger during the zero lower bound period. Interestingly, households do understand that expected house price increases make now a good time to buy houses. This suggests that indeed households may understand the relevant relative price effect, but not the effects of general inflation and real interest rates.

[30] The qualitative house price expectations are coded '+1' for an expected increase in house prices, '0' for no price change, and '-1' for an expected decrease in house prices. Furthermore, we use only the sample until 2010:12, because afterwards there was a break in the survey design, in that the house price expectation question was only asked from homeowners and not from all survey participants anymore. Finally, the Michigan survey also asks for an expected percentage change in house prices. Unfortunately, this quantitative series shows a large number of missing observations, and hence we decided not to use it.

Table 9: Readiness to Spend on Cars and 5Y Inflation Expectations

Dependent Variable: Buying Conditions for Cars	Sample: 1990:04 to 2010:12		
Number of observations: 28756	Pseudo R^2: 0.0416		
		Marginal Effects	
Independent Variables	Coefficients	at $D_{ZLB} = 0$	at $D_{ZLB} = 1$
Inflation Expectations (5Y)	−0.0033	−0.0012	−0.0050**
	(0.0027)	(0.0009)	(0.0024)
ZLB Dummy Interacted with Expected Inflation (5Y)	−0.0106		
	(0.0072)		
Expected Change in Gasoline Prices (5Y)	−0.0005***	−0.0002***	−0.0002***
	(0.0001)	(0.0000)	(0.0000)
Car Loan Rate	−0.0236***	−0.0083***	−0.0084***
	(0.0059)	(0.0021)	(0.0021)

Notes: This table shows ordered probit results where the dependent variable is "Buying conditions for cars", based on (Q16), which is coded '+1' for good, '0' for neither good nor bad, and '-1' for bad. We add the car loan rate from the Federal Reserve Board of the Governors, the expected gasoline price change over the next five years in cents per gallon and based on (Q17), and the 'Home Owner' dummy as additional controls to the ones included in the baseline specification from the main text. Like the baseline specification this regression has been run on the subsample of the first interviews only. The sample period is 1984:01 to 2010:12.

Table 10: Readiness to Spend on Houses and Inflation Expectations

			Marginal Effects	
Specification	Independent Variables	Coefficients	at $D_{ZLB} = 0$	at $D_{ZLB} = 1$
Benchmark	Exp. Inflation (1Y)	-0.0110^{***}	-0.0032^{***}	-0.0056^{***}
($N = 60486$,		(0.0016)	(0.0005)	(0.0009)
Sample: 1987:01 to 2012:12)	ZLB Dummy × Exp. Inflation (1Y)	-0.0080^{**}		
		(0.0034)		
	ZLB Dummy	-0.6783^{***}	-0.1948^{***}	
		(0.0554)	(0.0160)	
	Mortgage Rate	-0.0350^{***}	-0.0100^{***}	-0.0102^{***}
		(0.0128)	(0.0037)	(0.0037)
	S&P Case-Shiller Index	-0.0052^{***}	-0.0015^{***}	-0.0015^{***}
		(0.0007)	(0.0002)	(0.0002)
5Y Expected Inflation	Exp. Inflation (5Y)	-0.0003	-0.0001	-0.0032^{**}
($N = 48501$,		(0.0022)	(0.0006)	(0.0013)
Sample: 1990:04 to 2012:12)	ZLB Dummy × Exp. Inflation (5Y)	-0.0107^{**}		
		(0.0048)		
	ZLB Dummy	-0.7938^{***}	-0.2238^{***}	
		(0.0651)	(0.0182)	
	Mortgage Rate	-0.0687^{***}	-0.0194^{***}	-0.0202^{***}
		(0.0153)	(0.0043)	(0.0045)
	S&P Case-Shiller Index	-0.0075^{***}	-0.0021^{***}	-0.0022^{***}
		(0.0008)	(0.0002)	(0.0002)
	Home Owner	0.1427^{***}	0.0402^{***}	0.0419^{***}
		(0.0173)	(0.0049)	(0.0051)
w/ Subj. Probabilities	Exp. Inflation(1Y)	-0.0148^{**}	-0.0043^{**}	-0.0059^{***}
($N = 5560$,		(0.0059)	(0.0017)	(0.0022)
Sample: 2007:05 to 2010:12)	ZLB Dummy × Exp. Inflation (1Y)	-0.0017		
		(0.0077)		
	ZLB Dummy	-0.2657	-0.0762	
		(0.2314)	(0.0590)	
	Subjective Prob. of Job Loss	-0.0010	-0.0003	-0.0003
		(0.0008)	(0.0002)	(0.0003)
	Subjective Prob. of Real Income Gains	0.0022^{***}	0.0006^{**}	0.0008^{**}
		(0.0009)	(0.0003)	(0.0003)
	Expected Change in House Prices (1Y)	0.0719^{**}	0.0206^{**}	0.0255^{**}
		(0.0285)	(0.0084)	(0.0114)
	Expected Change in Gas Price (1Y)	0.0001	0.0000	0.0000
		(0.0005)	(0.0001)	(0.0002)
	Mortgage Rate	-0.1895	-0.0543	-0.0673^{*}
		(0.1251)	(0.0332)	(0.0385)
	S&P Case-Shiller Index	-0.0485^{**}	-0.0139^{**}	-0.0172^{***}
		(0.0208)	(0.0062)	(0.0053)
	Home Owner	0.1803^{***}	0.0517^{***}	0.0640^{***}
		(0.0544)	(0.0163)	(0.0235)

Notes: This table shows ordered probit results for three different specifications, each using as the dependent variable "Buying conditions for houses", based on Q18, which is coded '+1' for good, '0' for neither good nor bad, and '-1' for bad. All of the standard controls from the benchmark specification are included. The upper panel shows results adding the mortgage rate from the Federal Reserve Board of Governors and the S&P Case-Shiller 10 City Home Price Index, available from FRED, as additional controls. The middle panel is similar to the first but instead using inflation expectations over a five-to-ten year horizon. The final panel augments the specification in the first panel to include subjective one-year-ahead house price expectation series, Q19, but also Q13, Q14, and Q15. The number N in parentheses refers to the number of observations used to estimate each specification; there the time horizon of the various samples is also specified. Like the baseline specification all these regressions have been run on the subsample of first interviews only.

E A Control Function Approach

A potential concern with our baseline specification is that survey-recorded inflation expectations may be observed or even reported with measurement error, which would work to bias the estimated coefficients towards zero. For example, survey respondents might put less effort into coming up with their best estimate for the inflation outlook when answering the survey as opposed to making actual purchasing decisions. On average their recorded survey responses may be right, but noisier than their true expectations.

We address this potential criticism by following the recommendation of Rivers and Vuong (1988), Wooldridge (2002), and Imbens and Wooldridge (2007) and employ a so-called control function (CF) approach to estimating the baseline specification. The CF approach is a two-stage instrumental variable estimation method that can also be applied to nonlinear models. For this exercise, we make use of the panel dimension of the Michigan Survey of Consumers and focus on those households that were interviewed twice, using their first-interview inflation expectations as an instrumental variable. Given that inflation, and hence also expected inflation, is fairly persistent, lagged individual inflation expectations are an obvious instrument for current expected inflation.

In the first stage, we regress household inflation expectations from the second interview on all exogenous control variables from the baseline estimation plus the household inflation expectations from the first interview. The results for the first stage are shown in the upper panel of Table 11. Individual lagged inflation expectations enter the first stage with a coefficient of 0.22 that is highly statistically significant (the t statistic is greater than 50), suggesting that first-interview inflation expectations constitute a reasonably strong instrument for second-interview expected inflation.

In the second stage, we estimate our baseline ordered probit which includes expected inflation on the right hand side, and the residual from the first stage regression as an additional control variable. Including the residual from the first stage directly controls for any potential endogeneity in expected inflation; it also controls for potential endogeneity of functions of expected inflation, such as the interaction term between expected inflation and the zero lower bound dummy (see Imbens and Wooldridge, 2007). The second stage estimates are in the bottom panel of Table 11. The important result here is: the point estimates on the coefficients and marginal effects of interest – expected inflation and expected inflation interacted with the zero lower bound dummy – are again negative, now significantly so both inside and outside the zero lower bound regime, and, if anything, somewhat larger in absolute value than our baseline estimates. This is consistent with a small attenuation effect in the standard ordered probit due to the presence of measurement error.

Table 11: Control Function Approach: Readiness to Spend on Durables and 1Y Inflation Expectations

First Stage			
Dependent Variable: Individual Inflation Expectations (1Y) Number of observations: 53282	Sample: 1984:01 to 2012:12 R^2: 0.1393 S.E. Residual: 3.4083		
Independent Variables	Coefficients		
Individual Lagged Inflation Expectations (1Y)	0.2180^{***} (0.0038)		
Second Stage			
Dependent Variable: Buying Conditions for Durables Number of observations: 51607	Sample: 1984:01 to 2012:12 Pseudo R^2: 0.0751		
		Marginal Effects	
Independent Variables	Coefficients	at $D_{ZLB}=0$	at $D_{ZLB}=1$
Inflation Expectations (1Y)	-0.0174^{**} (0.0073)	-0.0048^{**} (0.0020)	-0.0129^{***} (0.0029)
ZLB Dummy Interacted with Expected Inflation (1Y)	-0.0175^{***} (0.0041)		
First Stage Residual	0.0197^{***} (0.0074)	0.0054^{***} (0.0020)	0.0073^{***} (0.0027)

Notes: This table shows results from the control function approach to estimating the benchmark specification. The upper part of the table shows the first-stage regression results of individual inflation expectations (1Y) from the second-time interviews on the individual inflation expectations (1Y) from the first-time interviews. The same control variables as in the baseline estimation are included in the regression but their coefficients and standard errors are omitted for the sake of brevity. Following Wooldridge (2002) the estimated coefficient (marginal effect) in the second stage is computed from the standard ordered probit coefficient (marginal effect) divided by $[1+(\text{coefficient on first-stage residual})^2 \times (\text{S.E. residual from first stage})^2]^{1/2}$.