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Household Inflation Expectations and Consumer Spending: Evidence from Panel Data

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Abstract:
Recent research offers mixed results concerning the relationship between inflation expectations and consumption, using qualitative measures of readiness to spend. We revisit this question using survey panel data from the United States of actual spending from 2009 through 2012 that also allow us to control for household heterogeneity. We find that durables spending increases with inflation expectations only for certain types of households, while nondurables spending does not respond to inflation expectations. Moreover, spending decreases with an expected increase in unemployment. These results imply a limited stimulating effect of inflation expectations on aggregate consumption, which could be offset in part or in full if expectations for inflation and unemployment move in the same direction.

JEL Classifications: D12, E52, E58
Keywords: Inflation expectations, survey data, durable and nondurable goods consumption

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1. INTRODUCTION

The relationship between household inflation expectations and consumer spending holds important implications for monetary policy, particularly in an environment where the zero lower bound (ZLB) on the monetary policy interest rate target is binding. During the recent period when the ZLB was binding in the United States (December 2008 through October 2015), various economists called for the Federal Reserve to commit to policies that would raise expectations of future inflation, causing a decline in the real interest rate and thereby encouraging greater spending in the present.[1] Although the United States is currently not subject to the ZLB, estimates of the natural real rate of interest have declined considerably since the Great Recession (Holston, Laubach, and Williams 2017; Del Negro et al. 2018). Combined with persistently low inflation, a lower real equilibrium rate implies that the ZLB may become binding more frequently (Kiley and Roberts 2017). Even in countries such as Japan that have instituted negative nominal interest rates, the debate over the use of inflation expectations as a tool for economic stimulus remains very much alive (Hogen and Okuma 2018).

This paper examines the relationship between household inflation expectations and actual spending on durable goods and, separately, on nondurable goods and services. We make use of a unique panel data set pertaining to US households surveyed from mid-2009 through late 2012, a time when the US federal funds target rate remained at its lower-bound range of 0 percent to 0.25 percent. We find that higher inflation expectations stimulate current consumption spending on durable goods for those consumers who have at least some college education and hold a mortgage, whereas there is practically no effect on consumption of nondurable goods and services for any

[1] See, for example, Paul Krugman, "Not Enough Inflation," *New York Times*, May 2, 2013; and Christina Romer, "Dear Ben: It's Time for Your Volcker Moment," *New York Times*, October 29, 2011. Considering earlier episodes, Romer (1992) and Eggertsson (2008) argue that increases in expected inflation in a low nominal rate environment—prompted by large inflows of gold—contributed significantly to the recovery from the Great Depression.

type of household. In particular, a 1 percentage point increase in the one-year-ahead inflation expectation increases durable goods spending by about 19 percent for the immediate quarter among households with a college-educated respondent and by 30 percent if the household also has a mortgage.

Because these strong but transitory effects hold only for durable goods—which account for just 10 percent of total consumer spending—and only for a subset of consumers, the aggregate spending increase is limited to 1 percent or less over two quarters. We also find a strong negative relationship between qualitative unemployment expectations and consumption that applies broadly across types of households and types of spending. Therefore, any positive effects of inflation expectations on total consumption may be more than offset if expectations for inflation and unemployment move in the same direction. Such co-movement has been documented by Kamdar (2018), and such offsetting effects are consistent with Coibion et al. (2019).

The earlier literature offers mixed findings on the relationship between household inflation expectations and consumption, typically using microeconomic survey data that capture "readiness to spend" qualitatively rather than the actual spending level. Using cross-sectional survey data of US consumers, Bachmann, Berg, and Sims (2015) observe either no relationship or, when the ZLB is binding, a negative relationship between household inflation expectations and readiness to spend on durable goods. Coibion et al. (2019) observe sharply negative effects of inflation expectations on durable goods spending among Dutch households—and modest negative effects on overall spending—when inflation expectations are manipulated experimentally within a consumer survey. In contrast, Duca, Kenny, and Reuter (2019) use cross-sectional survey data from the euro area to document that higher expected inflation boosts readiness to spend in a ZLB environment. D'Acunto et al. (2019) find that among Finnish men, only high-IQ individuals act in a manner that

indicates a positive relationship between inflation expectations and the readiness to purchase durables. Two related papers on German and Polish consumers (D'Acunto, Hoang, and Weber 2016 and 2018, respectively) find that an unexpected announcement of an increase in the consumption tax boosts inflation expectations and readiness to spend on durables by economically significant amounts.[2]

Our panel data on household-level spending and economic expectations, which were assembled using two separate modules of the RAND American Life Panel survey (ALP), offer several advantages that help us reconcile the seemingly conflicting evidence in the literature: (1) the spending measures refer to actual spending levels (based on one-month or one-quarter recall) rather than to hypothetical "spending readiness," planned spending changes, or one-year recall of spending changes; (2) the data enable us to test the response of spending on nondurable goods and services separately from the response of durable goods spending and to estimate responses along both the discrete and continuous margins; (3) the panel aspect allows us to control for unobserved heterogeneity across households that might affect inflation expectations and spending simultaneously; and (4) we assess heterogeneity in behavior along new dimensions, including mortgagor status and other financial indicators, to reveal additional information about the mechanisms by which inflation expectations might influence spending. The data contain a rich set of controls for other economic expectations that could confound our estimates—including expectations for unemployment, nominal interest rates, own wages, and house prices—and they

[2] A few other studies offer partial answers regarding actual consumption spending, rather than readiness to spend. Ichiue and Nishiguchi (2015) find evidence of a stimulating effect of inflation expectations using a Japanese survey that asks qualitatively whether the actual total spending of the household increased compared with one year earlier. Crump et al. (2019) use panel survey data and find that when US households expect inflation to increase, they respond by planning to reduce consumption growth moving forward. Such a response implies that present consumption would increase relative to future consumption but not necessarily in absolute terms.

contain measures of the uncertainty surrounding both inflation expectations and wage expectations.

For policy purposes, the ability to test the microeconomic response of spending on nondurable goods and services in addition to the response of spending on durable goods is critical, because ultimately policymakers care about stimulating total consumer spending, of which spending on durable goods forms a relatively small portion—slightly more than 10 percent on average during the time period covered in our data.[3] Some of the studies listed above offer estimates of the effects of inflation expectations on aggregate spending, but they do so using only indirect and/or qualitative methods.[4] The ability to assess whether household financial conditions—including monthly housing and car payments, mortgagor status, and outstanding mortgage balances—mediate the response to inflation expectations also carries a high degree of policy relevance. For example, theory suggests that borrowing constraints and/or idiosyncratic income risk could limit the effectiveness of forward guidance and other policies that are geared toward changing consumers' expectations about interest rates (McKay, Nakamura, and Steinsson 2015). We find some evidence that borrowing constraints—as indicated by higher recurring debt payments relative to income—may inhibit the consumption response to inflation expectations.

The differential response between college-educated and other respondents may reflect differences in IQ, a factor that, as noted above, is found to mediate the planned spending response to inflation expectations (D'Acunto et al. 2019). The robust response of college-educated mortgagors suggests such households understand that higher inflation erodes their real mortgage

[3] This calculation is based on personal consumption expenditures data from May 2009 through November 2012 produced by the Bureau of Economic Analysis and accessed using the Federal Reserve Bank of St. Louis's FRED online database, available at https://fred.stlouisfed.org/.

[4] Earlier papers estimate effects on total spending based on either macroeconomic correlations with qualitative responses on readiness to spend (Bachmann et al. 2015; Duca et al. 2019; and D'Acunto et al. 2016) or on qualitative recalled changes in total spending (Ichiue and Nishiguchi 2015).

obligations. As further evidence of that understanding, effects on durable goods spending are in some cases stronger among households with larger mortgage balances.

Among respondents whose spending responses to inflation expectations are weak or possibly negative—such as non-college-educated respondents—the results might reflect negative associations with inflation. For example, these consumers may perceive that inflation erodes their standard of living (Shiller 1996); they may associate higher inflation with higher unemployment (Coibion, Gorodnichenko, and Kamdar 2018; Kamdar 2018); or higher inflation could be associated with greater economic uncertainty, as argued in the popular media by Paul Volcker,[5] and as shown formally by Mackowiak and Wiederholt (2012). We find that expecting an increase in unemployment is associated with a large negative impact on spending on durable goods (and a modest negative impact on spending on nondurable goods and services) for all types of households. Therefore, policies that seek to stimulate spending by raising inflation expectations may actually be less effective or even counterproductive at the zero lower bound, given the weak economic conditions that tend to accompany such time periods, particularly if consumers' expectations for inflation and unemployment tend to move in the same direction. This finding may also explain why conclusions derived from randomized information treatments (Coibion et al. 2019) seemingly oppose those from a natural experiment with a consumption tax (D'Acunto, Hoang, and Weber 2016). In particular, an increase in expected inflation that stems from news about inflation may also lead to a more pessimistic outlook, whereas replacing a less efficient tax with a consumption tax might not result in weaker expectations for the economy.

Broadly speaking, our results are not quite as pessimistic as those of Bachmann, Berg, and Sims (2015) concerning the effectiveness of policies that aim to stimulate spending by raising

[5] See Paul A. Volcker, "A Little Inflation Can Be a Dangerous Thing." *New York Times*, September 18, 2011.

inflation expectations. The measure of optimism we obtain stems mostly from results along the continuous margin of durable goods spending, which, we find, behaves somewhat differently from the discrete spending margin that is the subject of the study by Bachmann et al. Another important difference is that our panel data, unlike cross-sectional survey data, allow us to control for household-level heterogeneity. For the continuous margin, we find that controlling for household-level heterogeneity significantly increases the positive relationship between inflation expectations and durable goods spending among the college-educated and mortgagor households.

At the same time, compared with studies based on European data or Japanese data, we find less support in the aggregate for policies designed to stimulate spending by engendering higher expectations for inflation. This comparatively weak response of spending on average may reflect that our data are from the early years of the recovery from the Great Recession. Durable goods consumption in the United States is found to have been less sensitive to real interest rates during that period than in previous recoveries (Van Zandweghe and Braxton 2013), and consistent with that finding, households may have had reduced access to credit and a reduced appetite for borrowing in response to negative housing wealth shocks and debt overhang (Mian, Rao, and Sufi 2013). Another factor that might have limited the response in our sample is a lack of understanding of the zero lower bound. Roughly one-third of our (weighted) sample observations include expectations of increasing nominal interest rates, and we find that the effect of inflation expectations on spending is stronger when we exclude these observations. This result supports the notion that inflation expectations act on consumption through their effect on real interest rates.

The remainder of the paper is organized as follows. Section 2 reviews the basic theoretical predictions concerning the relationship between inflation expectations and current spending, Section 3 describes the data, Section 4 describes the empirical models, Section 5 presents the

results, Section 6 discusses aggregate policy implications, and Section 7 concludes with an assessment of our findings in the context of the related literature.

2. CONCEPTUAL BACKGROUND

It is important to review the economic logic underpinning the prediction that an increase in expected inflation—all else held constant—will boost current consumption relative to future consumption. This prediction draws on the Fisher equation, which approximates the real rate of interest as the difference between the nominal interest rate and the expected inflation rate. In the standard intertemporal choice framework, a decline in the real interest rate encourages substitution toward present consumption relative to future consumption, regardless of whether the decline in the real rate occurs due to a decline in the nominal interest rate or an equivalent increase in expected inflation. Purchases of large consumer durables should be particularly sensitive to real interest rates, because such purchases are easily substituted across time and are often financed with debt (see, for example, Bachmann, Berg, and Sims 2015).

These relationships are captured by the consumption Euler equation, which relates expected one-period consumption growth to the nominal interest rate, expected inflation, and other factors as follows:

$$E_t^i\left[\Delta c_{t+1}^i\right] = \sigma r_t - \sigma E_t^i[\pi_{t+1}] + \sigma \log \beta + o_{i,t} \quad . \tag{1}$$

Following Crump et al. (2019), the expression on the left-hand side above represents the household's expected change in log consumption between time *t* and time *t+1*. Note that on the right-hand side, both the nominal interest rate, r_t, and the inflation expectation, $E_t^i[\pi_{t+1}]$, are scaled by the elasticity of intertemporal substitution, σ, although the sign for expected inflation is negative; that is, consumption *growth* increases with the nominal rate and decreases with expected inflation, both at the same absolute rate. In the third term, β denotes the discount factor, and the

final term, $o_{i,t}$, captures the first-order approximation error. The latter consists of conditional higher-order moments of the subjective joint distribution of consumption growth and future inflation (Jappelli and Pistaferri 2000; Carroll 2001).

However, an exogenous increase in expected inflation may fail to boost current consumption in absolute terms (rather than just relative to future consumption) for several reasons. Even in the standard intertemporal choice model, the net effect on current consumption of a decline in the real interest rate—achieved either by reducing the nominal rate or raising the inflation expectation—depends on the consumer's net asset position. Among net savers, a decline in the real rate yields a negative wealth effect that may more than offset the positive substitution effect, leading to a decline in both current and future consumption. Among net debtors, a lower real rate should boost current consumption, as both wealth and substitution effects are positive in that case. The latter mechanism also underpins part of Fisher's debt deflation hypothesis (1933)—in which deflation (prompted by a financial crash) increases the real value of nominal debt obligations and thus discourages consumption, and reflation is an appropriate policy response.

Furthermore, an increase in the inflation expectation may not be equivalent to a decline in the nominal borrowing rate in terms of its impact on the intertemporal substitution of consumption. For one, equivalence fails if the consumer's future income is not fully indexed to inflation. In such a case, it is readily shown that an increase in expected inflation has ambiguous effects on current consumption for net savers and net debtors alike, whereas income indexation has no bearing on the effect of a decline in the nominal rate.[6] Although aggregate income growth should track

[6] In this scenario, the higher inflation expectation reduces real future income for both net borrowers and net savers. Among borrowers this effect may more than offset the increase in real wealth gained from the increase in expected inflation.

inflation in the long run, incomes are in fact not uniformly indexed to inflation for all consumers (see, for example, Barattieri, Basu, and Gottschalk 2014).

For several other reasons, inflation expectations may operate differently from nominal interest rates in terms of their impact on current consumption. In a model with dispersed information, Mackowiak and Wiederholt (2012) show that policymakers' commitment to higher inflation may send negative signals about the outlook for the economy, thereby reducing current consumption. In a related vein, recent evidence (Kamdar 2018) shows that consumers' expectations for inflation and unemployment tend to move in the same direction, and which direction they move depends on whether underlying consumer sentiment is positive (prompting expectations of lower unemployment and lower inflation) or negative (having the opposite effect). Finally, inflation expectations may operate differently from nominal rates within non-neoclassical transmission channels for monetary policy. For example, the bank lending channel (Bernanke and Gertler 1995) operates through changes in the supply of bank deposits in response to open-market operations of the central bank, and it is not obvious that movements in expected inflation would have a similar impact on bank deposits.

Given these considerations, earlier macroeconomic evidence that real aggregate spending responds positively to a decline in nominal rates need not apply to the question of whether attempts to boost expectations for inflation would similarly stimulate spending.[7] Instead, the question should be treated as a separate and fundamentally empirical matter that could yield different answers in different economic environments.

[7] For example, Christiano, Eichenbaum, and Evans (2005) and Bernanke and Gertler (1995) exploit nominal interest rate shocks to identify effects of real rate movements on real spending, and find that unexpected declines (increases) in short-term policy rates are associated with significant increases (declines) in real spending.

3. DATA SOURCES AND DESCRIPTIVE STATISTICS

A. Spending Data

Our spending data and some of the associated control variables pertain to US households that responded to spending modules fielded as part of the RAND-American Life Panel (ALP) Financial Crisis Surveys conducted from May 2009 through November 2012 (see Hurd and Rohwedder 2012 for complete details on the survey). The ALP is an internet panel survey covering the US population aged 18 and older. It does not suffer from selection bias based on internet access, because participants are provided with such access if needed. The spending modules ask respondents about recent spending *for the entire household* on specific items. For frequently purchased items, such as food and personal services, the survey elicits spending information from the previous calendar month; for durable goods (such as refrigerators and furniture), the survey asks how much the household spent on each good during the previous calendar quarter. Selected screenshots and other information about the survey are provided in the appendix. Hurd and Rohwedder (2012) find that an estimate of average household total spending for 2010 based on the ALP survey's spending data lines up closely with average household total spending for 2010 in the Consumer Expenditure Survey (CEX). [8]

We construct three dependent variables, each referring to a different measure of spending. These variables, described in Exhibit A, are combined one-quarter spending on a bundle of durable goods, combined one-month spending on a bundle of nondurables goods and services, and a binary variable indicating whether the household purchased any durable goods in the given quarter. The list of durable goods for which spending information was elicited includes refrigerators, stoves and ovens, washers and dryers, dishwashers, televisions, computers, and home furnishings such as

[8] For more information on the RAND-ALP, see https://www.rand.org/research/data/alp.html.

furniture, carpeting/rugs, and small appliances.[9] The items in the nondurables and services bundle are listed in Exhibit A.[10] We separate the spending categories for two main reasons: first, spending on durable goods is generally expected to respond more strongly to real interest rates than is spending on nondurable goods and/or services (see, for example, Bachmann, Berg, and Sims 2015); second, it is impossible to calculate total *monthly* spending per household when spending on durables is reported at only a quarterly frequency, and it is difficult to calculate total *quarterly* spending unless the household completed the survey in each month of the quarter.

The survey also elicited information on automobile purchases at a quarterly frequency—including a discrete indicator of a car purchase and the purchase price if relevant. However, in our sample the incidence of a car purchase is very low, and the relevant data exhibit ambiguity.[11] Therefore, we do not include car purchases in either the continuous durable goods spending variable or the discrete indicator of durables purchases. Separately and at a monthly frequency, the survey asked respondents to report recurring payments on car loans or leases, and to report any payments for housing rent and/or home mortgages. In theory these payments might respond to expected inflation for the same reasons as purchases might. However, in our sample at least, these payments do not exhibit much variation for respondents individually over time.[12] Therefore, we omit monthly car and housing payments from our nondurables/services spending bundle. As

[9] With the exception of home furnishings, for each item or pair on this list we observe a binary indicator of whether any such goods were purchased and a separate variable indicating the full purchase price. For home furnishings, we observe total spending on furniture and related items. See the appendix for survey details.

[10] From the polled-monthly nondurables/services bundle we exclude the following: (1) education spending, because single-month values in the data are often extremely high and may reflect an entire semester's tuition; (2) "sports" spending, because it combines spending on services (gym memberships) as well as durable goods (skis, boats, and bicycles). From the polled-quarterly spending items we exclude the following, as they do not fit neatly into the durable goods category: insurance payments, property taxes, travel, and home repair and maintenance.

[11] For example, we observe a non-trivial number of cases in which the dummy variable for whether a car was purchased in the quarter equals zero but the car purchase price variable is strictly positive, as well as cases in which a car purchase is indicated but the purchase price is missing.

[12] Using data from the same spending modules—but not the exact same data set—Hurd and Rohwedder (2013) note that housing and car payments do not vary much from month to month.

discussed below, we do use combined housing and car payments as an explanatory factor that may proxy for a household's borrowing capacity.[13]

The spending modules also contain information on a variety of demographic and financial indicators that we use as explanatory factors and controls. For example, we observe age, race, sex, and educational attainment, which we divide into two groups based on whether the respondent has at least some college education. Households in which the respondent has at least some college education are referred to as "college-type households," and those in which the respondent has no college education are called "non-college households." The spending modules also indicate whether the household owns a home, whether it has a mortgage, and the total remaining amount owed on the mortgage if relevant. Annual household income, in discrete ranges, is observed in the ALP modules described in the next section.[14]

B. Expectations for Inflation and Other Economic Conditions

The data on respondents' expectations for inflation, wage growth, unemployment, interest rates, and household income are drawn from responses to the Federal Reserve Bank of New York's mini-module on household expectations, which was appended to the ALP for the period of May 2008 through November 2012 at a roughly six-week frequency (Armantier et al. 2013; Bruine de Bruin et al. 2011). These modules represent a precursor to the New York Fed's Survey of Consumer Expectations (described in Armantier et al. 2017), which uses similar (but not identical)

[13] In attaching the monthly housing and car payments to the quarterly spending series, we use the payments values from the first month of the quarter. Given the potential endogeneity of these payments—for example, if any adjustments to monthly payments are made simultaneously with other spending decisions—we also estimate versions of all models that omit variables involving monthly payments. Results (available upon request) are highly robust.

[14] We transform the annual income ranges into point values using the midpoint of each range, and incomes in the maximum range of $200,000 or greater are set to $237,500. Results are robust to a range of choices for the maximum income value. For the complete list of ranges, see the appendix. The RAND-ALP Financial Crisis Surveys elicited "income earned in the previous month," but we find those data to be poorly behaved and therefore we use the annual household income data instead.

methods of eliciting inflation expectations. Bruine de Bruin et al. (2011, pp. 3–4) describe the key features of the survey modules as follows:

> "[The] surveys…allow respondents to report their point forecasts as well as their density forecasts for price and wage inflation. The questions about density forecasts ask respondents to assign probabilities to predetermined intervals or bins for future changes in the general price level and in wage earnings (e.g., go down by 0% to 2%, go up by 0% to 2%, go up by 2% to 4%, etc.)."

The resulting density forecasts can be used to construct individual measures of the central tendency and of uncertainty. For the former we use the density median, and for the latter we use the interquartile range. To construct these measures, we adopt the methods used by Bruine de Bruin et al. (2011), which are described in detail in Engelberg, Manski, and Williams (2009).[15]

The New York Fed survey elicited information about quantitative expectations for same-job wage growth and house prices as point estimates, and it elicited information about qualitative expectations of movements—up, down, or no change—in unemployment and "interest rates for borrowing money"; we assume the latter were interpreted by the respondents as nominal interest rates. All these expectations were elicited for the one-year-ahead horizon. Information about several other types of economic expectations was elicited, but high non-response rates restricted our use of them. For detailed descriptions of all explanatory variables, see Exhibit B, and for the complete text of relevant survey questions, see the appendix.

[15] In particular, we fit a beta distribution to the points on the individual cumulative distributive function for expected inflation (or expected nominal wage growth), which can be inferred from the probabilities on the various bins. When positive probability is placed on only one or two bins, the method assumes that the density function has the shape of an isosceles triangle. For further details on this method, see Engelberg, Manski, and Williams (2009).

C. Constructing the Merged Sample

There is substantial overlap between the sets of respondents to the ALP spending module and the ALP/New York Fed expectations module, enabling us to create an unbalanced panel data set containing matched observations of economic expectations, household spending, and the control variables described above. The quarterly panel spans the fourth quarter of 2009 through the fourth quarter of 2012, and the monthly panel spans September 2009 through November 2012.[16]

Spending on durable goods is reported at a quarterly frequency, and the data do not indicate the exact date(s) within the quarter on which the spending took place. However, the expectations for inflation and other economic outcomes are reported at a six-week frequency on average, and we know exactly (to the day) when each expectations survey was completed. Ideally, the expectations assigned to a given spending event would be those dated just before that event, so they would have been salient and yet would not have been influenced *ex post* by the spending itself. Lacking the exact timing of the spending, we face a tradeoff between using expectations formed before the start of the spending quarter that may have been subsequently revised before the spending occurred, and using expectations dated within the spending quarter itself, in which case the expectations may have been formed after at least some of the spending took place. To balance this tradeoff, the "current" expectation (for inflation or wage growth, for example) is defined as the expectation dated within the first month of the spending quarter, if available. If no such expectations are available, we look for expectations dated within the month immediately preceding the spending quarter or, if these are also missing, from the month before that. If none of these is

[16] The full panel of matched observations of monthly spending and inflation expectations spans April 2009 through November 2012, but due to missing observations and use of lagged data, the earliest period in the regression sample is September 2009.

available, the durables spending observation is dropped. The "lagged" expectation—and this is included only for inflation—is the one dated within the first month of the quarter preceding the spending quarter. If no such lagged expectation is available, we look for an inflation expectation from the month before that and (if that is unavailable) as far back as 12 months before the start of the spending quarter. If no candidate for the lagged inflation expectation is available, the spending observation is dropped.

Spending on nondurable goods and services is reported at a monthly frequency. As with spending on durable goods, we don't observe the exact timing of the spending within the month, but we observe the date on which each expectations survey was completed. The matching procedure is roughly analogous to the one we use for durable goods spending: For the "current" expectation (for inflation, for example), our first choice is to use the expectation dated within the first 10 days of the spending month. If such is unavailable, we look for an expectation dated up to five weeks before the start of the spending month; and if no suitable candidate is available, the spending observation is dropped. To assign the lagged expectation for inflation, we use the next-most-recent expectation for inflation reported by the household (relative to the "current" expectation), but from no more than 12 months before the spending month. And if all candidates for the lagged inflation expectation are missing, the observation is dropped.

Beginning with the set of matched observations of spending (on either durables or nondurables/services) and expectations, we impose sample restrictions before arriving at the baseline regression sample for either type of spending. To control for wage growth expectations, we retain only observations in which these expectations are non-missing. Therefore, our results are applicable to households that have at least one employed individual (that is, the respondent). Some respondents with non-missing wage expectations reported being both retired and employed,

as these categories are not mutually exclusive in the survey.[17] We drop observations involving an extreme value for the given type of spending, the inflation expectation, the house price growth expectation, or the monthly mortgage payment.[18] We drop 34 household-by-month observations involving zero dollars of combined household spending on nondurable goods—the set that includes food and utilities. However, observations involving zero dollars of single-quarter spending on durable goods are not dropped, as these reports are plausible. We drop households with only two or fewer observations of a given type of spending. And in the case of durable goods, we drop households that lack at least one observation involving nonzero spending.[19] The latter restriction is imposed because those households with uniformly zero spending contribute no identifying variation in models that control for household-level heterogeneity.

After these exclusions, the baseline durable goods spending sample amounts to 1,084 household-quarter observations, drawn from 166 unique households that contribute an (unweighted) average of 6.5 observations each. The nondurables and services spending sample contains a total of 2,010 household-month observations, based on 201 households with an average of 10 observations apiece. (All households in the former group also appear in the latter group.) Although the numbers of households are small, sample weights are used to maximize the representativeness of each sample.[20]

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[17] We retain these observations, although all results are robust to excluding them.

[18] We exclude all observations in which either the short-run inflation expectation or the medium-run inflation expectation equals 35 percent or greater (11 observations in the durable goods sample and 17 observations in the nondurable goods sample). We exclude two observations in which the expected house price growth is less than −50 percent. We exclude one observation in which the monthly mortgage payment exceeds $200,000. One observation is dropped in which single-quarter durable goods spending is $34,000 and one in which single-month nondurables spending is more than $28,000. Results are qualitatively robust to all these exclusions.

[19] The exclusion based on number of observations per individual does not reduce the number of observations dramatically and results in a modest increase in the precision of the estimates. Results are similar when restricting to households with at least four observations, but sample sizes are smaller.

[20] Researchers at RAND supplied us with a separate set of weights for each spending panel, such that a given household's weight is constant over time within each panel. Weights are calibrated to match the distribution of various demographic characteristics (including age-by-sex, race-by-sex, and household-size-by-income) of the 2012

D. Summary Statistics

Table 1a shows the weighted summary statistics of the key dependent and independent variables for our two main regression samples, constructed as described just above. Columns 1 through 4 pertain to the baseline sample for durable goods spending (N=1,084), and columns 5 through 8 pertain to the baseline sample for nondurable goods spending (N=2,010). The statistics for time-varying factors (such as spending) represent the weighted means across person-by-quarter or person-by-month observations; the means of demographic characteristics are weighted over the unique set of respondents represented in the sample. All dollar values are expressed in January 2012 dollars. Tables 1b and 1c provide analogous summary statistics restricted to the college subsample and the mortgagor subsample, respectively.

The set of respondents in the baseline durable goods sample appears to be approximately representative of the US population (of adults) in terms of the share with only a high school diploma or less education—at about 41 percent in our sample versus 42 percent in the 2012 American Community Survey (ACS)[21]—and in terms of the share that is female (45 percent in the sample versus 51.4 percent in the 2012 ACS). However, the durable goods sample over-represents homeowners (82 percent versus 69 percent in the 2012 Current Population Survey [CPS]) and underrepresents nonwhites (12 percent versus 22 percent, based on the 2012 ACS), and the mean age, at 56, is elevated relative to the mean age of 46 among all US adults aged 17 and older (based on the 2012 CPS).[22] Our sample's median age is slightly less elevated, at 54 versus 46 for the US

Current Population Survey (CPS). For weighting purposes, age was set to a respondent's age as of 2012. Sample weights are used in all descriptive statistics and regression analysis.

[21] The ACS figure for the share with no college education refers to individuals aged 25 and older and is taken from the American FactFinder. In our sample the share with only high school education or less does not change when restricting to aged 25 and older.

[22] The CPS homeownership rate of 69 percent represents the average rate over the 12 months of 2012, according to the monthly Integrated Public Use Microdata Series of the CPS (IPUMS-CPS). Similarly, the average age among US adults aged 17 and older represents the 12-month average for 2012 based on the IPUMS-CPS.

adult population. Also, median annual household income, estimated at $67,500 in our sample, exceeds the US value of $55,500, based on the 2012 ACS. [23] The group represented in the nondurable goods sample comes closer to the US population in terms of the female share (51 percent), the nonwhite share (19 percent), and median income ($55,000). However, the mean and median ages (55 and 53, respectively) are still elevated relative to the US population. The elevated age profile of both samples reflects the requirement that individuals have non-missing wage expectations, a point that we keep in mind when interpreting our results.

In the baseline sample, mean quarterly household spending on large durable goods—including major appliances, furniture, and televisions, but not including motor vehicles—amounts to $320, and 42 percent of (weighted) observations involve the purchase of at least one large durable good.[24] The corresponding values are about the same for the college sample and for the mortgagor sample. To put the sample mean durable goods spending figure in perspective, we estimate per-household quarterly expenditures on "furnishings and durable household equipment" using US real personal consumption expenditures data (in 2012 dollars) from the National Income and Product Accounts (NIPA). We arrive at an average figure of $513 per household per quarter for the period 2009Q4 through 2012Q4.[25] Although our sample mean value amounts to only about 62 percent of this estimate, earlier research by the Bureau of Labor Statistics shows that estimates

[23] Household income is observed as an income range rather than an exact value. Throughout the analysis we convert the income range to an exact value by substituting the midpoint of the range; the estimated medians represent the median of those midpoints. For the top category of $200,000 or greater we set income to $237,500, but results are robust to setting the top income at $200,000 instead.

[24] Recall that in the baseline durable goods sample, households that never purchased any durable goods do not contribute any observations.

[25] We use the Bureau of Economic Analysis spending category "furnishings and durable household equipment," which falls under the broader durable goods category, and divide by the total number of US households for the relevant time period. For source data see https://apps.bea.gov/iTable/iTable.cfm?ReqID=19&step=2#reqid=19&step=2&isuri=1&1921=underlying.

of household spending from the Consumer Expenditure Survey (CEX) tend to fall similarly short of comparable spending values based on the NIPA accounts.[26]

Average monthly spending on selected nondurable goods and services comes to $1,547 in the baseline sample and slightly more in the mortgagor sample. It is harder to compare our nondurables and services spending total to a comparable aggregate in the national accounts—the categories don't align well—but, as noted above, Hurd and Rohwedder (2012) find that this ALP spending module does a good job of reproducing the average per-household annual spending figures from the CEX when all spending categories are combined.

As shown in Figure 1, the respective median values of the one-year-ahead inflation expectation from our baseline durable goods spending sample (from 2009Q4 through 2012Q4) tend to overshoot the realized four-quarter changes in actual inflation in the United States from 2010Q4 through 2013Q4 (based on the non-seasonally adjusted all-items CPI-U).[27] The forecast errors (in percentage points) show an average of just above 1.0 for the time period, with a high of about 2.3 and a low of about –0.10. At the same time, the movements in our sample expectations over time generally track those in actual inflation one year forward, notwithstanding the marked fluctuations in our series from 2011Q4 through 2012Q3. In terms of bias, the median expectation from our baseline sample in most quarters proves more accurate than the corresponding median expectation from the Michigan Survey of Consumers, also shown in Figure 1.

The monthly median values of expected inflation from our baseline nondurables/services spending panel are considerably noisier, as shown in Figure 2, which plots those values against the monthly median values of expected inflation from the Michigan survey for the same time period. Most likely due to the small samples size per month, in four separate months the monthly

[26] See the Bureau of Labor Statistics website: https://www.bls.gov/cex/cecomparison.htm.
[27] This statement is based on Bureau of Labor Statistics data accessed via Haver Analytics.

median inflation expectation in our baseline sample exceeds 7 percent—even after we omit values of 35 percent or greater. We test the robustness to these high median values in Section 5.D.

Inflation expectations exhibit significant variation both between respondents and for respondents' individually ("within respondent[s]") over time—the standard deviation across all observations is in the vicinity of 3 percentage points in any given sample; see Tables 1a, 1b, and 1c. In the baseline sample (for either type of spending), the average within-respondent standard deviation of the one-year-ahead inflation expectation is close to 2 percentage points, the median within-respondent absolute difference between the current and the lagged inflation expectation is about 1 percentage point, and the 75th percentile value of the latter difference is about 2.5 percentage points.

Considering other economic expectations, within any given sample only a modest share of observations (4 percent to 16 percent) includes the expectation that interest rates would decline one year forward, consistent with short-term rates being held at zero and long-term borrowing rates already being quite low throughout our sample period. Unemployment expectations in our data appear somewhat pessimistic relative to the actual experience in the United States at the time, which generally involved falling (although generally high) unemployment: In most samples, the share of observations that include the expectation of an increase in unemployment exceeds the share that include the expectation of a decrease. The respective sample mean values of expected same-job real wage growth range from 1.25 percent (college sample, durable goods spending panel) to –1.34 percent (baseline sample, other spending panel). The latter figure comes quite close to the average realized (year-over-year) growth rate in median real weekly earnings from 2010Q4 through 2013Q4, which was –0.9 percent.[28] Based on the broader sample of the expectations

[28] These calculations are based on median usual weekly real earnings data produced by the Bureau of Labor Statistics and accessed from the St. Louis Fed's FRED website: https://fred.stlouisfed.org/series/LES1252881600Q.

surveys alone—not merged with the spending surveys—Armantier et al. (2013) report a similar, if slightly lower, range for the median value of expected real wage growth for the same time period.[29]

4. EMPIRICAL ESTIMATION METHODS

A. Approximate Reduced Form Specification

The consumption Euler equation in Section 2 above describes the expected one-period change in log consumption as a function of expected inflation and other factors, whereas our goal is to estimate the levels of response of current consumption to expected inflation and other factors. Similarly, in the case of discrete choice we want to estimate the probability of purchasing durable goods in response to inflation expectations and other factors. Starting from equation (1), solving for an easy-to-estimate reduced-form equation with current consumption (or log consumption or the probability of purchase) on the left-hand side is not a straightforward process. Consistent with the earlier literature, we adopt approximate reduced form equations that are informed by a combination of theory, economic intuition, and the properties of our data.

The durable goods spending data exhibit a high degree of skewness and include a large number of zeroes, properties that are to be expected for lumpy purchases. A common approach involves running an OLS regression of log spending on the explanatory variables of interest. This approach addresses data skewness, but it tends to yield biased results.[30] As a remedy, Wooldridge (2002) and Manning and Mullahy (2001) recommend using generalized linear models (GLM). The GLM approach addresses skewness by allowing nonlinear transformations of the dependent

[29] This statement is based on visual inspection of Figure 16 on page 298 of Armantier et al. (2013).

[30] OLS models of log spending may yield biased results for at least two reasons. First, if errors are heteroskedastic, spending predictions on the non-log scale will be biased (usually downward) unless adjustments that accurately account for the heteroskedasticity are applied (Nichols 2010; Manning 1998). Second, when there is a significant number of zero values, dropping these or translating them may also bias the coefficient estimates (Manning and Mullahy 2001).

variable (such as logs), yet it is robust to heteroscedasticity and can accommodate zeroes. Zeroes are allowed because the model specifies, for example, the log of *expected* spending rather than log spending itself. The extension of the GLM approach to panel data involves the use of generalized estimating equations (GEE), which permit flexible and robust models of the within-panel error correlation structure (Ballinger 2004; Zeger, Liang, and Albert 1988). From the GEE framework, we adopt a Poisson model, which implies that the log of the conditional mean of spending is linear in the explanatory variables. In our case, we write log expected spending as follows:[31]

$$\log E[\,C_t^i] = \alpha_0 + \alpha_1 E_t^i[\pi_{t+1}] + \alpha_2 E_t^i[\Delta r_{t+1}] + \alpha_3 E_t^i[\Delta U_{t+1}] + \alpha_4 E_t^i[\Delta w_{t+1}^i] + \alpha_5 E_t^i[\Delta H_{t+1}] + \alpha_6 y_t^i + \alpha_7 Unc_t^i(\pi_{t+1}) + \alpha_8 Unc_t^i(\Delta w_{t+1}^i) + \alpha_9 X_t^i + \mu_i + D_t \quad . \qquad (2)$$

In theory, the Poisson model represents counts data, but in practice, the distributional assumption does not need to be correct to generate consistent estimates. In particular, the Poisson quasi-maximum likelihood estimator (QMLE) is consistent as long as the conditional mean is correctly specified, even if the conditional variance does not equal the conditional mean. The estimators are asymptotically normal, and robust standard errors are readily obtained (Wooldridge 2002). For comparability, we use the same basic model to describe spending on nondurable goods and services as we do to describe spending on durable goods. [32] The nondurables and services spending data contain no zeroes, but they also exhibit significant skewness.

[31] Under reasonable assumptions one can start with a standard log-linear model of consumption and arrive at an expression for log expected consumption that is roughly equivalent to equation (3), up to additive differences in the constant term, the individual effects, and the time dummies. However, under the Poisson model the variance of non-log consumption increases in expected consumption, whereas in the standard log-linear model the conditional variance is homoscedastic.

[32] Consumption in the standard Euler equation refers to an undifferentiated nondurable good. If durable and nondurable goods are separable in the utility function, one can estimate analogues of equation (2) separately for the different types of goods. If the different types of goods are not separable, Padula (1999) argues, one should condition on the current stock of durables when estimating an Euler equation for nondurables spending. Accordingly, in models of nondurables spending we include a dummy for homeownership status as a proxy for the stock of durable goods.

In equation (2), $E_t^i[\pi_{t+1}]$ refers to the one-year-ahead inflation expectation as of the current time period, and α_1 denotes its reduced-form coefficient (as a semi-elasticity), which is not the same as the intertemporal elasticity of substitution. As noted in Section 2, this coefficient may take either a positive or negative sign depending on factors such as the household's initial net asset position and the relative strength of income and substitution effects. $E_t^i[\Delta r_{t+1}]$ refers to the expected (directional) change in nominal interest rates, $E_t^i[\Delta U_{t+1}]$ refers to the expected (directional) change in the aggregate unemployment rate, $E_t^i[\Delta w_{t+1}^i]$ stands for the expected percent change in the respondent's own real wage in the same job, and $E_t^i[\Delta H_{t+1}]$ refers to the expected percent change in the average US home price.[33] All these expectations are subjective at the level of the survey respondent and refer to one-year-ahead outcomes.

Turning to the second row of equation (2), the term y_t^i refers to (log) annual household income. $Unc_t^i(\pi_{t+1})$ denotes the subjective uncertainty of future inflation, and $Unc_t^i(\Delta w_{t+1}^i)$ refers to the subjective variance of (nominal) same-job wage growth for the survey respondent. As in Crump et al. (2019), these terms are included as proxies for the approximation error term, $o_{i,t}$, from equation (1). The term X_t^i refers to a vector of time-varying aspects of the household's financial situation, including whether the household owns a home, whether it has a home mortgage, and the combined amount of recurring payments it makes on its home (rent or mortgage payment) and its car (car loan payment). In the case of mortgagors, this list also includes the remaining

[33] With further abuse of notation, $E_t^i[\Delta r_{t+1}]$ actually refers to two distinct dummy variables: one indicating whether the subject expects interest rates to increase one year ahead, and another indicating whether the subject expects interest rates to decrease one year ahead. A separate coefficient is estimated for each dummy. At most, one of the two dummies can equal one; if neither dummy equals one, the subject expects interest rates to stay constant. Similarly, $E_t^i[\Delta U_{t+1}]$ refers to two distinct dummy variables, respectively, for whether the subject expects unemployment to increase and whether the subject expects unemployment to decrease one year ahead.

balance on the household's mortgage. We use time-period dummies, D_t, to capture all time-specific (quarter-by-year or month-by-year) aggregate influences on current spending.

The term μ_i refers to fixed factors at the household level that may influence the household's inflation expectations as well as its spending and the higher-order conditional moments. In theory this term captures observed factors, such as demographic characteristics, and unobserved factors, such as financial literacy and idiosyncratic preferences, that could influence both expectations formation and spending (Bruine de Bruin et al. 2010; Burke and Manz 2014). In practice, we proxy for the unobserved heterogeneity using the correlated random effects approach (Wooldridge 2019; Wooldridge 2002; Zeger, Liang, and Albert 1988; Chamberlain 1982; Mundlak 1978). This method models the individual heterogeneity term, μ_i, as a linear function of the within-respondent means of the time-varying regressors. Accordingly, we include the within-respondent mean of each of the time-varying explanatory variables as an additional regressor. This approach assumes that, after we include these controls, the time-varying disturbances are rendered strictly exogenous.[34] However, the disturbances may still be correlated within a respondent over time. We assume an exchangeable correlation structure, which means that all the off-diagonal elements of the variance-covariance matrix are equal in expectation.[35] Because our panel is unbalanced, this method requires that selection into the sample in a given period is uncorrelated with the time-varying innovations in the dependent variable (Wooldridge 2019). According to Hurd and Rohwedder (2012), the spending panel data exhibit no evidence of this type of selection bias.

[34] In linear models, the correlated random effects method is equivalent to a fixed effects estimation, and therefore the inclusion of "random effects" in the name may be misleading. See Wooldridge (2019).

[35] In Stata, the estimation proceeds using the "xtgee" command, selecting the Poisson family with the log link function, using the random effects option, and assuming an exchangeable correlation structure. The standard errors are clustered at the individual level, and the robust option is selected.

It is also possible to estimate a fixed effects Poisson model using conditional maximum likelihood, which places no restrictions on the unobserved heterogeneity. However, this approach carries several disadvantages compared with the correlated random effects approach: (1) it cannot give estimates of population average marginal effects and therefore does not yield quantitative policy implications; (2) the estimation cannot make use of population weights; (3) consistent estimation requires that the residuals be serially uncorrelated within a respondent; and (4) the estimation tends to be less efficient than the estimation of correlated random effects Poisson models (Ballinger 2004).

In addition to models of spending on durable and nondurable goods, we also estimate models of whether any durable goods were purchased at all. In the latter case, given the binary dependent variable, we adopt a logit model, which we also estimate using GEE with correlated random effects, but we select the options that imply a logit link function and a binomial error distribution.

In all models, we also include the lagged inflation expectation, as described in Section 3.C above, in order to detect any lagged effects (at a modal distance of roughly one quarter or roughly one month) of expected inflation on spending. In the case of big-ticket durable goods, lagged effects are plausible because it may take time to select the specific model of the good desired. More generally, lagged effects could occur if households have ingrained spending habits that take time to adjust to changes in expectations.

In the most comprehensive models, we also include several interaction terms not shown in equation (2). These include interactions between the inflation expectation and (1) the dummy variable for no college exposure, (2) the within-respondent mean of log income, (3) the within-respondent average of the recurring payments, (4) the within-respondent average mortgage

indicator, and, in the mortgagor sample, the within-respondent mean of the mortgage balance. These interactions test hypotheses about the mechanisms that either inhibit or promote a positive spending response to expected inflation. For example, households with more education may have greater economic literacy and/or greater cognitive abilities, either of which would predict a better understanding of inflation and real interest rates and therefore a stronger spending response to expected inflation. Households with lower income might have lower net worth (higher net debt), which in theory predicts a stronger response. For similar reasons, mortgagor households (compared with otherwise similar non-mortgagor households) might also exhibit a stronger response to their inflation expectations. Also, based on real wealth effects of nominal debt, mortgagor households with higher mortgage balances (controlling for income) are expected to react more positively than those with lower balances. Higher existing payments on housing and cars (again, controlling for income) could limit a household's ability to borrow further and so might inhibit its spending response to an expected increase in inflation. In each interaction term we use the within-respondent mean of the given factor on the premise that the mean offers a more reliable indicator of the mediating factor, and because we do not expect to pick up within-respondent changes in the response to expected inflation due to likely small changes in, for example, the household's mortgage balance over a relatively short time period.

B. Identification Issues

In order to estimate equation (2), identification of the coefficient α_1 requires that within-respondent changes in inflation expectations be strictly exogenous in the time-varying idiosyncratic shocks to spending. We control for what we believe are the most important potential confounders of the effects of inflation expectations on spending, including household-level heterogeneity, household-level expectations for economic factors other than inflation, household-

level financial conditions, aggregate shocks, and, in extended models, regional fixed effects and regional gas prices. Controlling for household-level heterogeneity addresses identification concerns to a significant degree, because a study that links similar survey data on inflation expectations with an economic experiment finds that, in the experiment, respondents adjusted their behavior reasonably as their inflation expectations changed organically over time (Armantier et al. 2015).

Movements in oil prices have been found to exert a significant influence on consumers' inflation expectations (Coibion and Gorodnichenko 2015). As shown in Figure 3, the quarterly median inflation expectation in our sample roughly tracks the four-quarter changes in US retail gas prices, at least from 2009Q4 through 2011Q4. Since changes in gasoline prices could directly affect real spending on non-gasoline items, as found by Gelman et al. (2019), it may be important to control for any confounding effects from gas price inflation. Time dummies will control for national gas prices per time period, but gas price movement could vary regionally. Therefore, as described in Section 5.D, we include regional gas price inflation as an additional control variable in some models, using publicly available information from the Energy Information Administration.

Essentially, we assume that, conditional on the included controls, the revisions to households' inflation expectations occur in response to factors that do not also directly affect their current consumption decisions. For example, a household member might hear a friend complain that inflation is too high (or increasing), and this might cause him to raise his own expectations for inflation, but the friend's complaint should not directly affect the household member's spending decision. Reading a newspaper article about a recent actual increase in headline inflation, or about an increase in the Federal Reserve's latest forecast for inflation, might have a similar effect of raising an individual's expectations for future inflation, and again (conditioned on the controls)

such information should affect current spending only insofar as it affects the household's inflation expectations.

Identification also requires that there is no reverse causality from spending to inflation expectations. Reverse causality might occur, for example, if a household notices an increase in its nominal spending on a given basket of goods—caused by recent inflation in the prices of those goods—and this recognition causes members of the household to raise their expectations for inflation. A household might also mistake an increase in real spending for an increase in nominal spending and have a similar response. We control for these possibilities in three ways: (1) we deflate nominal spending values to obtain real spending values, as described in Exhibit A;[36] (2) we include time dummies in all models to control for any confounding effects from actual aggregate inflation, aggregate gas price inflation, and other macroeconomic factors; and (3) we match the data in a way that reduces the possibility that expectations were formed after the spending took place. Regarding the data matching, it is possible to restrict the sample to the set of observations in which the "current" inflation expectation was formed before the beginning of the spending quarter or month. When we use that method, the results (available upon request) are actually quite robust, but we lose a significant number of observations.

5. RESULTS

A. Durables goods spending on the continuous margin

Table 2a shows the results of models of durable goods spending estimated over the baseline sample and, separately, over the sample restricted to observations from respondents with at least some college education ("college sample"). All models are estimated using the GEE approach, with random effects and assuming an exchangeable within-respondent correlation structure—as

[36]All results are robust to using nominal spending values instead of the deflated values.

discussed in Section 4.A above. Most models (as indicated in the tables) adopt a correlated random effects structure, in which we include the within-respondent means of the time-varying regressors in order to control for household-level heterogeneity (Wooldridge 2002).[37] The coefficients on most of the latter variables are suppressed from the tables for compactness; see table notes for details.

Most coefficient estimates represent semi-elasticities, while the coefficients on household income and monthly payments represent elasticities. For the inflation expectation, inflation uncertainty, the wage growth expectation, wage growth uncertainty, and the house price growth expectation, a unit change represents 1 percentage point; for expected movements in unemployment and interest rates (and other discrete factors such as female gender), a coefficient represents the effect of changing the value of the dummy variable from zero to one. All variables that enter into interactions have been re-centered on their sample-wide means in order to facilitate interpretation of interaction effects. All expectations variables refer to expected outcomes one year forward of the date on which information about the expectations were elicited. The joint significance of each regression is indicated by a Pearson chi-squared statistic and its corresponding P-value, shown at the bottom of the table.[38]

Column 1 of Table 2a shows results from a standard GEE model that includes just the current inflation expectation and current inflation uncertainty, plus a constant term and time dummies. Column 2 presents the results from the model that implements the correlated random effects estimation while also adding extensive control variables and interactions between the

[37] We include the within-household mean of the current inflation expectation but not also the within-household mean of the lagged inflation expectation, because there is considerable overlap between these variables.
[38] The Pearson chi-squared statistics are based on the Pearson residuals. The latter are based on the raw residuals of (non-log) spending from its fitted value, adjusted for the fact that, under the Poisson distribution, the conditional variance of (non-log) spending is increasing in its conditional mean.

inflation expectation (and related variables) and the "no-college" indicator. Columns 3 and 4 are the analogs of the first two columns, respectively, restricted to the college sample. Column 5 is similar to column 4, but it also includes interaction terms between the current inflation expectation and each of three within-respondent average characteristics: (1) the average of the monthly payments variable, (2) the average of the mortgage indicator variable, and (3) the average (log) annual household income.

In column 1, the main coefficient on the inflation expectation is a small positive value that is not significantly different from zero. In column 2, we observe a negative interaction between the inflation expectation and the "no college" dummy, suggesting that non-college households respond less positively to expected inflation than do college-exposed households, or they may even respond negatively. Motivated by this observation, we isolate the households in which the respondent has some college education. Column 3 shows that these "college types" respond positively to their current inflation expectation, and after controls are added in column 4, the effect becomes greater and even more highly significant. Note that the coefficient on the household-mean inflation expectation is a large negative value, suggesting that households that tend to exhibit higher expectations for inflation also tend to spend less money on durable goods. Without this control, the effect of the current inflation expectation is therefore biased downward (compare columns 3 and 4), suggesting that the earlier literature's cross-sectional (rather than panel) surveys may underestimate the relationship between inflation expectations and consumption. Based on columns 2 through 4, college types respond positively to their lagged inflation expectation, and non-college types respond less positively or perhaps negatively. Also, college types respond less strongly to their lagged inflation expectation than they do to their current inflation expectation.

In column 5, the coefficient in the top row—which is positive but imprecisely estimated—represents the semi-elasticity of durable goods spending with respect to the current inflation expectation for a college-type household with the sample-mean values for each of the interaction factors near the bottom of the table. We observe a significant interaction effect, such that households with higher average income levels exhibit smaller percentage increases in spending for a given increase in expected inflation, while the other interaction coefficients are statistically insignificant. These results suggest that the average response to (current) expected inflation among college types is driven by households with below-average incomes.

Table 2b shows estimates of the average marginal effects of the inflation expectation (either current or lagged) on durable goods spending within the college sample (expressed as semi-elasticities). Column headings indicate the model number (from Table 2a) from which the estimates are derived. The row labels indicate the values of the covariates used in producing the estimates.[39] Standard errors are in parentheses below each estimate. Based on either model, both of which control for household-level heterogeneity, durable goods spending increases an average of 19 percent for a 1 percentage point increase in the household's current inflation expectation, and both estimates are highly significant. Based on Model 4, spending increases 9 percent for a 1 percentage point increase in the lagged inflation expectation, but in Model 5 the effect of the lagged expectation is smaller and insignificant. Based on Model 5, college-type households with a mortgage may exhibit a response to expected inflation that is stronger than the average response of college-type households, and stronger than the response of college-type households with average income at the 25th percentile of the college sample income distribution.

[39] Using Stata's "margins" command, average marginal effects are estimated holding the given characteristic(s) at the specified value(s) and integrating over the distribution of the remaining regressors among the population with the given characteristic(s).

Looking back at Table 2a, the estimated coefficients on variables other than the (current or lagged) inflation expectation mostly agree with economic intuition. For example, households reduce current spending on durables by a large and statistically significant percentage when they expect the unemployment rate to increase. Durables spending exhibits a strong positive association with (within-respondent-average) income, although current income carries a marginally significant negative coefficient. Female respondents report values of household spending that are much larger than the values for male respondents, but the effects become only marginally significant in the college sample. The (time-varying) real wage expectation exhibits positive but small and insignificant coefficients, and coefficients on (time-varying) wage growth uncertainty are also not significantly different from zero. Mean (within-respondent) wage growth uncertainty is negatively associated with spending, suggesting that households with consistently higher wage growth uncertainty also tend to spend less on durable goods, but the effects are at best marginally significant. The coefficients on inflation uncertainty have inconsistent signs and are generally insignificant, perhaps because it matters whether the uncertainty skews to the upside or the downside. The coefficients on expecting an interest rate increase are similarly inconclusive.

Table 3a shows results estimated over the subsample of respondents who report having a mortgage in each period they are observed. For this subsample, the current inflation expectation exhibits a positive association with durable goods spending in all models, and again the association is stronger when the controls for household heterogeneity are included (in columns 2 and 3). We again obtain a negative interaction between the current inflation expectation and the no-college dummy, but the coefficient is no longer statistically significant. Column 3 presents results that are consistent with the predictions discussed above: a significantly positive coefficient for the interaction between the current inflation expectation and the remaining mortgage balance

(averaged within the respondent), a negative (but insignificant) coefficient for the interaction between average recurring payments and the current inflation expectation, and also a negative (insignificant) coefficient for the interaction between average household income and the current inflation expectation.

Table 3b shows the estimated average marginal effects among mortgagors, based on model 3 from Table 3a. The average marginal effects of the current inflation expectation among college-educated mortgagors—in percentage terms—exceed the previous estimates for college types in general (from Table 2b). The average college-educated mortgagor increases spending on durables 30 percent per 1 percentage point increase in the current inflation expectation. Among non-college types with a mortgage, the marginal effects estimates are uniformly positive, but the effects are insignificant. The impact of the mortgage balance on the inflation response is economically significant: College-type mortgagors with a mortgage balance at the 75^{th} percentile increase spending 42 percent per 1 percentage point increase in the current inflation expectation. In contrast, the inflation response at the 25^{th} percentile of the monthly payments distribution (among college-type mortgagors) is only slightly greater than the average response among college-type mortgagors (32 percent versus 30 percent). Unlike college types on average, college-type mortgagors exhibit a zero response to the lagged inflation expectation.

Conceptually, inflation expectations affect consumer spending because the real interest rate declines with expected inflation when the nominal interest rate is fixed. To test this mechanism, we estimate a model of durable goods spending over a restricted set of observations in which the respondent expects nominal interest rates to either stay the same or decrease, with no restrictions on education or mortgagor status. We presume that individuals who expect nominal interest rates to remain fixed (or decline) will respond more strongly to an increase in expected inflation than

would those who expect nominal rates to increase. Results are shown in Table 4, which for comparison purposes also includes estimates over the complete baseline sample (based on the model in column 2 of Table 2b). The point estimates of the average marginal effects on the current inflation expectation are uniformly larger (all are positive) when estimated over the restricted sample. However, among non-college types the marginal effect of the lagged inflation expectation achieves a statistically significant negative value in the restricted sample. These results therefore offer some empirical support for the mechanism of real interest rate effects, but they are obviously not conclusive.

B. Durable goods consumption on the discrete margin

The spending survey on which we rely is designed to minimize recall error (Hurd and Rohwedder 2012). Nevertheless, discrete purchase decisions, compared with exact spending amounts, may be subject to less recall bias, especially in the case of large durable goods. Moreover, the response of consumption to expected inflation could operate differently along the extensive margin, with potential implications for policy. Therefore, we investigate discrete margins of durable goods consumption to gain a more complete and robust picture of the consumption response to inflation expectations.

Table 5a shows results of logit models of whether any durable goods were purchased in a given quarter, estimated using GEE and including the same controls for fixed heterogeneity employed previously. Results are shown for two models for each of the baseline and mortgagor samples. We suppress results from the college sample, because given the baseline sample estimates, they prove redundant. Non-college types are significantly less likely to purchase durable goods as the current inflation expectation increases (row 4 of columns 1 and 2). Among college types (based on columns 1 and 2), the chances of purchasing durable goods appear unresponsive

to an increase in the current inflation expectation. Results for the mortgagor sample (columns 3 and 4) indicate that college-educated mortgagors are more likely to purchase durables as the current inflation expectation increases, whereas mortgagors with no college education appear to exhibit the opposite tendency, based on the large negative interaction coefficient.

Table 5b shows estimates of average marginal effects in the baseline sample, from the models in the first two columns of Table 5a. The average response on the discrete margin is negative, though not necessarily significant, but this average effect embeds a significant negative response (–18 percent or –21 percent) among non-college types and a null response among college types. As shown in Table 5c (based on the last two columns of Table 5a), we observe among mortgagors an even starker difference in responses based on educational attainment: For a 1 percentage point increase in the current inflation expectation, college-educated mortgagors are 30 percent more likely to purchase durables, whereas mortgagors with no college education are 25 percent less likely to buy durables.

Table 5a also shows that the interactions between expected inflation and other variables are in some cases weaker than those observed for the continuous spending response. For example, the response to the current inflation expectation generally decreases with household income for all types, but the effects are no longer significant among mortgagors. Among mortgagors, the interaction between the current inflation expectation and the mean mortgage balance remains positive but is no longer statistically significant. Other results from Table 5a worth noting are that for all groups, the chances of buying durable goods decrease by an economically and statistically significant margin when a respondent expects unemployment to increase. Also, although households with higher average wage growth uncertainty appear significantly less likely to

purchase durables, an increase in a respondent's wage growth uncertainty is associated with a significant increase in the chances of purchasing durables, across all samples.

C. Spending on Nondurable Goods and Services

Ultimately, policymakers want to know whether policies that would boost inflation expectations would increase spending in the aggregate, considering all types of goods and all types of households. Accordingly, we need to consider the impact of an increase in expected inflation on other types of spending, consisting in our case of monthly spending on a bundle of nondurable goods and services (see Exhibit A mentioned above).

Table 6a shows results from GEE models of monthly spending on nondurable goods and services estimated separately over the baseline sample, the college sample, and the mortgagor sample. Aside from the difference in the dependent variable and the time unit, the model for a given sample is equivalent to the most complete model of durable goods spending estimated over the same sample. (We suppress models with fewer regressors, because the coefficients of interest are quite similar across model specifications.) The results indicate that other spending is mostly unresponsive to expected inflation, whether current or lagged and regardless of respondents' educational attainment and mortgagor status—marginal effects estimates are discussed shortly.

Other coefficient estimates in Table 6a are qualitatively similar to those observed for durable goods spending but are in most cases smaller in size. For example, the semi-elasticity of expecting an increase in unemployment (rather than no change) on nondurables and services spending is just –0.12 for the baseline sample (column 1), whereas the corresponding value for durable goods spending is much greater, at roughly –1.16 (based on column 2 of Table 2a).

Considering the marginal effects estimates, Table 6b confirms that there is a zero response of other spending to the current inflation expectation on average in both the baseline sample and

among college types. Among mortgagors (regardless of educational attainment) there is, if anything, a negative response of nondurables/services spending to an increase in the current inflation expectation, but the average marginal effect is modest (–2 percent) and only marginally significant. Among mortgagors with a 75th percentile mortgage balance, the response of other spending to the current inflation expectation is not significantly positive, despite the positive interaction coefficient between the mortgage balance and the current inflation expectation.

D. Robustness Checks

This section reports selected results of various robustness checks. In most cases we report results only for models of durable goods spending and discrete purchases, as these are the only outcomes for which we observe significant positive effects of expected inflation on consumption. For compactness we show results only for selected model specifications. Any results not shown are available on request.

***Controlling for gas price inflation*:** For reasons discussed in Section 3 above, the estimated relationships between inflation expectations and spending could be confounded by the omission of gasoline price inflation. Using the respondent's state of residence, we attach a measure of retail gasoline price inflation at the level of the Petroleum Administration for Defense District, or PADD, as published by the US Energy Information Administration.[40] We also include PADD dummies to isolate regional gas price effects from regional fixed effects. Table A1 shows results for durable goods spending that include these controls. For a given sample the model corresponds to the model with all variables except for the interactions between the current inflation expectation and each of

[40] We use the year-over-year change in the region-specific price of regular gasoline, dated to the quarter or month of the given observation. Monthly gas prices reflect the simple average of the published weekly prices for the given month, and similarly for quarterly prices. The seven districts are New England (PADD 1A), Central Atlantic (PADD 1B), Lower Atlantic (PADD 1C), Midwest (PADD 2), Gulf Coast (PADD 3), Rocky Mountain (PADD 4), and West Coast/Alaska/Hawaii (PADD 5). For more information, see https://www.eia.gov/todayinenergy/detail.php?id=4890 and https://www.eia.gov/dnav/pet/TblDefs/pet_pri_gnd_tbldef2.asp.

the following variables: household income, mortgagor status or mortgage balance, and monthly payments. The results are robust: The respective coefficient point estimates on the inflation expectation (either current or lagged) are not significantly different from the previous estimates, and the statistical significance levels are unchanged. We also observe either marginally significant (college sample) or highly significant (baseline and mortgagor samples) coefficients on regional gas price inflation that are, in terms of magnitude, either close to or somewhat smaller than the corresponding coefficients on expected inflation. As shown in Table A2, results for the discrete purchase margin of durables goods are similarly robust, and gas price inflation itself exerts no significant effect on the likelihood of purchasing durables. The results from the previous section remain similar when we add the same controls to models of spending on nondurable goods and services, as shown in Table A3.

Since demand for gasoline is relatively inelastic, we might have expected consumption of non-gasoline items to fall in response to an uptick in gas price inflation; however, we find that durables spending rises and other outcomes are unresponsive to gas price inflation.[41] We can think of at least two reasons for this positive association. First, substitution effects might dominate income effects, with consumers moving away from car purchases (a complement to gasoline) and toward other durable goods. Second, regional gas price inflation might be picking up regional differences in inflation that are not eliminated by our national deflators. In this case, however, the correlation between gas price inflation and spending would be purely mechanical and we would expect to observe similar correlations for all types of spending, whereas Table A3 shows that is not the case.

[41] For example, Gelman et al. (2019) observe large increases in non-gasoline consumption in response to the large declines in oil prices in 2014.

Including medium-run inflation expectations: Longer-run expectations for inflation might also influence current consumption, and we observe expectations for inflation for the two-to-three-year-ahead horizon in our data set. In the models estimated so far, we have omitted these medium-run inflation expectations in order to retain comparability with previous studies, most of which observe only expectations for one-year-ahead inflation. Table A4 shows results of selected models of durable goods spending (on the continuous margin) that add the (current) medium-run inflation expectation (comparable to columns 2, 4, and 5 from Table 2a and columns 2 and 3 from Table 3a). In most cases the estimated coefficient on the (current) one-year-ahead inflation expectation is larger in the model that includes the medium-run inflation expectation, but the new estimates generally lie within one standard deviation of the original estimates. Among mortgagors, the negative interaction between the mean mortgage balance and the (current) one-year-ahead inflation expectation remains positive and highly significant, and its point estimate is unchanged. The coefficient on the medium-run inflation expectation is negative in all cases but is only marginally significant at best. These results suggest that omitting the medium-run inflation expectation from the featured models may yield somewhat conservative estimates of the coefficients on the (current) one-year-ahead inflation expectation. Results along the extensive margin of durables consumption (not shown) are similarly robust to including the medium-run inflation expectation.

Large fluctuations in the monthly median inflation expectation: Inspecting Figure 2 above, we observe that the sample median inflation expectation appears elevated in selected months—for example, the median expectation exceeds 8 percent in both June 2010 and March 2011. These values most likely reflect our relatively small sample sizes per month. To ensure that these large fluctuations are not biasing results pertaining to the monthly panel, we run regressions

of nondurables/services spending for each of the three samples (baseline, college, mortgagor), omitting all observations from June 2010, July 2010, March 2011, and April 2011. We omit the months following the expectations spikes to ensure that extreme values don't enter as lagged expectations, either. Other data from the omitted months still enter into the calculations of within-respondent averages of the explanatory variables, rendering those values unchanged. Results from one model for each sample are shown in Table A5—corresponding column for column to Table 6a above. In almost all cases the coefficient estimates are not significantly different from what they were when all months were included. One exception is that among mortgagors, the interaction between the no-college dummy and the current inflation expectation has become significantly negative, suggesting that mortgagors without any college education may reduce spending on nondurable goods and services when the inflation expectation increases (given that the main coefficient on the inflation expectation is not significantly different from zero).

6. AGGREGATE POLICY IMPLICATIONS

Despite our finding that some types of households exhibit a strong durable goods consumption response to an increase in expected inflation, our results do not make a strong case for policies seeking to boost aggregate consumption by engineering expectations of higher inflation. The primary reasons are that the effects are limited to durable goods spending for a subset of the population, and even for that group, the effects are not very persistent. Therefore, even if the central bank can engineer a permanent shift in inflation expectations, the effects are likely to be limited.

For example, in the baseline sample the average effect of a 1 percentage point increase in the current inflation expectation on consumption is limited to a 4 percent increase in durables spending in a single quarter, whereas lagged effects are zero or possibly negative (based on Table

4, column 1, top row). That durables account for only 10 percent of aggregate spending means that aggregate spending in the quarter increases just 0.4 percent. One can boost this estimate by arguing that the effects are strongly positive for college-educated consumers, whereas the negative point estimates for non-college types should be treated as zeroes, given their imprecision. Focusing on college-educated consumers (Table 2b), following a 1 percentage point increase in the inflation expectation, we would get a 19 percent increase in durables spending in the first quarter, followed by an additional 9 percent increase in the second quarter. Calculations similar to those above would yield an increase of approximately 1 percent in aggregate spending over two quarters.[42]

Based on European data, Duca, Kenny, and Reuter (2019) estimate that a 2 percentage point increase in expected inflation would lead to a cumulative increase in aggregate spending on the order of 0.36 percent over a three-year horizon. This prediction is quite close to the one in our most optimistic scenario, once our results are translated to an equivalent scale. Since we do not have significant results beyond two quarters, our optimistic estimate of a 1 percent increase in two-quarter spending implies a 0.17 percent increase in three-year spending, and twice that amount for a 2 percentage point increase in expected inflation. However, the Duca et al. estimate draws on the correlation between durables spending attitudes and overall spending in the aggregate, which may reflect the common influence of sentiment on both factors rather than the influence of inflation expectations on nondurables/services spending.[43] Considering our more pessimistic assessment, weaker effects in the United States compared with Europe could reflect the fact that, during our

[42] For the first (second) quarter, we get a 19 percent (9 percent) increase in 10 percent of aggregate spending by a group that constitutes about three-quarters of aggregate spending (based on the 2017 Consumer Expenditure Survey). Assuming spending would otherwise have been constant across quarters, these assumptions imply an increase in two-quarters spending of 0.5*(0.19+0.09)*0.1*0.75=0.0105, or 1.05 percent.

[43] D'Acunto, Hoang, and Weber (2016) do a back-of-the-envelope calculation that the 3 percent VAT increase in Germany translates to 4.8 percent higher durable consumption expenditure if all Germans expect higher inflation. Since we do not know how much of a change in inflation expectations this VAT increase corresponds to, it is difficult to compare our results with theirs.

observation period, US households faced greater debt overhang in the wake of the mortgage crisis (Mian, Rao, and Sufi 2013), resulting in a persistent insensitivity to interest rates, as observed by Van Zandweghe and Braxton (2013).

Furthermore, if attempts to boost expectations for future inflation lead some individuals to also expect an increase in unemployment—as suggested by recent research (Kamdar 2018)—then according to our results, aggregate spending might actually decline, as households in our sample spend significantly less (on all types of goods) when they expect an increase in unemployment rather than stable unemployment. Nonetheless, our policy implications are subject to the caveat that the effects we estimate may not be causal, because the variations in expectations that we exploit, even at the within-respondent level, may not be strictly exogenous. Other caveats are that our sample population is not fully representative because it is relatively old and includes only employed people (with wage expectations), and our spending bundles do not include all spending categories.

7. CONCLUSION

Using a unique panel data set that matches the inflation expectations of individual respondents with the actual spending behavior of the respondent's household, we find that some subgroups of the population—particularly college-educated mortgagors and, to a lesser extent, college-educated individuals in general—exhibit significantly greater real spending on durable goods when their one-year-ahead expectations for inflation are higher. Considering the discrete margin, the probability of purchasing durable goods exhibits a marginally significant negative association with expected inflation in the baseline sample on average, but among mortgagors with a college education, the corresponding association is strongly positive. Spending on nondurable goods and services is basically unresponsive to expected inflation regardless of educational

attainment and mortgagor status. Also, expecting an increase in unemployment is associated with large and robust negative effects on durable goods spending and modest negative effects on nondurables/services spending.

Our results shed light on the factors that might enable or inhibit the consumption response to inflation expectations. Our finding that households with mortgages—and among mortgagors, those with higher mortgage balances—increase durables spending more than households without mortgages (or with lower mortgage balances) agrees with the prediction that individuals with higher debt loads—all else being equal—should respond more strongly to higher expected inflation. The modest inhibiting effect of higher recurring debt payments on the response of durable goods consumption to expected inflation in some models suggests that higher payments may limit a household's ability or desire to finance new durables purchases even as real borrowing costs decline. Moreover, consistent with the idea that an increase in inflation expectations encourages greater spending by reducing the real interest rate, the spending response of durable goods to higher expected inflation appears stronger after we drop observations in which households also expect nominal interest rates to increase. Nonetheless, on average in our broadest sample, households' expectations of nominal interest rates do not influence their spending significantly.

Overall, our results help to reconcile some of the conflicting evidence observed across previous studies. Compared with other papers that use data from the United States, our results are qualitatively similar to those of Bachmann, Berg, and Sims (2015) in that we also observe a zero or possibly negative response of durable goods purchases on the extensive margin to the household's inflation expectation. However, our positive results along the continuous margin are more consistent with the findings of Crump et al. (2019)—who also control for household-level

heterogeneity and who examine the quantitative response of total spending growth. The fact that we observe some positive effects of inflation expectations on durable goods consumption agrees loosely with the results of a few studies of European consumers, although those studies typically observe only qualitative measures of readiness-to-spend.

In sum, we observe evidence of positive effects of household inflation expectations on durable goods spending along the continuous margin. Nevertheless, since the effects are limited to durable goods consumption for only a subset of the population, the estimated aggregate effects on total consumption are rather limited. If consumers' expectations for inflation and unemployment tend to move in the same direction, policies that stimulate inflation expectations may have the unintended consequence of stoking higher expected unemployment and, as a result, could lead to net reductions in aggregate spending. Therefore, central banks should exercise caution in using inflation expectations as a policy tool.

References

Armantier, Olivier, Giorgio Topa, Wilbert van der Klaauw, and Basit Zafar. 2017. "An Overview of the Survey of Consumer Expectations." *FRBNY Economic Policy Review* (December 2017): 51–72.

Armantier, Olivier, Wändi Bruine de Bruin, Simon Potter, Giorgio Topa, Wilbert van der Klaauw, and Basit Zafar. 2013. "Measuring Inflation Expectations." *Annual Review of Economics* 5: 273–301.

Armantier, Olivier, Wändi Bruine de Bruin, Giorgio Topa, Wilbert van der Klaauw, and Basit Zafar. 2015. "Inflation Expectations and Behavior: Do Survey Respondents Act on Their Beliefs?" *International Economic Review* 56(2): 505–36.

Bachmann, Rudiger, Tim O. Berg, and Eric R. Sims. 2015. "Inflation Expectations and Readiness to Spend: Cross-Sectional Evidence." *American Economic Journal: Economic Policy* 7(1): 1–35.

Ballinger, Gary A. 2004. "Using Generalized Estimating Equations for Longitudinal Data Analysis." *Organizational Research Methods* 7(2): 127–150.

Barattieri, Alessandro, Susanto Basu, and Peter Gottschalk. 2014. "Some Evidence on the Importance of Sticky Wages." *American Economic Journal* 6(1): 70–101.

Bernanke, Ben S., and Mark Gertler. 1995. "Inside the Black Box: The Credit Channel of Monetary Policy Transmission." *Journal of Economic Perspectives* 9(4): 27–48.

Bruine de Bruin, Wandi, Wilbert van der Klaauw, Julie Downs, Baruch Fischhoff, Giorgio Topa, and Olivier Armantier. 2010. "Expectations of Inflation: The Role of Financial Literacy and Demographic Variables." *Journal of Consumer Affairs* 44(2): 381–402.

Bruine de Bruin, Wandi, Charles F. Manski, Giorgio Topa, and Wilbert van der Klaauw. 2011. "Measuring Consumer Uncertainty about Future Inflation." *Journal of Applied Econometrics* 26(3): 454–478.

Bryan, Michael F., and Guhan Venkatu. 2001. "The Demographics of Inflation Opinion Surveys." *Federal Reserve Bank of Cleveland, Economic Commentary,* October 2001.

Burke, Mary. A., and Michael Manz. 2014. "Economic Literacy and Inflation Expectations: Evidence from a Laboratory Experiment." *Journal of Money, Credit and Banking* 46(7): 1421–1456.

Burke, Mary A., and Ali Ozdagli. 2013. “Household Inflation Expectations and Consumer Spending: Evidence from Panel Data.” Federal Reserve Bank of Boston Working Papers No. 13-25.

Carroll, Christopher D. 2001. “Death to the Log-Linearized Consumption Euler Equation! (And Very Poor Health to the Second-Order Approximation).” *The B.E. Journal of Macroeconomics* 1(1): Article 6.

Chamberlain, Gary (1982). “Multivariate Regression Models for Panel Data.” *Journal of Econometrics* 18(1): 5–46

Christiano, Lawrence J., Martin Eichenbaum, and Charles L. Evans. 2005. “Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy.” *Journal of Political Economy* 113(1): 1–45.

Coibion, Olivier, and Yuriy Gorodnichenko. 2015. “Is the Phillips Curve Alive and Well after All? Inflation Expectations and the Missing Disinflation.” *American Economic Journal: Macroeconomics* 7(1): 197–232.

Coibion, Olivier, Yuriy Gorodnichenko, and Rupal Kamdar. 2018. “The Formation of Expectations, Inflation, and the Phillips Curve.” *Journal of Economic Literature* 56(5): 1447–1941.

Coibion, Olivier, Dimitris Georgarakos, Yuriy Gorodnichenko, and Maarten van Rooij. 2019. “How Does Consumption Respond to News About Inflation? Field Evidence from a Randomized Control Trial.” NBER Working Paper No. 26106.

Crump, Richard K., Stefano Eusepi, Andrea Tambalotti, and Giorgio Topa. 2019. “Subjective Intertemporal Substitution.” Federal Reserve Bank of New York Staff Reports No. 734. (Revised from original version of July 2015).

D'Acunto, Francesco, Daniel Hoang, and Michael Weber. 2016. “The Effect of Unconventional Fiscal Policy on Consumption Expenditure.” NBER Working Paper 22563.

D'Acunto, Francesco, Daniel Hoang, and Michael Weber. 2018. “Unconventional Fiscal Policy.” NBER Working Paper 24244.

D’Acunto, Francesco, Daniel Hoang, Maritta Paloviita, and Michael Weber. 2019. “IQ, Expectations, and Choice.” NBER Working Paper 25496.

Del Negro, Marco, Domenico Giannone, Marc P. Giannoni, and Andrea Tambalotti. 2018. “Global Trends in Interest Rates.” Federal Reserve Bank of New York Staff Reports No. 866.

Drukker, David M. 2003. “Testing for Serial Correlation in Linear Panel-Data Models.” *The Stata Journal* 3(2): 168–177.

Duca, Ioana A., Geoff Kenny, and Andreas Reuter. 2019. “Inflation Expectations, Consumption & the Lower Bound: Micro Evidence from a Large Euro Area Survey.” European Economy Discussion Paper 092.

Eggertsson, Gauti B. 2008. “Great Expectations and the End of the Depression.” *American Economic Review* 98(4): 1476–1516.

Eggertsson, Gauti B., and Michael Woodford. 2003. “The Zero Bound on Interest Rates and Optimal Monetary Policy.” *Brookings Papers on Economic Activity* 2003(1): 139–211.

Engelberg, Joseph, Charles F. Manski, and Jared Williams. 2009. “Comparing the Point Predictions and Subjective Probability Distributions of Professional Forecasters.” *Journal of Business and Economic Statistics* 27(1): 30–41.

Fisher, Irving. 1933. “The Debt-Deflation Theory of Great Depressions.” *Econometrica* 1(4): 337–357.

Gelman, Michael, Yuriy Gorodnichenko, Shachar Kariv, Dmitri Koustas, Matthew D. Shapiro, Dan Silverman, and Steven Tadelis. 2017. “The Response of Consumer Spending to Changes in Gasoline Prices.” NBER Working Paper 22969.

Gomes, João, Urban Jermann, and Lukas Schmid. 2016. “Sticky Leverage.” *American Economic Review* 106(12): 3800–3828.

Hogen, Yoshihiko and Ryoichi Okuma. 2018. “The Anchoring of Inflation Expectations in Japan: A Learning-Approach Perspective.” Bank of Japan Working Paper Series 18-E-8.

Holston, Kathryn, Thomas Laubach, and John C. Williams. 2017. “Measuring the Natural Rate of Interest: International Trends and Determinants.” *Journal of International Economics* 108 (Supplement 1): S39–S75.

Hurd, Michael D., and Susann Rohwedder. 2009, “Methodological Innovations in Collecting Spending Data: The HRS Consumption and Activities Mail Survey.” *Fiscal Studies* 30(3/4): 435–459.

Hurd, Michael D., and Susann Rohwedder. 2012. “Measuring Total Household Spending in a Monthly Internet Survey: Evidence from the American Life Panel.” NBER Working Paper No. 17974.

Hurd, Michael D., and Susann Rohwedder. 2013. “Expectations and Household Spending.” Michigan Retirement Research Center Research Paper 2013-300.

Ichiue, Hibiki, and Shusaku Nishiguchi. 2013. "Inflation Expectations and Consumer Spending at the Zero Bound: Micro Evidence." Bank of Japan Working Paper No. 13-E-11. Available at https://www.boj.or.jp/en/research/wps_rev/wps_2013/data/wp13e11.pdf.

Jappelli, Tullio, and Luigi Pistaferri. 2000. "Using Subjective Income Expectations to Test for Excess Sensitivity of Consumption to Predicted Income Growth." *European Economic Review* 44(2): 337–358.

Kamdar, Rupal. 2018. "The Inattentive Consumer: Sentiment and Expectations." Manuscript. https://rupalkamdar.github.io/pdfs/Inattentive_Consumer.pdf

Kiley, Michael T., and John M. Roberts. 2017. "Monetary Policy in a Low Interest Rate World." *Brookings Papers on Economic Activity* (Spring): 317–396.

Krugman, Paul R. 1998. "It's Baaack! Japan's Slump and the Return of the Liquidity Trap." *Brookings Papers on Economic Activity* 29(2): 157–187.

Mackowiak, Bartosz, and Mirko Wiederholt. 2012. "Dispersed Inflation Expectations and the Zero Lower Bound." Society for Economic Dynamics Meeting Papers 1071.

Manning, Willard G. 1998. "The Logged Dependent Variable, Heteroscedasticity, and the Retransformation Problem." *Journal of Health Economics* 17(3): 283–295.

Manning, Willard G., and John Mullahy. 2001. "Estimating Log Models: To Transform or Not to Transform?" *Journal of Health Economics* 20(4): 461–494

McKay, Alisdair, Emi Nakamura, and Jon Steinsson. 2016. "The Power of Forward Guidance Revisited." *American Economic Review* 106(10): 3133–3158.

Mian, Atif R., Kamalesh Rao, and Amir Sufi. 2013. "Household Balance Sheets, Consumption, and the Economic Slump." *Quarterly Journal of Economics* 128(4): 1687–1726.

Mundlak, Yair. 1978. "On the Pooling of Time Series and Cross Section Data." *Econometrica* 46(1): 69–85.

Nichols, Austin. 2010. "Regression for Nonnegative Skewed Dependent Variables." Slide presentation. https://www.stata.com/meeting/boston10/boston10_nichols.pdf

Padula, Mario. 1999. "Euler Equations and Durable Goods." Centre for Studies in Economics and Finance Working Paper No. 30.

RAND American Life Panel. https://mmicdata.rand.org/alp/.

Romer, Christina D. 1992. "What Ended the Great Depression?" *Journal of Economic History* 52(4): 757–784.

Shiller, Robert J. 1996. "Why Do People Dislike Inflation?" NBER Working Paper 5539.

Van Zandweghe, Willem, and John C. Braxton. 2013. "Has Durable Goods Spending Become Less Sensitive to Interest Rates?" *Federal Reserve Bank of Kansas City Economic Review* Fourth Quarter 2013.

Woodford, Michael. 2012. "Methods of Policy Accommodation at the Interest-Rate Lower Bound." Presented at "The Changing Policy Landscape," 2012 FRB Kansas City Economic Policy Symposium, Jackson Hole, WY. Available at http://kansascityfed.org/publicat/sympos/2012/mw.pdf.

Wooldridge, Jeffrey M. 2002. *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: The MIT Press.

Wooldridge, Jeffrey M. 2019. "Correlated Random Effects Models with Unbalanced Panels." *Journal of Econometrics* 211(1): 137–150.

Zeger, Scott L., Kung-Yee Liang, and Paul S. Albert. 1988. "Models for Longitudinal Data: A Generalized Estimating Equation Approach." *Biometrics* 44(4): 1049–1060.

Exhibit A: Dependent Variables

Durable Goods Spending (quarterly frequency)[44]	Combined spending on refrigerators, stoves, ovens, washers, dryers, dishwashers, televisions, computers, and home furnishings; deflators = CPI-U Appliances, CPI-U washers, CPI-U televisions, CPI-U computers, CPI-U furniture; all Jan. 2012
Bought Any Durable Goods (quarterly frequency)	Binary indicator of whether the household spent any money on durable goods (from the list of goods above) in the quarter
Other Spending: Nondurable Goods/Services (monthly frequency)	Clothing, food (home and away), utilities (phone/cable/internet, electricity, water, heating), gasoline, personal care (goods and services), hobbies and leisure equipment, house cleaning (goods/services), gardening (goods/services), health care and medical expenditures (not including drugs), other child spending, entertainment; deflator = CPI-U Nondurables, Jan. 2012

Exhibit B. Explanatory Variables and Controls

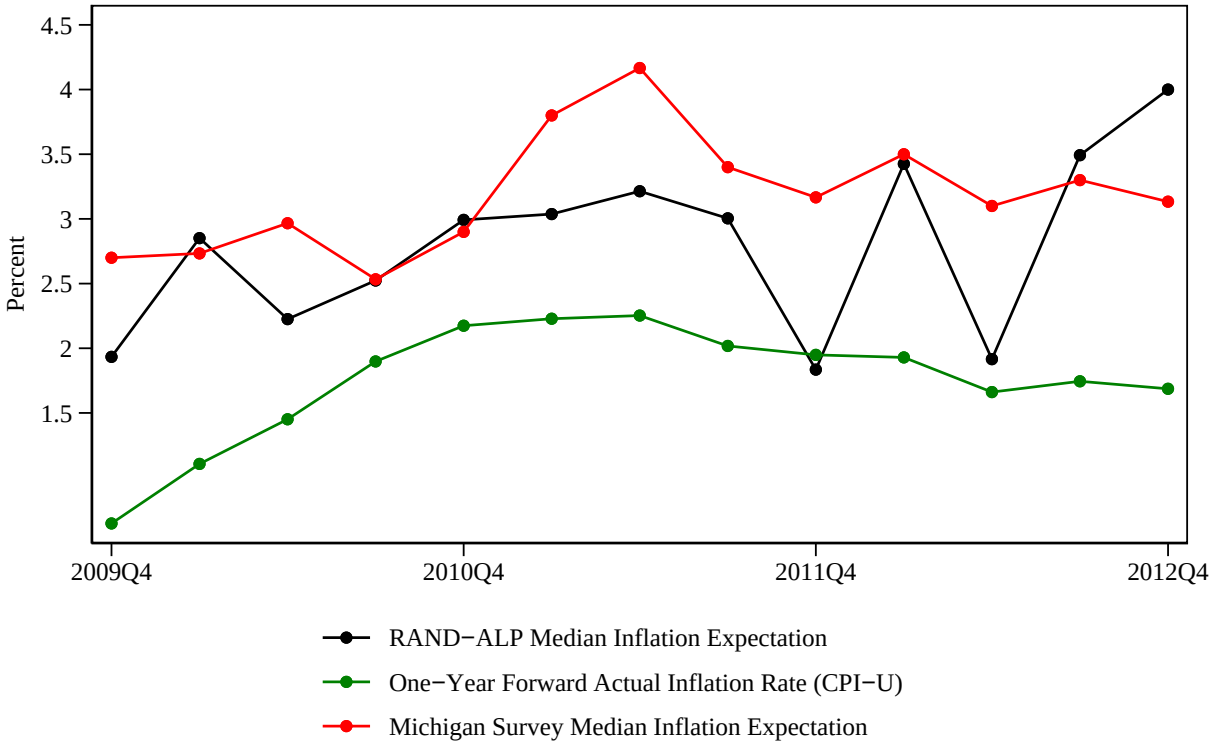
Variable Name	**Description**
Inflation Expectation (current and lagged)	Median of density function for one-year-ahead inflation rate, given by the individual respondent.
Inflation Uncertainty (current and lagged)	Interquartile range of respondent's density function over one-year-ahead inflation rate.
Medium-run Inflation Expectation	Median of density function for two-to-three-year-ahead inflation rate, given by individual respondent. (Does not appear in most models.)
Medium-run Inflation Uncertainty	Interquartile range of respondent's density function over the inflation rate two to three years ahead. (Does not appear in most models.)

[44]Beginning in November 2011, half of the respondents to the ALP spending modules (selected at random) were polled about spending on durable goods (and other infrequent purchases) at a monthly frequency rather than a quarterly frequency (see Hurd and Rohwedder 2013). To construct the quarterly durables spending total for such respondents, we sum the monthly spending amounts on the relevant items within the quarter, provided a given respondent had non-missing data for all three months in the quarter. If that condition is not met, the quarterly durables spending total is considered missing.

Real Wage Growth Expectation[45]	Difference between the nominal wage growth expectation and the inflation expectation, both one year ahead. Nominal wage growth expectation equals the median of the respondent's density function over same-job wage growth (analogous to the inflation expectation).
Wage Growth Uncertainty[46]	Interquartile range of density function for (nominal) same-job wage growth, one year ahead.
Expects Interest Rate Increase (Decrease)	Binary indicator equal to 1 if respondent expects borrowing rates to increase (decrease) one year ahead; 0 otherwise.
Expects Unemployment Increase (Decrease)	Binary indicator equal to 1 if respondent expects unemployment rate to increase (decrease) one year ahead; 0 otherwise.
House Price Growth Expectation	Median of density function for one-year-ahead growth in US average house price, given by individual respondent.
Household Income	Log of an imputed value of annual household income, where the imputed value represents the midpoint of the reported income range.
Homeowner	Binary indicator equal to 1 if household currently owns its primary residence; 0 otherwise. Indicator varies across observations within some respondents.
Has Mortgage	Binary indicator equal to 1 if household currently holds a mortgage on its primary residence; 0 otherwise. Indicator varies within some respondents.
Recurring Debt Payments	Combined payments (per month or quarter) for household on housing (rent or mortgage) and car payment (lease or loan).
Mortgage Balance	Remaining principal balance on household's mortgage—included in models on mortgagee subsample only.
Sociodemographic Characteristics of the Respondent	Age as a continuous variable, plus dummy variables for nonwhite, female, retired, and no college education. Other than age, these variables do not vary within a survey respondent over time.
Within-respondent Means of All Time-varying Independent Variables	For example, within-respondent mean of short-run inflation expectation; included in models to control for household-level heterogeneity in some models
Time Dummies	Quarterly or monthly

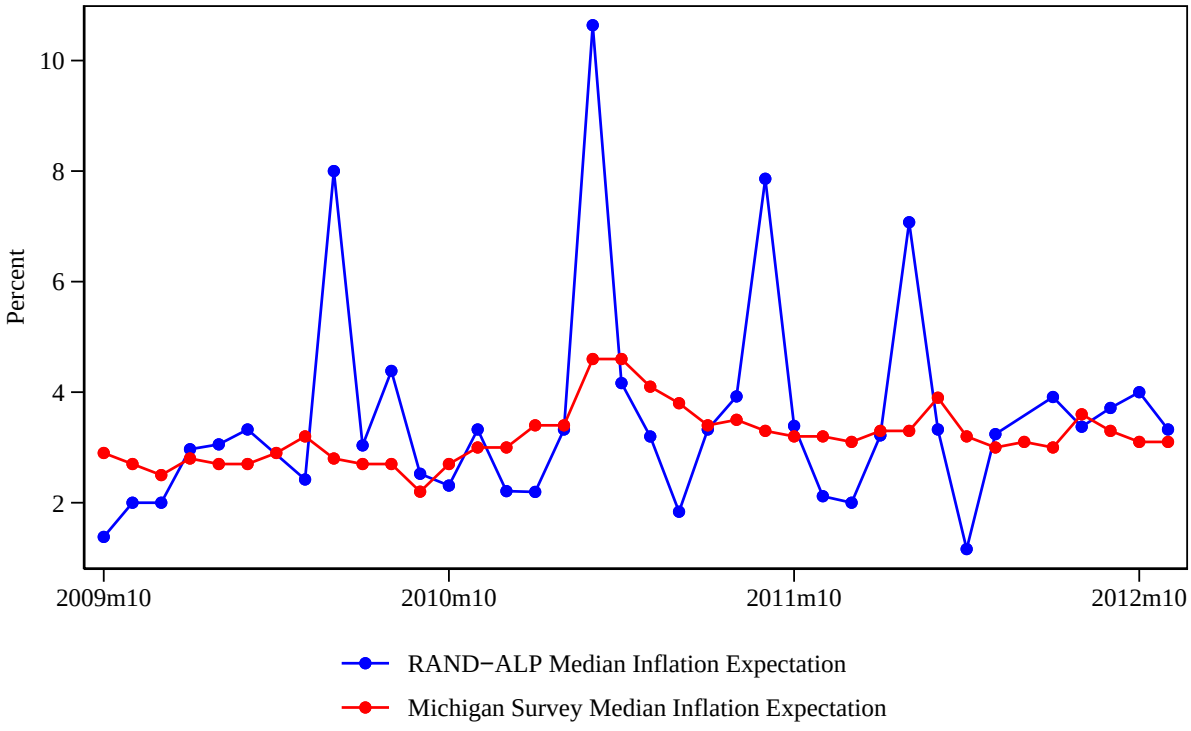
[45] Results are robust if the real wage growth expectation is defined as the difference between the respective density means of nominal wage growth and inflation in place of the medians.
[46] We cannot construct an interquartile range for real wage growth.

Figure 1. RAND−ALP Inflation Expectations vs. Realized Inflation and Michigan Inflation Expectations



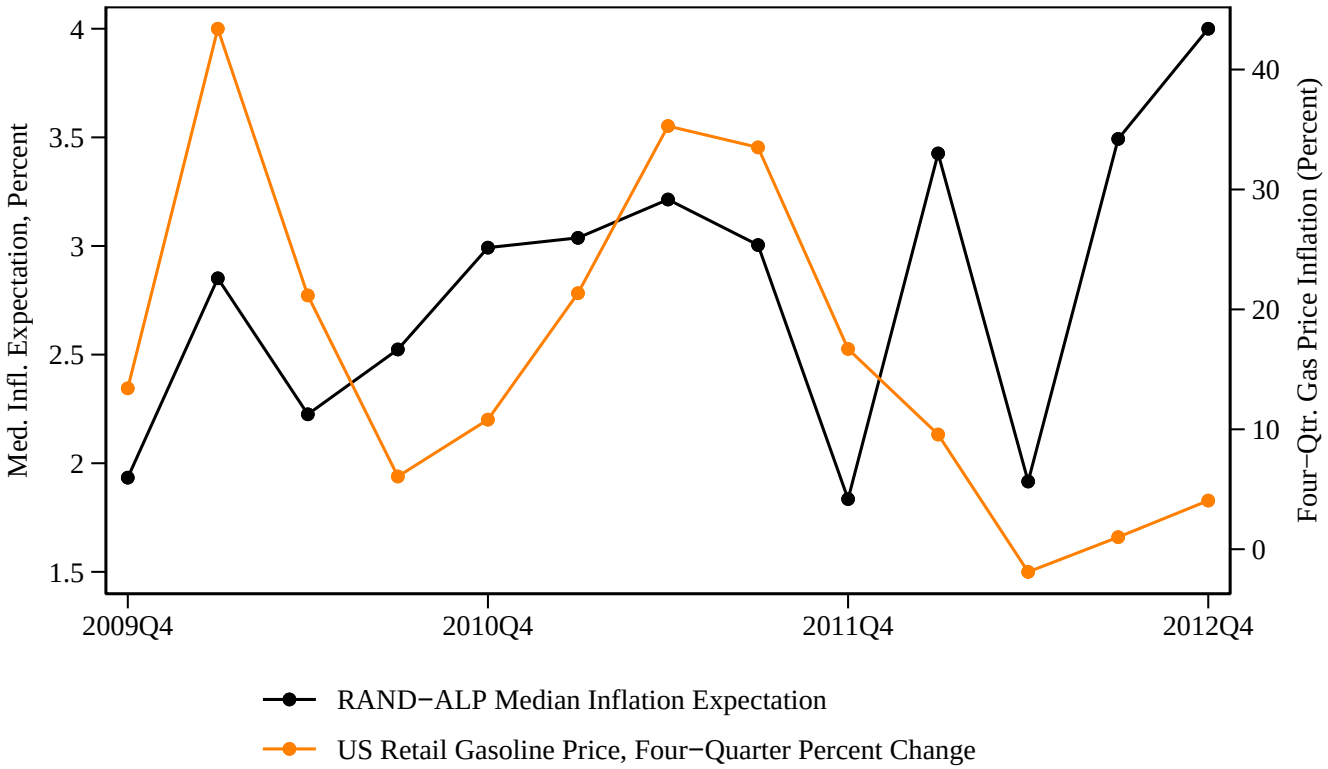
Notes: Median inflation expectation refers to the median one−year−ahead inflation expectation for the given quarter.
The RAND−ALP median expectations are calculated using the baseline regression sample for durable goods spending.

Figure 2. RAND−ALP Inflation Expectations vs. Michigan Inflation Expectations



Notes: Median inflation expectation refers to the median one−year−ahead inflation expectation for the given month.
The RAND−ALP median expectations are calculated using the baseline regression sample for nondurable goods and services spending.

Figure 3. RAND−ALP Inflation Expectations vs. Gas Price Inflation



Notes: Median inflation expectation refers to the median one−year−ahead inflation expectation for the given quarter.
The RAND−ALP median expectations are calculated using the baseline regression sample for durable goods spending.
Gas price inflation is the four−quarter percent change in the average US price of regular grade gasoline.
Source: Average US gasoline prices provided by US Energy Information Administration/Haver Analytics.

Table 1a. Summary Statistics for Baseline Samples

	Durables Spending Panel (N=1,084)				Nondurables Spending Panel (N=2,010)			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Durables Spending ($)	320.11	845.60	0.00	12,942.66	.	.	.	.
Nondurables Spending ($)	.	.	.	.	1,547.04	967.61	249.96	10,028.94
Bought Durables	0.42	0.49	0.00	1.00	.	.	.	.
Inflation Expectation	3.20	3.01	–5.00	23.25	3.97	3.46	–5.00	21.58
Inflation Uncertainty	2.15	1.96	0.14	20.54	2.18	2.13	0.14	20.54
Household Income (Median $)	67,500	44,551	8,750	237,500	55,000	48,730	8,750	237,500
Expects Interest Rate Increase	0.34	0.47	0.00	1.00	0.37	0.48	0.00	1.00
Expects Interest Rate Decrease	0.11	0.32	0.00	1.00	0.05	0.22	0.00	1.00
Expects Unemployment Increase	0.24	0.43	0.00	1.00	0.29	0.45	0.00	1.00
Expects Unemployment Decrease	0.23	0.42	0.00	1.00	0.22	0.41	0.00	1.00
Real Wage Growth Expectation	0.20	7.24	–22.80	35.36	–1.34	6.68	–20.57	35.36
Wage Growth Uncertainty	1.36	1.80	0.14	20.27	1.56	2.16	0.14	20.73
House Price Growth Expectation	2.60	7.05	–50.00	25.00	1.41	8.32	–100.00	25.00
Age*	56.63	7.30	43.00	74.00	55.19	6.74	43.00	74.00
Nonwhite*	0.12	0.32	0.00	1.00	0.19	0.40	0.00	1.00
Female*	0.45	0.50	0.00	1.00	0.51	0.50	0.00	1.00
No College*	0.41	0.49	0.00	1.00	0.44	0.50	0.00	1.00
Has Mortgage*	0.57	0.47	0.00	1.00	0.46	0.48	0.00	1.00

Notes: * Values represent the weighted average of the given variable over the unique set of individuals in the given sample.

Table 1b. Summary Statistics for College Subsamples

	Durables Spending Panel (N=939)				Nondurables Spending Panel (N=1,750)			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Durables Spending ($)	351.52	995.93	0.00	12,942.66	.	.	.	.
Nondurables Spending ($)	.	.	.	.	1,585.47	1,073.47	249.96	10,028.94
Bought Durables	0.40	0.49	0.00	1.00	.	.	.	.
Inflation Expectation	3.59	3.33	–5.00	23.25	4.30	3.20	–5.00	21.58
Inflation Uncertainty	2.33	1.82	0.14	15.45	2.54	2.15	0.14	17.64
Household Income (Median $)	55,000	49,717	8,750	237,500	55,000	54,896	8,750	237,500
Expects Interest Rate Increase	0.38	0.48	0.00	1.00	0.43	0.50	0.00	1.00
Expects Interest Rate Decrease	0.14	0.35	0.00	1.00	0.04	0.21	0.00	1.00
Expects Unemployment Increase	0.23	0.42	0.00	1.00	0.31	0.46	0.00	1.00
Expects Unemployment Decrease	0.25	0.43	0.00	1.00	0.22	0.42	0.00	1.00
Real Wage Growth Expectation	1.25	9.33	–22.80	35.36	–0.94	7.73	–20.57	35.36
Wage Growth Uncertainty	1.50	1.89	0.14	20.27	1.77	2.42	0.14	20.73
House Price Growth Expectation	3.27	7.73	–50.00	25.00	1.54	9.03	–100.00	25.00
Age*	60.45	6.76	44.00	74.00	58.77	6.91	44.00	74.00
Nonwhite*	0.18	0.39	0.00	1.00	0.26	0.44	0.00	1.00
Female*	0.45	0.50	0.00	1.00	0.49	0.50	0.00	1.00
Has Mortgage*	0.54	0.49	0.00	1.00	0.46	0.48	0.00	1.00

Notes: * Values represent the weighted average of the given variable over the unique set of individuals in the given sample.

Table 1c. Summary Statistics for Mortgagor Subsamples

	Durables Spending Panel (N=671)				Nondurables Spending Panel (N=579)			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Durables Spending ($)	336.51	914.74	0.00	12,942.66	.	.	.	.
Nondurables Spending ($)	.	.	.	.	1,753.51	1,016.21	332.77	9,544.67
Bought Durables	0.41	0.49	0.00	1.00	.	.	.	.
Inflation Expectation	2.70	2.45	–3.54	23.25	3.07	2.74	–3.30	19.02
Inflation Uncertainty	2.11	2.05	0.14	20.54	1.96	2.10	0.14	20.54
Household Income (Median $)	67,500	44,185	8,750	237,500	87,500	49,152	8,750	237,500
Expects Interest Rate Increase	0.31	0.46	0.00	1.00	0.34	0.47	0.00	1.00
Expects Interest Rate Decrease	0.16	0.36	0.00	1.00	0.08	0.27	0.00	1.00
Expects Unemployment Increase	0.27	0.44	0.00	1.00	0.34	0.47	0.00	1.00
Expects Unemployment Decrease	0.24	0.43	0.00	1.00	0.22	0.41	0.00	1.00
Real Wage Growth Expectation	–0.26	3.99	–22.80	35.36	–0.94	3.92	–18.02	35.36
Wage Growth Uncertainty	1.42	1.85	0.14	17.64	1.50	1.85	0.14	14.20
House Price Growth Expectation	1.92	6.44	–20.00	25.00	0.65	6.23	–20.00	20.00
Age*	54.84	7.06	43.00	70.00	54.91	7.04	43.00	70.00
Nonwhite*	0.10	0.30	0.00	1.00	0.14	0.35	0.00	1.00
Female*	0.41	0.49	0.00	1.00	0.44	0.50	0.00	1.00
No College*	0.47	0.50	0.00	1.00	0.44	0.50	0.00	1.00

Notes: * Values represent the weighted average of the given variable over the unique set of individuals in the given sample.

Table 2a. Real Durable Goods Spending vs. Year-ahead Expectations, GEE Estimation

	(1)	(2)	(3)	(4)	(5)
	Baseline Sample		College Sample		
Inflation Expectation	0.038	0.134*	0.074**	0.188***	0.095
	(0.038)	(0.070)	(0.030)	(0.061)	(0.091)
Inflation Uncertainty	–0.009	0.132	0.016	0.078	0.118
	(0.043)	(0.098)	(0.063)	(0.104)	(0.110)
No College		–0.480			
		(0.437)			
No College × Inflation Expectation		–0.265**			
		(0.132)			
No College × Inflation Uncertainty		–0.041			
		(0.165)			
Lagged Inflation Expectation		0.109***		0.086**	0.059
		(0.034)		(0.036)	(0.037)
No College × Lagged Inflation Expectation		–0.220**			
		(0.106)			
Lagged Inflation Uncertainty		–0.168		–0.195	–0.169
		(0.148)		(0.140)	(0.144)
No College × Lagged Inflation Uncertainty		0.228			
		(0.193)			
(Log) Monthly Payments		0.027		–0.064	–0.040
		(0.188)		(0.282)	(0.291)
Expects Unemployment Increase		–1.158***		–1.042***	–1.150***
		(0.358)		(0.380)	(0.398)
Expects Unemployment Decrease		–0.153		0.069	0.034
		(0.254)		(0.290)	(0.312)
Expects Interest Rate Increase		0.170		–0.076	–0.067
		(0.312)		(0.339)	(0.342)
Expects Interest Rate Decrease		–0.069		0.429	0.438
		(0.373)		(0.553)	(0.558)
Real Wage Growth Expectation		0.030		0.060	0.059
		(0.055)		(0.050)	(0.052)
Wage Growth Uncertainty		–0.025		0.047	0.039
		(0.083)		(0.084)	(0.085)
(Log) Household Income		–1.311		–1.418*	–1.111
		(0.871)		(0.815)	(0.829)
Mortgage Indicator		–0.378		–0.763	–0.929
		(0.726)		(1.763)	(1.886)
Age		0.003		–0.006	0.004
		(0.019)		(0.018)	(0.018)
Nonwhite		0.135		–0.453	–0.414
		(0.295)		(0.309)	(0.294)
Female		0.395**		0.473*	0.460*
		(0.189)		(0.274)	(0.263)
Retired		–0.151		–0.334	–0.368
		(0.233)		(0.224)	(0.240)
Homeowner		0.457		–0.089	0.215
		(0.672)		(1.444)	(1.510)
House Price Growth Expectation		–0.003		–0.014	–0.019
		(0.023)		(0.021)	(0.022)
Mean Inflation Expectation (within-respondent)		–0.237**		–0.353***	–0.341***
		(0.115)		(0.096)	(0.092)
Mean (Log) Household Income (within-respondent)		2.530***		2.170***	1.917**
		(0.911)		(0.838)	(0.853)
Mean Wage Growth Uncertainty (within-respondent)		–0.191		–0.245*	–0.243*
		(0.121)		(0.130)	(0.128)
Mean (Log) Monthly Payments × Inflation Expectation					0.013
					(0.022)
Mean Mortgage Indicator × Inflation Expectation					0.086
					(0.078)
Mean (Log) Household Income × Inflation Expectation					–0.133**
					(0.061)
Constant	5.752***	4.073***	5.735***	4.198***	3.709***
	(0.591)	(1.267)	(0.835)	(1.174)	(1.149)
Correlated Random Effects	No	Yes	No	Yes	Yes
Chi^2	29.55	1614.66	40.06	4669.98	6298.57
P Value	0.01	0.00	0.00	0.00	0.00
Sample Size	1084	1084	939	939	939

Notes: In all columns, time dummies (for each quarter-by-year) are included, but coefficients are suppressed. In columns 2, 4, and 5, coefficients on the following additional regressors are suppressed: the within-respondent means, respectively, of monthly payments, expects unemployment increase, expects unemployment decrease, expects interest rate increase, expects interest rate decrease, real wage growth expectation, house price growth expectation, homeowner indicator, and mortgage indicator. Robust standard errors are clustered at the level of the individual. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2b. Average Marginal Effects of Inflation Expectations on Durable Goods Spending, College Sample as Semi-elasticities

	Current Inflation Expectation		**Lagged Inflation Expectation**	
	Model (4)	Model (5)	Model (4)	Model (5)
Average (College)	0.19***	0.19***	0.09**	0.06
	(0.06)	(0.06)	(0.04)	(0.04)
Mortgage		0.23***		0.06
		(0.06)		(0.04)
25th Percentile Household Income		0.24***		0.06
		(0.06)		(0.04)
Observations	939	939	939	939

Notes: A given estimate indicates the population average fractional change in quarterly durable goods spending for a 1 percentage point increase in expected inflation one year ahead (either current or lagged), conditional on displaying the given characteristic. Standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3a. Real Durable Goods Spending vs. Year-ahead Expectations, Mortgagor Sample, GEE Estimation

	(1)	(2)	(3)
Inflation Expectation	0.092**	0.230***	0.448**
	(0.044)	(0.059)	(0.176)
Inflation Uncertainty	–0.029	0.135	0.165
	(0.066)	(0.101)	(0.107)
Lagged Inflation Expectation	0.039	–0.012	0.004
	(0.047)	(0.052)	(0.041)
Lagged Inflation Uncertainty	–0.018	–0.357***	–0.344***
	(0.159)	(0.082)	(0.082)
No College		0.437	0.522
		(0.581)	(0.597)
No College × Inflation Expectation		–0.246	–0.188
		(0.181)	(0.192)
No College × Inflation Uncertainty		–0.095	–0.126
		(0.189)	(0.206)
No College × Lagged Inflation Expectation		0.191	0.129
		(0.148)	(0.165)
No College × Lagged Inflation Uncertainty		0.273*	0.304*
		(0.160)	(0.173)
(Log) Monthly Payments		–0.764***	–0.805***
		(0.199)	(0.182)
Expects Unemployment Increase		–1.185**	–1.215**
		(0.570)	(0.579)
Expects Unemployment Decrease		–0.118	–0.216
		(0.243)	(0.246)
Expects Interest Rate Increase		0.510*	0.507*
		(0.307)	(0.295)
Expects Interest Rate Decrease		0.009	–0.058
		(0.428)	(0.456)
(Log) Mortgage Balance		0.692**	0.433
		(0.271)	(0.293)
Real Wage Growth Expectation		0.097*	0.083
		(0.053)	(0.057)
Wage Growth Uncertainty		0.046	0.051
		(0.057)	(0.052)
(Log) Household Income		–1.917**	–1.693*
		(0.960)	(1.004)
Age		0.055***	0.051**
		(0.019)	(0.022)
Nonwhite		0.343	0.295
		(0.388)	(0.406)
Female		0.013	0.050
		(0.275)	(0.276)
Retired		–0.978***	–0.897**
		(0.307)	(0.350)
House Price Growth Expectation		–0.013	–0.015
		(0.023)	(0.021)
Mean Inflation Expectation (within-respondent)		–0.238**	–0.360***
		(0.120)	(0.138)
Mean (Log) Household Income (within-respondent)		2.226**	2.216**
		(1.052)	(1.129)
Mean Wage Growth Uncertainty (within-respondent)		–0.467***	–0.476***
		(0.113)	(0.120)
Mean (Log) Monthly Payments × Inflation Expectation			–0.102
			(0.102)
Mean (Log) Mortgage Balance × Inflation Expectation			0.134**
			(0.052)
Mean (Log) Household Income × Inflation Expectation			–0.104
			(0.083)
Constant	6.140***	1.860	2.039
	(0.695)	(1.376)	(1.507)
Correlated Random Effects	No	Yes	Yes
Chi^2	41.85	8909.13	9967.90
P Value	0.00	0.00	0.00
Sample Size	671	671	671

Notes: In all columns, time dummies (for each quarter-by-year) are included, but coefficients are suppressed. In columns 2 and 3, the coefficients on the following additional regressors are suppressed: the within-respondent means, respectively, of monthly payments, expects unemployment increase, expects unemployment decrease, expects interest rate increase, expects interest rate decrease, real wage growth expectation, house price growth expectation, and mortgage balance. Robust standard errors are clustered at the level of the individual. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3b. Average Marginal Effects of Inflation Expectations on Durable Goods Spending, Mortgagor Sample as Semi-elasticities

	Current Inflation Expectation	**Lagged Inflation Expectation**
	Model (3)	Model (3)
Average (Mortgagor)	0.20	0.07
	(0.13)	(0.08)
No College	0.11	0.13
	(0.22)	(0.15)
Some College or More	0.30***	0.00
	(0.08)	(0.04)
No College, 25th Percentile Household Income	0.15	0.13
	(0.21)	(0.15)
College, 25th Percentile Household Income	0.34***	0.00
	(0.08)	(0.04)
No College, 25th Percentile Payments	0.13	0.13
	(0.22)	(0.15)
College, 25th Percentile Payments	0.32***	0.00
	(0.09)	(0.04)
No College, 75th Percentile Mortgage Balance	0.23	0.13
	(0.24)	(0.15)
College, 75th Percentile Mortgage Balance	0.42***	0.00
	(0.11)	(0.04)
Observations	671	671

Notes: A given estimate indicates the population average fractional change in quarterly durable goods spending for a 1 percentage point increase in expected inflation one year ahead (either current or lagged), conditional on displaying the given characteristic. Standard errors are in parentheses. $^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$.

Table 4. Average Marginal Effects of Inflation Expectations on Durable Goods Spending
Restricting on Non-increasing Interest Rate Expectations (as Semi-elasticities)

	Current Inflation Expectation		**Lagged Inflation Expectation**	
	Baseline	Restricted	Baseline	Restricted
Average (All)	0.04	0.18	-0.02	-0.11
	(0.08)	(0.13)	(0.05)	(0.10)
No College	-0.10	0.09	-0.13	-0.33**
	(0.15)	(0.17)	(0.10)	(0.16)
Some College or More	0.15**	0.29**	0.08**	0.12*
	(0.06)	(0.12)	(0.03)	(0.07)
No College, Mortgage	-0.08	0.15		
	(0.15)	(0.16)		
College, Mortgage	0.17***	0.35***		
	(0.06)	(0.12)		
No College, 25th Percentile Household Income	-0.06	0.12		
	(0.15)	(0.17)		
College, 25th Percentile Household Income	0.19***	0.32***		
	(0.06)	(0.12)		
Observations	1084	542	1084	542

Notes: Restricted sample retains only observations such that interest rate expectations are constant or declining. A given estimate indicates the population average fractional change in quarterly durable goods spending for a 1 percentage point increase in expected inflation one year ahead (either current or lagged), conditional on displaying the given characteristic. Standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5a. Bought Durables vs. Year-ahead Expectations, GEE Logit Estimation

	(1)	(2)	(3)	(4)
	Baseline Sample		Mortgagor Sample	
Inflation Expectation	–0.002	–0.107	0.409***	0.623***
	(0.081)	(0.098)	(0.154)	(0.201)
Inflation Uncertainty	–0.044	–0.047	–0.170	–0.128
	(0.125)	(0.120)	(0.191)	(0.181)
No College	–0.822*	–0.812	–1.471**	–1.506**
	(0.461)	(0.498)	(0.625)	(0.609)
No College × Inflation Expectation	–0.364***	–0.357***	–1.134***	–0.942***
	(0.114)	(0.120)	(0.171)	(0.186)
No College × Inflation Uncertainty	0.370**	0.361*	0.757***	0.616***
	(0.175)	(0.192)	(0.220)	(0.230)
Lagged Inflation Expectation	0.091	0.070	–0.236	–0.292*
	(0.059)	(0.065)	(0.163)	(0.158)
No College × Lagged Inflation Expectation	–0.241	–0.228	0.347	0.339
	(0.149)	(0.148)	(0.234)	(0.236)
Lagged Inflation Uncertainty	–0.038	–0.030	0.078	0.064
	(0.146)	(0.159)	(0.221)	(0.214)
No College × Lagged Inflation Uncertainty	0.044	0.062	–0.295	–0.202
	(0.222)	(0.224)	(0.245)	(0.233)
(Log) Monthly Payments	–0.135	–0.131	–1.244***	–1.355***
	(0.234)	(0.238)	(0.330)	(0.325)
Expects Unemployment Increase	–1.654***	–1.767***	–3.065***	–3.106***
	(0.390)	(0.387)	(0.744)	(0.703)
Expects Unemployment Decrease	–0.166	–0.182	–1.828***	–1.822***
	(0.501)	(0.514)	(0.506)	(0.534)
Expects Interest Rate Increase	0.328	0.340	1.042*	1.015
	(0.332)	(0.346)	(0.610)	(0.641)
Expects Interest Rate Decrease	0.404	0.458	–0.449	–0.551
	(0.895)	(0.904)	(1.347)	(1.374)
Real Wage Growth Expectation	–0.084	–0.081	–0.071	–0.072
	(0.062)	(0.063)	(0.076)	(0.087)
Wage Growth Uncertainty	0.180**	0.175**	0.201**	0.183*
	(0.084)	(0.085)	(0.097)	(0.099)
(Log) Household Income	–1.011	–0.636	–3.152**	–2.986*
	(0.882)	(0.871)	(1.565)	(1.546)
Mortgage Indicator	0.450	0.338		
	(0.695)	(0.688)		
Age	–0.004	–0.003	0.031	0.016
	(0.024)	(0.024)	(0.035)	(0.034)
Nonwhite	0.145	0.191	–0.313	–0.431
	(0.402)	(0.432)	(0.701)	(0.611)
Female	0.460**	0.465**	0.250	0.130
	(0.226)	(0.220)	(0.345)	(0.332)
Retired	0.331	0.231	–0.388	–0.393
	(0.417)	(0.408)	(0.708)	(0.643)
Homeowner	–0.736	–0.524		
	(1.505)	(1.419)		
House Price Growth Expectation	0.004	0.003	0.008	0.009
	(0.023)	(0.023)	(0.032)	(0.035)
Mean Inflation Expectation (within-respondent)	0.081	0.037	–0.023	–0.066
	(0.136)	(0.134)	(0.320)	(0.312)
Mean (Log) Household Income (within-respondent)	2.200**	1.883**	4.687***	4.926***
	(0.857)	(0.888)	(1.615)	(1.560)
Mean Wage Growth Uncertainty (within-respondent)	–0.213**	–0.223**	–0.646***	–0.545***
	(0.108)	(0.104)	(0.156)	(0.157)
Mean (Log) Monthly Payments × Inflation Expectation		–0.013		–0.221*
		(0.017)		(0.119)
Mean Mortgage Indicator × Inflation Expectation		0.155		
		(0.102)		
Mean Household Income × Inflation Expectation		–0.170***		–0.196
		(0.046)		(0.180)
(Log) Mortgage Balance			1.022*	0.901*
			(0.550)	(0.506)
Mean (Log) Mortgage Balance			–0.818	–0.955*
			(0.589)	(0.576)
Mean (Log) Mortgage Balance × Inflation Expectation				0.048
				(0.087)
Constant	–1.311	–1.353	–2.390	–1.339
	(1.672)	(1.669)	(2.353)	(2.262)
Correlated Random Effects	Yes	Yes	Yes	Yes
Chi^2	669.53	1066.62	2203.08	5965.96
P Value	0.00	0.00	0.00	0.00
Sample Size	1084	1084	671	671

Notes: Coefficients on the following additional regressors are suppressed from all columns: the quarterly time dummies and the within-respondent means, respectively, of monthly payments, expects unemployment increase, expects unemployment decrease, expects interest rate increase, expects interest rate decrease, real wage growth expectation, house price growth expectation, homeowner indicator, and mortgage indicator. Robust standard errors are clustered at the level of the individual. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5b. Average Marginal Effects of Inflation Expectations on Probability of Purchasing Durables, Baseline Sample as Semi-elasticities

	Current Inflation Expectation		**Lagged Inflation Expectation**	
	Model (1)	Model (2)	Model (1)	Model (2)
Average (All)	-0.10*	-0.06	-0.01	-0.02
	(0.05)	(0.05)	(0.04)	(0.04)
No College	-0.21***	-0.18**	-0.09	-0.09
	(0.07)	(0.07)	(0.08)	(0.08)
Some College or More	-0.00	0.03	0.05	0.04
	(0.05)	(0.04)	(0.04)	(0.04)
No College, Mortgage		-0.15**		
		(0.07)		
College, Mortgage		0.07		
		(0.05)		
No College, 25th Percentile Household Income		-0.18**		
		(0.08)		
College, 25th Percentile Household Income		0.06		
		(0.05)		
Observations	1084	1084	1084	1084

Notes: A given estimate indicates the population average fractional change in quarterly durable goods spending for a 1 percentage point increase in expected inflation one year ahead (either current or lagged), conditional on displaying the given characteristic. Standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5c. Average Marginal Effects of Inflation Expectations on Probability of Purchasing Durables, Mortgagor Sample as Semi-elasticities

	Current Inflation Expectation	**Lagged Inflation Expectation**
	Model (4)	Model (4)
Average (Mortgagor)	0.02	-0.07
	(0.10)	(0.07)
No College	-0.25**	0.03
	(0.12)	(0.10)
Some College or More	0.31***	-0.18*
	(0.11)	(0.10)
No College, 25th Percentile Household Income	-0.29*	0.03
	(0.15)	(0.11)
College, 25th Percentile Household Income	0.36***	-0.21*
	(0.13)	(0.11)
No College, 25th Percentile Payments	-0.27**	0.03
	(0.12)	(0.10)
College, 25th Percentile Payments	0.32***	-0.19*
	(0.11)	(0.10)
No College, 75th Percentile Mortgage Balance	-0.23	0.03
	(0.15)	(0.10)
College, 75th Percentile Mortgage Balance	0.35***	-0.18*
	(0.11)	(0.10)
Observations	671	671

Notes: A given estimate indicates the population average fractional change in quarterly durable goods spending for a 1 percentage point increase in expected inflation one year ahead (either current or lagged), conditional on displaying the given characteristic. Standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6a. Real Nondurables/Services Spending vs. Year-ahead Expectations, GEE Estimation

	(1) Baseline Sample	(2) College Sample	(3) Mortgagor Sample
Inflation Expectation	–0.002	0.005	0.036
	(0.007)	(0.007)	(0.023)
Inflation Uncertainty	0.015	0.007	0.022
	(0.011)	(0.009)	(0.014)
No College	0.007		–0.118
	(0.091)		(0.118)
No College × Inflation Expectation	0.003		–0.015
	(0.009)		(0.022)
No College × Inflation Uncertainty	–0.027**		0.007
	(0.013)		(0.022)
Lagged Inflation Expectation	0.005	0.004	–0.010
	(0.004)	(0.005)	(0.010)
No College × Lagged Inflation Expectation	0.009		0.011
	(0.008)		(0.022)
Lagged Inflation Uncertainty	–0.003	–0.005	0.004
	(0.014)	(0.012)	(0.014)
No College × Lagged Inflation Uncertainty	–0.011		0.006
	(0.018)		(0.025)
(Log) Monthly Payments	–0.002	–0.010	–0.002
	(0.006)	(0.008)	(0.035)
Expects Unemployment Increase	–0.115***	–0.057	–0.128**
	(0.033)	(0.053)	(0.063)
Expects Unemployment Decrease	–0.029	0.000	0.002
	(0.027)	(0.035)	(0.048)
Expects Interest Rate Increase	0.011	–0.000	0.114***
	(0.028)	(0.029)	(0.042)
Expects Interest Rate Decrease	–0.020	–0.010	0.093
	(0.052)	(0.084)	(0.070)
Real Wage Growth Expectation	–0.001	0.001	0.010
	(0.002)	(0.003)	(0.007)
Wage Growth Uncertainty	–0.003	–0.002	–0.004
	(0.007)	(0.008)	(0.011)
(Log) Household Income	0.107	0.144	0.011
	(0.091)	(0.107)	(0.142)
Mortgage Indicator	–0.013	0.108	
	(0.063)	(0.120)	
Age	–0.010	–0.004	–0.005
	(0.007)	(0.007)	(0.008)
Nonwhite	0.067	0.196	0.073
	(0.142)	(0.153)	(0.131)
Female	0.065	0.050	0.205**
	(0.084)	(0.111)	(0.090)
Retired	–0.099	–0.073	0.131
	(0.093)	(0.076)	(0.127)
Homeowner	0.032	–0.025	
	(0.069)	(0.110)	
House Price Growth Expectation	–0.000	0.002	0.000
	(0.002)	(0.002)	(0.003)
Mean Inflation Expectation (within-respondent)	–0.017	–0.014	–0.067**
	(0.023)	(0.022)	(0.031)
Mean (Log) Household Income (within-respondent)	0.421***	0.400***	0.468***
	(0.112)	(0.114)	(0.164)
Mean Wage Growth Uncertainty (within-respondent)	0.026	–0.023	0.007
	(0.026)	(0.033)	(0.030)
Mean (Log) Monthly Payments × Inflation Expectation		0.001	–0.035*
		(0.004)	(0.018)
Mean Mortgage Indicator × Inflation Expectation		–0.005	
		(0.011)	
Mean (Log) Household Income × Inflation Expectation		–0.012	0.022
		(0.008)	(0.019)
Mean (Log) Mortgage Balance × Inflation Expectation			0.027**
			(0.011)
Constant	7.605***	7.113***	7.245***
	(0.405)	(0.424)	(0.457)
Correlated Random Effects	Yes	Yes	Yes
Chi^2	1311.06	1325.47	1495.11
P Value	0.00	0.00	0.00
Sample Size	2010	1750	579

Notes: Coefficients on several additional regressors are suppressed from all columns. These additional regressors consist of the monthly time dummies and the within-respondent means, respectively, of monthly payments, expects unemployment increase, expects unemployment decrease, expects interest rate increase, expects interest rate decrease, real wage growth expectation, house price growth expectation, homeowner indicator, and mortgage indicator. In column 3 the model also includes the within-respondent mean mortgage balance, and the coefficient on that variable is suppressed. Robust standard errors are clustered at the level of the individual. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6b. Average Marginal Effects of Inflation Expectations on Real Nondurables/Services Spending as Semi-elasticities

	Baseline Sample		**College Sample**		**Mortgagor Sample**	
	Current IE	Lagged IE	Current IE	Lagged IE	Current IE	Lagged IE
Average	0.00	0.01*	0.01	0.00	-0.02*	-0.01
	(0.00)	(0.00)	(0.01)	(0.00)	(0.01)	(0.01)
Mortgage	0.00	0.01*	0.00	0.00		
	(0.01)	(0.00)	(0.01)	(0.00)		
25th Percentile Household Income	0.01***	0.01*	0.01	0.00		
	(0.01)	(0.00)	(0.01)	(0.00)		
No College					-0.03*	0.00
					(0.02)	(0.02)
Some College or More					-0.01	-0.01
					(0.02)	(0.01)
No College, 25th Percentile Household Income					-0.04*	0.00
					(0.02)	(0.02)
College, 25th Percentile Household Income					-0.02	-0.01
					(0.02)	(0.01)
No College, 25th Percentile Payments					-0.02	0.00
					(0.02)	(0.02)
College, 25th Percentile Payments					-0.00	-0.01
					(0.02)	(0.01)
No College, 75th Percentile Mort Balance					-0.01	0.00
					(0.02)	(0.02)
College, 75th Percentile Mort Balance					0.01	-0.01
					(0.02)	(0.01)
Observations	2010	2010	1750	1750	579	579

Notes: A given estimate indicates the population average fractional change in quarterly nondurable goods spending for a 1 percentage point increase in expected inflation one year ahead (either current or lagged), conditional on displaying the given characteristic. Standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A1. Real Durable Goods Spending vs. Year-ahead Expectations, GEE Estimation (Control for Gas Price Inflation)

	(1) Baseline Sample	(2) College Sample	(3) Mortgagor Sample
Inflation Expectation	0.103*	0.175***	0.207***
	(0.061)	(0.057)	(0.058)
No College	–0.299		0.751
	(0.420)		(0.489)
No College × Inflation Expectation	–0.305***		–0.281*
	(0.106)		(0.144)
Inflation Uncertainty	0.121	0.057	0.083
	(0.094)	(0.089)	(0.091)
No College × Inflation Uncertainty	–0.008		–0.047
	(0.149)		(0.158)
Lagged Inflation Expectation	0.118***	0.081**	0.004
	(0.034)	(0.035)	(0.043)
No College × Lagged Inflation Expectation	–0.155*		0.250**
	(0.092)		(0.119)
Lagged Inflation Uncertainty	–0.227	–0.187	–0.348***
	(0.148)	(0.145)	(0.073)
No College × Lagged Inflation Uncertainty	0.223		0.213*
	(0.175)		(0.123)
(Log) Monthly Payments	–0.021	–0.117	–0.680***
	(0.175)	(0.223)	(0.196)
Regional Gas Price Inflation	0.093**	0.103*	0.146***
	(0.041)	(0.057)	(0.037)
Expects Unemployment Increase	–1.312***	–1.171***	–1.430**
	(0.399)	(0.393)	(0.674)
Expects Unemployment Decrease	–0.205	0.091	–0.237
	(0.241)	(0.304)	(0.242)
Expects Interest Rate Increase	0.273	0.095	0.636**
	(0.290)	(0.333)	(0.289)
Expects Interest Rate Decrease	0.149	0.514	0.248
	(0.371)	(0.563)	(0.443)
Real Wage Growth Expectation	–0.004	0.025	0.066
	(0.044)	(0.039)	(0.056)
Wage Growth Uncertainty	–0.026	0.009	0.061
	(0.071)	(0.072)	(0.052)
(Log) Household Income	–0.977	–1.133	–0.774
	(0.811)	(0.746)	(0.932)
Mortgage Indicator	–0.092	0.198	
	(0.615)	(1.392)	
Age	0.011	–0.013	0.054**
	(0.017)	(0.017)	(0.022)
Nonwhite	0.284	–0.342	0.533
	(0.300)	(0.350)	(0.404)
Female	0.362*	0.253	0.044
	(0.212)	(0.274)	(0.272)
Retired	–0.124	–0.043	–0.764*
	(0.283)	(0.279)	(0.431)
Homeowner	0.013	–1.275	
	(0.759)	(1.276)	
House Price Growth Expectation	–0.001	–0.013	–0.019
	(0.021)	(0.022)	(0.020)
Mean Inflation Expectation (within-respondent)	–0.218**	–0.327***	–0.196*
	(0.093)	(0.090)	(0.118)
Mean (Log) Household Income (within-respondent)	2.123**	1.651**	1.017
	(0.839)	(0.767)	(1.014)
Mean Wage Growth Uncertainty (within-respondent)	–0.211**	–0.154	–0.522***
	(0.090)	(0.109)	(0.097)
(Log) Mortgage Balance			0.901**
			(0.363)
Constant	2.848*	3.957***	1.270
	(1.501)	(1.439)	(1.752)
Correlated Random Effects	Yes	Yes	Yes
Region Dummies	Yes	Yes	Yes
Chi^2	1383.03	6290.25	14386.49
P Value	0.00	0.00	0.00
Sample Size	1084	939	671

Notes: Regional gas price inflation refers to the four-quarter percent change in the average retail gasoline price for the household's region of residence, one of seven Petroleum Administration for Defense Districts (or PADDs), as defined by the US Energy Information Administration. PADD region dummies are included, but their coefficients are suppressed. For other suppressed coefficients, see notes to Table 6a. Robust standard errors are clustered at the level of the individual. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A2. Bought Durables vs. Year-ahead Expectations, GEE Logit Estimation (Control for Gas Price Inflation)

	(1) Baseline Sample	(2) College Sample	(3) Mortgagor Sample
Inflation Expectation	0.000	–0.005	0.414***
	(0.079)	(0.069)	(0.156)
Inflation Uncertainty	–0.035	–0.118	–0.157
	(0.125)	(0.142)	(0.197)
No College	–0.766		–1.305*
	(0.470)		(0.756)
No College × Inflation Expectation	–0.359***		–1.184***
	(0.118)		(0.198)
No College × Inflation Uncertainty	0.352**		0.776***
	(0.173)		(0.250)
Lagged Inflation Expectation	0.099*	0.102	–0.196
	(0.059)	(0.078)	(0.172)
No College × Lagged Inflation Expectation	–0.232		0.302
	(0.145)		(0.248)
Lagged Inflation Uncertainty	–0.066	–0.115	0.062
	(0.148)	(0.197)	(0.251)
No College × Lagged Inflation Uncertainty	0.056		–0.273
	(0.224)		(0.260)
(Log) Monthly Payments	–0.150	–0.197	–1.241***
	(0.240)	(0.288)	(0.340)
Regional Gas Price Inflation	0.011	0.065	0.080
	(0.050)	(0.063)	(0.070)
Expects Unemployment Increase	–1.720***	–2.112***	–3.207***
	(0.411)	(0.630)	(0.737)
Expects Unemployment Decrease	–0.145	–0.035	–1.904***
	(0.504)	(0.807)	(0.519)
Expects Interest Rate Increase	0.323	0.157	1.019
	(0.346)	(0.599)	(0.636)
Expects Interest Rate Decrease	0.393	1.379	–0.416
	(0.942)	(1.475)	(1.265)
Real Wage Growth Expectation	–0.082	–0.107**	–0.078
	(0.063)	(0.052)	(0.077)
Wage Growth Uncertainty	0.177**	0.158	0.205**
	(0.083)	(0.097)	(0.104)
(Log) Household Income	–0.940	–1.490	–2.987*
	(0.871)	(1.117)	(1.614)
Mortgage Indicator	0.488	1.043	
	(0.717)	(2.630)	
Age	0.002	–0.055	0.036
	(0.027)	(0.034)	(0.043)
Nonwhite	0.603	0.393	–0.379
	(0.448)	(0.900)	(0.927)
Female	0.394	–0.004	0.242
	(0.247)	(0.405)	(0.400)
Retired	0.230	0.328	–0.536
	(0.430)	(0.600)	(0.885)
Homeowner	–0.879	–3.111	
	(1.618)	(4.181)	
House Price Growth Expectation	0.005	0.034	–0.001
	(0.023)	(0.040)	(0.032)
Mean Inflation Expectation (within-respondent)	0.097	0.079	0.049
	(0.126)	(0.159)	(0.283)
Mean (Log) Household Income (within-respondent)	2.133**	1.993*	4.418***
	(0.853)	(1.133)	(1.699)
Mean Wage Growth Uncertainty (within-respondent)	–0.235**	0.023	–0.783***
	(0.107)	(0.152)	(0.199)
(Log) Mortgage Balance			1.091**
			(0.548)
Mean (Log) Mortgage Balance			–0.980
			(0.635)
Constant	–1.699	0.445	–3.761
	(1.912)	(2.075)	(3.231)
Correlated Random Effects	Yes	Yes	Yes
Region Dummies	Yes	Yes	Yes
Chi^2	759.47	672.46	1838.63
P Value	0.00	0.00	0.00
Sample Size	1084	939	671

Notes: Regional gas price inflation refers to the four-quarter percent change in the average retail gasoline price for the household's region of residence, one of seven Petroleum Administration for Defense Districts (or PADDs), as defined by the US Energy Information Administration. PADD region dummies are included, but their coefficients are suppressed. For other suppressed coefficients, see notes to Table 5a. Robust standard errors are clustered at the level of the individual. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A3. Real Nondurable Goods Spending vs. Year-ahead Expectations, GEE Estimation (Control for Gas Price Inflation)

	(1) Baseline Sample	(2) College Sample	(3) Mortgagor Sample
Inflation Expectation	–0.001	0.003	0.003
	(0.007)	(0.007)	(0.017)
No College	0.030		–0.123
	(0.083)		(0.116)
No College × Inflation Expectation	0.001		–0.035
	(0.009)		(0.022)
Inflation Uncertainty	0.008	0.005	0.018
	(0.009)	(0.008)	(0.014)
No College × Inflation Uncertainty	–0.020*		–0.005
	(0.012)		(0.022)
Lagged Inflation Expectation	0.004	0.002	–0.012
	(0.003)	(0.003)	(0.011)
No College × Lagged Inflation Expectation	0.008		0.016
	(0.007)		(0.024)
Lagged Inflation Uncertainty	0.000	–0.005	0.001
	(0.010)	(0.009)	(0.014)
No College × Lagged Inflation Uncertainty	–0.012		–0.001
	(0.015)		(0.027)
(Log) Monthly Payments	–0.002	–0.005	–0.002
	(0.006)	(0.008)	(0.033)
Regional Gas Price Inflation	–0.002	–0.004	–0.009
	(0.004)	(0.005)	(0.011)
Expects Unemployment Increase	–0.088***	0.015	–0.123*
	(0.032)	(0.035)	(0.064)
Expects Unemployment Decrease	–0.041	–0.008	0.010
	(0.026)	(0.031)	(0.051)
Expects Interest Rate Increase	0.007	–0.003	0.105***
	(0.027)	(0.027)	(0.038)
Expects Interest Rate Decrease	–0.030	–0.041	0.090
	(0.050)	(0.079)	(0.068)
Real Wage Growth Expectation	–0.002	0.001	0.009
	(0.002)	(0.003)	(0.006)
Wage Growth Uncertainty	–0.009	–0.011	–0.003
	(0.009)	(0.009)	(0.011)
(Log) Household Income	0.097	0.134	–0.036
	(0.088)	(0.094)	(0.147)
Mortgage Indicator	–0.028	0.055	
	(0.066)	(0.125)	
Age	–0.005	–0.001	–0.003
	(0.007)	(0.007)	(0.008)
Nonwhite	0.026	0.008	0.165
	(0.135)	(0.133)	(0.182)
Female	0.109	0.081	0.183**
	(0.076)	(0.092)	(0.089)
Retired	–0.059	–0.002	0.188
	(0.089)	(0.062)	(0.160)
Homeowner	0.049	–0.041	
	(0.072)	(0.121)	
House Price Expectation	–0.001	0.003	0.001
	(0.002)	(0.002)	(0.003)
Mean Inflation Expectation (within-respondent)	–0.041*	–0.042**	–0.069**
	(0.023)	(0.019)	(0.028)
Mean (Log) Household Income (within-respondent)	0.427***	0.403***	0.502***
	(0.113)	(0.100)	(0.176)
Mean Wage Growth Uncertainty (within-respondent)	0.024	–0.002	0.005
	(0.027)	(0.031)	(0.037)
(Log) Mortgage Balance			0.055
			(0.052)
Constant	7.110***	6.873***	6.964***
	(0.411)	(0.477)	(0.587)
Correlated Random Effects	Yes	Yes	Yes
Region Dummies	Yes	Yes	Yes
Chi^2	1613.53	1035.53	1637.81
P Value	0.00	0.00	0.00
Sample Size	1984	1724	579

Notes: Regional gas price inflation refers to the four-quarter percent change in the average retail gasoline price for the household's region of residence, one of seven Petroleum Administration for Defense Districts (or PADDs), as defined by the US Energy Information Administration. PADD region dummies are included, but their coefficients are suppressed. For other suppressed coefficients, see notes to Table 6a. Robust standard errors are clustered at the level of the individual. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A4. Real Durable Goods Spending vs. Year-ahead Expectations (Including Medium-run Expectations)

	(1) Baseline Sample	(2) College Sample	(3) College Sample	(4) Mortgage Sample	(5) Mortgage Sample
Inflation Expectation	0.208**	0.231***	0.121	0.305***	0.564***
	(0.086)	(0.083)	(0.108)	(0.093)	(0.185)
Inflation Uncertainty	0.174**	0.106	0.144	0.165	0.229*
	(0.089)	(0.095)	(0.101)	(0.105)	(0.120)
No College	–0.827			1.261	0.988
	(0.585)			(0.988)	(0.892)
No College × Inflation Expectation	–0.292**			–0.099	–0.100
	(0.118)			(0.225)	(0.209)
No College × Inflation Uncertainty	–0.189			–0.259	–0.318
	(0.177)			(0.218)	(0.210)
Medium-run Inflation Expectation	–0.144*	–0.068	–0.071	–0.117	–0.134
	(0.077)	(0.083)	(0.084)	(0.104)	(0.098)
No College × Medium-run Inflation Expectation	–0.006			–0.183	–0.157
	(0.120)			(0.184)	(0.186)
Medium-run Inflation Uncertainty	–0.032	–0.100	–0.087	–0.102	–0.153
	(0.083)	(0.104)	(0.108)	(0.101)	(0.104)
No College × Medium-run Inflation Uncertainty	0.251*			0.167	0.244
	(0.150)			(0.154)	(0.181)
Lagged Inflation Expectation	0.112***	0.087**	0.062	–0.035	–0.014
	(0.035)	(0.036)	(0.040)	(0.054)	(0.045)
No College × Lagged Inflation Expectation	–0.250**			0.233	0.164
	(0.113)			(0.142)	(0.160)
Lagged Inflation Uncertainty	–0.134	–0.184	–0.158	–0.354***	–0.313***
	(0.160)	(0.142)	(0.145)	(0.080)	(0.086)
No College × Lagged Inflation Uncertainty	0.161			0.202	0.193
	(0.211)			(0.165)	(0.192)
(Log) Monthly Payments	–0.003	–0.094	–0.065	–0.765***	–0.809***
	(0.189)	(0.285)	(0.301)	(0.199)	(0.174)
Expects Unemployment Increase	–1.318***	–1.107***	–1.232***	–1.466***	–1.568***
	(0.358)	(0.428)	(0.439)	(0.489)	(0.504)
Expects Unemployment Decrease	–0.163	–0.007	–0.037	–0.209	–0.299
	(0.261)	(0.328)	(0.347)	(0.301)	(0.288)
Expects Interest Rate Increase	0.089	–0.130	–0.135	0.405	0.402
	(0.278)	(0.342)	(0.348)	(0.284)	(0.286)
Expects Interest Rate Decrease	–0.066	0.358	0.365	0.037	–0.055
	(0.403)	(0.563)	(0.565)	(0.411)	(0.461)
Real Wage Growth Expectation	0.041	0.069	0.065	0.095*	0.085
	(0.056)	(0.044)	(0.045)	(0.057)	(0.061)
Wage Growth Uncertainty	–0.012	0.057	0.049	0.065	0.077
	(0.083)	(0.085)	(0.086)	(0.059)	(0.055)
(Log) Household Income	–1.424	–1.389*	–1.070	–1.801**	–1.354
	(0.885)	(0.773)	(0.795)	(0.877)	(0.937)
Mortgage Indicator	–0.282	–0.615	–0.806		
	(0.716)	(1.806)	(1.923)		
Age	–0.003	–0.009	–0.001	0.054***	0.050**
	(0.019)	(0.017)	(0.018)	(0.020)	(0.025)
Nonwhite	0.019	–0.436	–0.379	0.477	0.416
	(0.301)	(0.295)	(0.285)	(0.402)	(0.413)
Female	0.541***	0.476*	0.450*	–0.092	–0.039
	(0.200)	(0.285)	(0.271)	(0.291)	(0.293)
Retired	–0.172	–0.165	–0.194	–0.733*	–0.725*
	(0.243)	(0.226)	(0.248)	(0.391)	(0.425)
Homeowner	0.255	–0.256	0.089		
	(0.691)	(1.453)	(1.568)		
House Price Growth Expectation	0.002	–0.010	–0.016	–0.013	–0.013
	(0.021)	(0.021)	(0.022)	(0.019)	(0.018)
Mean Inflation Expectation (within-respondent)	–0.349**	–0.323**	–0.310**	–0.252	–0.385*
	(0.140)	(0.137)	(0.134)	(0.204)	(0.214)
Mean Medium-run Inflation Expectation (within-respondent)	0.183	–0.024	–0.012	0.108	0.135
	(0.113)	(0.139)	(0.142)	(0.172)	(0.168)
Mean Medium-run Inflation Uncertainty (within-respondent)	–0.374**	0.014	–0.025	–0.039	–0.032
	(0.157)	(0.208)	(0.203)	(0.182)	(0.173)
Mean (Log) Household Income (within-respondent)	2.723***	2.178***	1.907**	2.280**	2.050*
	(0.924)	(0.813)	(0.835)	(1.005)	(1.076)
Mean Wage Growth Uncertainty (within-respondent)	–0.200	–0.259*	–0.253*	–0.483***	–0.503***
	(0.124)	(0.133)	(0.131)	(0.136)	(0.139)
Mean (Log) Monthly Payments	–0.027	0.264	0.261	1.195**	1.268***
	(0.191)	(0.292)	(0.296)	(0.492)	(0.421)
Mean (Log) Monthly Payments × Inflation Expectation			0.007		–0.121
			(0.019)		(0.107)
Mean Mortgage Indicator × Inflation Expectation			0.114		
			(0.077)		
Mean Household Income × Inflation Expectation			–0.133**		–0.151
			(0.067)		(0.096)
(Log) Mortgage Balance				0.780**	0.501
				(0.345)	(0.363)
Mean (Log) Mortgage Balance × Inflation Expectation					0.134**
					(0.058)
Constant	4.410***	4.796***	4.313***	1.844	2.207
	(1.303)	(1.229)	(1.211)	(1.506)	(1.838)
Correlated Random Effects	Yes	Yes	Yes	Yes	Yes
Chi^2	3371.93	6476.98	8163.04	16729.24	26021.30
P Value	0.00	0.00	0.00	0.00	0.00
Sample Size	1084	939	939	678	678

Notes: The medium run refers to the period between two and three years ahead. For a list of variables included in the regressions but suppressed from the tables, see notes to Table 6a. Robust standard errors are clustered at the level of the individual. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A5. Real Nondurables and Services Spending vs. Year-ahead Expectations, GEE Estimation Excluding Months (and Lagged Months) with a Median Inflation Expectation of 8 Percent or Greater

	(1) Baseline Sample	(2) College Sample	(3) Mortgage Sample
Inflation Expectation	0.001	0.011	0.037
	(0.009)	(0.009)	(0.028)
Inflation Uncertainty	0.000	–0.006	0.002
	(0.009)	(0.008)	(0.013)
No College	0.016		–0.157
	(0.092)		(0.131)
No College × Inflation Expectation	0.002		–0.055*
	(0.011)		(0.031)
No College × Inflation Uncertainty	–0.020*		0.033
	(0.012)		(0.028)
Lagged Inflation Expectation	0.001	–0.001	–0.004
	(0.004)	(0.004)	(0.012)
No College × Lagged Inflation Expectation	0.004		0.018
	(0.008)		(0.024)
Lagged Inflation Uncertainty	–0.001	–0.004	–0.001
	(0.012)	(0.012)	(0.015)
No College × Lagged Inflation Uncertainty	–0.011		0.005
	(0.016)		(0.024)
(Log) Monthly Payments	–0.004	–0.016*	–0.005
	(0.007)	(0.009)	(0.041)
Expects Unemployment Increase	–0.102***	–0.042	–0.128*
	(0.033)	(0.042)	(0.068)
Expects Unemployment Decrease	–0.053*	0.009	–0.008
	(0.032)	(0.036)	(0.062)
Expects Interest Rate Increase	–0.005	–0.032	0.123***
	(0.028)	(0.033)	(0.042)
Expects Interest Rate Decrease	–0.034	–0.018	0.078
	(0.063)	(0.096)	(0.123)
Real Wage Growth Expectation	–0.006**	–0.000	0.008
	(0.003)	(0.003)	(0.007)
Wage Growth Uncertainty	–0.000	–0.000	0.008
	(0.008)	(0.008)	(0.008)
(Log) Household Income	0.083	0.138	–0.012
	(0.092)	(0.113)	(0.156)
Mortgage Indicator	–0.007	0.143	
	(0.070)	(0.114)	
Age	–0.009	–0.004	–0.009
	(0.007)	(0.007)	(0.007)
Nonwhite	0.049	0.199	0.029
	(0.151)	(0.157)	(0.120)
Female	0.051	0.018	0.192**
	(0.087)	(0.116)	(0.091)
Retired	–0.047	–0.015	0.179
	(0.095)	(0.072)	(0.158)
Homeowner	0.038	–0.056	
	(0.072)	(0.121)	
House Price Growth Expectation	–0.000	0.001	–0.005
	(0.002)	(0.002)	(0.003)
Mean Inflation Expectation (within-respondent)	–0.016	–0.023	–0.097***
	(0.023)	(0.022)	(0.033)
Mean (Log) Household Income (within-respondent)	0.451***	0.421***	0.487***
	(0.119)	(0.129)	(0.171)
Mean Wage Growth Uncertainty (within-respondent)	0.039	–0.023	–0.007
	(0.028)	(0.034)	(0.034)
Mean (Log) Monthly Payments × Inflation Expectation		–0.000	–0.016
		(0.004)	(0.021)
Mean Mortgage Indicator × Inflation Expectation		–0.002	
		(0.011)	
Mean (Log) Household Income × Inflation Expectation		–0.015*	0.035
		(0.008)	(0.021)
(Log) Mortgage Balance			–0.028
			(0.026)
Mean (Log) Mortgage Balance × Inflation Expectation			0.020
			(0.012)
Constant	7.596***	7.149***	7.491***
	(0.410)	(0.427)	(0.440)
Correlated Random Effects	Yes	Yes	Yes
Chi^2	993.47	1536.74	1938.95
P Value	0.00	0.00	0.00
Sample Size	1761	1536	481

Notes: From each sample we exclude all observations from June 2010 and March 2011 because in each of those months the sample median inflation expectation exceeded 8 percent. We also exclude observations from July 2010 and April 2011 to ensure that unusually high expectations do not enter as lagged expectations. For a list of variables included in the regressions but suppressed from the tables, see notes to Table 6a. Robust standard errors are clustered at the level of the individual. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.