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INFLATION EXPECTATIONS AND READINESS TO SPEND: CROSS-SECTIONAL EVIDENCE. REVIEW AND EXTENSION OF RESULTS

Abstract: In an environment where the zero lower bound on nominal interest rates hasbecome binding, central bank communication and influencing household expectationshas become even more important for stabilization policy. This paper examines therelationship between household inflation expectations and their buying attitudes withrespect to durable goods. The first part of this paper focuses on the results by Bachmannet al(2015) and some related literature which uses microdata. The main observationis that there seems to be a negative, if at all, relationship between expected inflationand current expenditure on durables. The second part builds upon the work of Bachmann etal(2015) and replicates their baseline specification with an extended sample, to examine whether households display some changes in behavior after experiencinga prolonged period of practically fixed interest rates.

Key words: consumer expectations, inflation, readiness to spend, zero lower bound

Introduction

In an environment of low nominal interest rates, expectations have become of key relevance for macroeconomic outcomes. The zero lower bound has imposed a binding constraint on conventional monetary policy and thus led central bankers to resort to unconventional measures in order to stir economic growth. In particular, the focus has been set on communicating with the public and influencing their expectations formation. According to common macroeconomic theory, increased inflation expectations should, when holding the nominal interest rate fixed, lead to a decline in the real interest rate, as postulated by the Fisher equation. Then, the lower real interest rate should induce an intertemporal substitution effect in consumption, causing consumers to increase spending and lower savings today (Euler equation). Arguably, temporarily higher inflation expectations will thus increase aggregate demand, stimulate GDP and help bring the economy back on its steady-state growth path. However, the few empirical studies on the topic yield mixed results.

This paper focuses on the work of Bachmann, Berg, and Sims (2015)[1]: "Inflation Expectations and Readiness to Spend: Cross-sectional evidence". The authors use microeconomic data from the University of Michigan Survey of Consumers to identify a causal relationship between the individual inflation expectations of the household and their spending behavior. Contrary to common theory, they find no significant relationship between the households' expected inflation and the reported readiness to spend on durable goods. Even more surprisingly, their baseline estimate shows that in an environment where the zero-lower-bound is binding, increased inflation expectations impact negatively the households' propensity to spend. In a number of model specifications and robustness checks the authors confirm that it is the idiosyncratic expectations about both the idiosyncratic and aggregate economic state as well as the trust in monetary authorities that influence households' spending decisions the most.

One possible explanation for these estimates is that they indicate the presence of "nominal illusion" among the public and reflect a lack of understanding of the relationship between real, nominal interest rates

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[1] Bachmann, Berg and Sims, 2015.

and expected inflation. The results could also imply that the magnitude of adverse effects caused by increased in inflation expectations might be underestimated by common theory. While lowering the real interest rate, expectations of greater inflation also have a negative income effect, which at times might outweigh the intertemporal substitution effect in consumption. This is especially the case, when according to consumers the growth in inflation expectations is accounted for mainly by an increase in gas prices. It is, however, diffcult to pinpoint which channels are actually at work, since not all of them are directly observable.

These results draw attention to the ambiguous relationship between inflation expectations and spending behavior. While they do not directly question the validity of the two models - Fisher and Euler equations, they still possess some signiffcant implications for monetary policy, especially with respect to arising opposition central bankers might face when advo-cating in ationary policies.

Empirical Setup, Baseline Results and Robustness Checks

Ever since the financial crisis many economists, mostly New Keynesian supporters, as well as policy makers have advocated that a central bank commitment for higher inflation would have a positive influence on current private spending. This proposition is based on results derived from the following two equations: (i) there exists an inverse relationship between current expenditure and the real interest rate (Euler equation), (ii) when holding the nominal interest rate fixed, increased inflation expectations lower the real interest rate (Fisher equation). Under certain assumptions on preferences and a fixed nominal return, solving the household's intertemporal maximization problem yields that an increase in anticipated inflation leads to an increase in consumption today, whereby the latter is relatively larger for durable goods compared to nondurables.

This result is of great importance for central banking, as their main instrument - the nominal interest rate is currently bounded from below and thus can be viewed as fixed. So, the question of interest in this paper is whether one can induce an increase in current private spending by engineering higher inflation expectations among consumers and what the magnitude of such an effect would be.

Bachman et al[2] aim at answering this question by looking at monthly consumer survey data on individual inflation expectations and spending behavior from the University of Michigan. Using microlevel data in this case is advantageous for the study as it makes possible to identify the inflation-expenditure relationship at the decision-maker level. Furthermore, the cross-sectional variation allows to control for statedependence of the effect by comparing the results at the zero lower bound and in normal times. The data sample covers a long time period from 1984 to 2012 and is designed to be representative. It also contains a rich set of demographic information on the respondents as well as a rotating panel component.

The authors use the cross-sectional data on quantitative inflation expectations over one and five-to-ten year horizons and qualitative measures of spending attitudes. Thereby they focus mainly on durable goods expenditure as the latter are thought to react more sensitively to changes in the interest rate and other important aggregate economic conditions. Thus we have an unobserved continuous measure of the household's readiness to spend on durable goods, y_{it} which is modeled as follows: $y_{i,t}^* = \beta_1 \pi_{i,t}^e + \beta_2 \pi_{i,t}^e \times D_{ZLB} + x_{i,t}\gamma + \epsilon_{i,t}$

Whereby $\pi_{i,t}^e$ stands for the amount of expected inflation, measured in percentage points, of household i in the next 12 months subsequent to the date t, D_{ZLB} is an indicator variable, which takes unity when the zero lower bound becomes binding (this period is defined by Bachman et al from December 2008 to December 2012), $x_{i,t}$ is a vector of controls. The coeffcient β_1 measures the partial effect of an increase in expected inflation on the readiness to spend on durables, while the coefficient β_2 allows to control for state-dependence of this effect (i.e. is this effect different at the zero lower bound). Since the latent variable $y_{i,t}^*$ is unobservable, the authors use the observable responses from the Survey of Consumers and define a variable which takes on three values of, depending on whether the household's point estimate lies below, in between or above the threshold values and , which are estimated with via maximum-likelihood. The authors then use an ordered probit model to estimate the effect of increased inflation expectations on the probability of answering *that it is a good time to spend.*

To be able to truly interpret the coefficients as causal effects, Bachman et al control for factors which might influence spending behavior but are at the same time correlated with expected inflation, both on cross-

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[2] Bachmann, Berg and Sims, 2015.

sectional and aggregate level. For example, they include a set of demographic characteristics such as gender, marital status, education degree, age, race, current real income etc. in the vector of controls. A potential endogeneity problem in this setting is the optimist-pessimist problem: an individual may be inherently optimistic (pessimistic) about the future development of the economy and might expect improvement in economic conditions, increases in real income and spending, better employment and working conditions and decline in prices. The resulting negative correlation between the independent variable and the error term might lead to biasedness of the coefficients. The inclusion of idiosyncratic expectations about the idiosyncratic situation of the household in the regression specification should eliminate this problem. Those expectations refer to the household's financial situation and expected trajectory of real income.

Another endogeneity problem may arise because respondents who anticipate a strong economy may also anticipate future increases in both the price level and spending, which in turn induces a positive correlation between expected inflation and the error term. To resolve this problem one must include idiosyncratic expectations about the aggregate conditions such as expected changes in the nominal interest rate, aggregate business conditions on one and five-to-ten-year horizon as well as a policy trust variable, which reflects the assumption that respondents who have doubt in economic policy also tend to refrain from increasing their expenditure. Lastly, Bachman et al also control for purely aggregate covariates.

In their baseline estimation[3], the authors look at the readiness to spend on durables and the anticipated 12-month change in the inflation rate. Contrary to what economic theory postulates, Bachman et al find no significant relationship between the expected inflation and the readiness to spend on durables, except at the zero lower bound, where the effect is, however, negative and small in absolute value. These results are surprising especially considering the fact that the coefficients of the control variables have the expected signs, as predicted by standard theoretical models, and are statistically significant. This implies that the variables of interest are measured accurately by the Michigan Survey data.

The estimated coefficient on the inflation expectations over 12-month horizon is negative and becomes even more negative and statistically significant when nominal interest rates are constraint from below. The observed marginal effect implies that "a 1 percentage point increase in expected inflation approximately lowers the probability that households have a positive attitude towards spending by 0.02 percentage points"[4]. This adverse effect becomes even stronger at the zero lower bound and increases to nearly -0.5 percentage points. Still, the authors find out that the effect of increased inflation expectations is too small in absolute value compared to the ones of other variables and given the overall volatility of monthly real durable consumption expenditure. It is also interesting to look at the coefficient of the zero lower bound dummy variable. Its value is positive and statistically significant, which at first glance might seem counterintuitive: households demonstrate a higher propensity to spend on durable goods in recession times. The authors argue, however, that this might reflect the positive impact of unconventional monetary and fiscal measures.

From the results one can conclude that the main determinants of durable goods expenditure are the idiosyncratic expectations about both the idiosyncratic conditions and the aggregate economic conditions as well as the overall trust in economic policy. These results have some very strong implications for monetary policy. Bearing in mind that almost all effects of the control variables comply with common macroeconomic theory, one can rule out the possibility that respondents simply answer incorrectly. They rather suggest that (i)either inflation expectations are irrelevant for consumers when deciding on their consumption expenditure or (ii)the public suffers from "nominal illusion": they lack understanding of the adverse relationship between current expenditure and the real interest rate on the one hand, and the role inflation expectations play when forming the real interest rate, on the other. Furthermore, this effect persists across different demographic groups, which might mean that Bachman et al have observed a structural relationship applicable to all US households.

So far it has become clear that the relationship between inflation expectations and current spending is rather ambiguous and extends beyond the one described by the Fisher and Euler equations. According to

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[3] For a summary and table of results see Bachmann, Berg and Sims, 2015.
[4] Bachmann, Berg and Sims, 2015.

recent studies[5] increased inflation expectations may cause a negative signaling effect, which can be interpreted by consumers that bad times come ahead. Furthermore, expectations about higher inflation may decrease spending in a sense that they reduce the real value of cash and other liquid assets (also known as "inflation tax"). The role of inflation expectations for expected real income should not be overlooked. As Burke and Ozdagli stress out in their work[6], unless income is perfectly indexed to inflation, increased expectations about the price development may cause significant wealth losses for households and thus dampen both current and future spending. Finally, the increase in inflation expectations when driven mostly by an increase in oil prices, represents a negative wealth shock.

As mentioned in the introduction, it is difficult to pinpoint which of those channels are responsible for the observed relationship. In an attempt to identify some of them, the authors carry out a number of robustness checks and specifications of the baseline model. Firstly, they omit the idiosyncratic expectation variables. After excluding the policy trust variable and assuming inflation expectations indeed work through the Taylor-Volcker channel, the marginal effects should become even more negative. The authors observe the expected sign but the change is not statistically significant. Supposedly consumers have a Philips curve perception[7] about inflation expectations in mind, control variables which refer to the expected future state of the economy may dampen a possible positive effect of inflation expectations on spending behavior. Thus, the authors continuously leave out variables that control for the expected financial situation of the household, unemployment rate, nominal interest rate and aggregate business conditions. Thus, the coefficients become even more negative and this confirms the view largely supported by Bachmann et al that the policy distress channel might be at work.

Next Bachmann et al focus on the negative wealth shock view by including expected one-year change in the price of gasoline and control for the optimist-pessimist problem by including variables for the subjective probability of job loss and real income gains. Indeed, the coefficient on the expected gasoline price is negative and statistically significant and this effect is not state-dependent. Compared to the baseline estimate, the effect of increased inflation expectations declines, which shows consistency with the assumption on the role of gas prices.

The authors use the panel component of the Michigan Consumer Survey to look at the variation of expected inflation for each individual separately and over time. They consequently take the first difference of the observations, first only for the independent variable then for both left and right hand side of the regression. In their first specification, they observe a small and statistically significant positive effect for positive nominal interest rates: "households that experience a one percentage point higher increase in expected inflation than the average household are about 0.1 percentage more likely to report that now is a good time to buy durables". Nevertheless, this as well as the rest of the results are in line with the baseline ones, as they confirm that the negative effect of inflation is somewhat stronger inside the zero lower bound.

Another interesting point to look at is the cross-sectional heterogeneity of the sample. Bachmann et al want to find out whether the estimated effects vary with respect to demographic groups. After including different characteristics concerning age, race, education degree, income category etc. they do not find stark differences across groups, which suggests that the observed relationship between increased inflation expectations and spending behavior is structural for the US households. The only exception makes the group of respondents with ex post very accurate inflation expectations (i.e. whose expectations remained within a band of 50 basis points of the actual annual inflation rate), who report a 3.8 percentage points increase in their readiness to spend at the margin. Bachmann et al also control whether past inflationary or deflationary episodes households have lived through somehow influence their spending attitudes, but the results are again negligible. From this robustness check one can conclude that neither a certain educational background nor a particular inflationary experience influence the relationship spending behavior and inflation expectations. Only households categorized as better inflation forecasters demonstrate results which comply with common macroeconomic theory, but those make up a small part of all respondents.

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[5] Volcker, 2010.
[6] Burke and Ozdagli, 2013
[7] Draeger and Lamla, 2013.

Finally, the authors test whether the relationship between inflation expectations and spending behavior has evolved over time by applying the model for each year separately. Overall, there are not any strong deviations among the time-varying coefficient for the period 1984 to 2012. It appears that the adverse relationship becomes stronger as one approaches the zero lower bound period.

All in all, the results indicate that engineering higher inflation expectations may not be enough to induce an increase in present consumption. On the contrary, the estimates rather suggest that in some cases higher expected inflation may even discourage current spending. Those results are in stark contrast to what we observe in Germany and Japan. Studies which look at buying attitudes in both counties[8]find that higher inflation expectations do positively influence current private spending. A possible explanation that emerges, especially in the context of the results for Japan, which has experienced a prolonged period of zero nominal policy interest rates, is that US households may have not yet realized the policy regime change to a practically fixed nominal interest rate. Instead, as Draeger et al[9] find, they think on the consequences of increased inflation according to the Taylor rule.

In this line of thought, a question of interest would be whether experiencing almost 8 years during which the zero lower bound on the Federal Funds Rate has been binding, has led US households to change their expectation formation and spending behavior in the direction postulated by Fisherian logic. The following part analyses this possibility by building upon the methodology and results derived by Bachmann et al[10].

The data set for the estimation is constructed analogically to the one of Bachmann et al (2015) using micro data from the Michigan Survey of Consumers. However, the author expands the sample period to 2016:11, thus doubling the time period described as zero lower bound. The aim of the estimation is to provide some empirical evidence on whether respondents who expect higher inflation have (begun to) alter their buying attitudes in the direction predicted by the Euler and Fisher equations.2 Furthermore, the author wants to find out whether doubling thezero lower bound period has led to any changes in the time variance of the coefficient on one-year expected inflation as measured in the baseline specification of Bachmann et al (2015).

Extending the results: empirical setup and discussion

The Michigan Consumer Survey data set used in the following includes cross-sectional data on quantitative inflation expectations and a qualitative measure of buying attitudes for durable goods, i.e. readiness to spend, over the one year horizon. As proposed by Bachman et al[11] the author uses an ordered probit model "to estimate the effect of increased inflation expectations on the probability of answering that it is a good time to spend"[12]. Furthermore, expectations of both idiosyncratic and aggregate economic conditions as well as some demographic characteristics are included as controls. The author adds measures for inflation dispersion, the current inflation rate,unemployment rate and nominal interest rate and variables which should account for the influence of overall volatility and aggregate business conditions.[13] Due to some data limitations three of those controls had to be omitted from the model.[14] As previously discussed, the author excludes all observations of the reported inflation expectations which exceed 20 percent in absolute value to reduce the influence of outliners on the results and focuses on the cross-sectional component of the data set. To be able to draw a comparison before and after expanding the zero lower bound period included in the sample, the author conducts two separate estimations for the periods 1984:1 to 2012:12 and 1984:1 to 2016:11.

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[8] Ichiue and Nishiguchi, 2015. D'Acunto, Hoang and Weber, 2015.

[9] Draeger andLamla, 2013.

[10] Bachmann, Sims and Berg, 2015.

[11] Bachmann, Berg and Sims, 2015.

[12] Bachmann, Berg and Sims, 2015.

[13] All series are taken from St. Louis Federal Reserve Bank data base FRED.

[14] Current inflation volatility, the relative price of durable goods and the race of the respondent.

Table 1. Short summary[15] of results

Dependent variable: buying conditions for durables				
Independent variable	Sample 1984:1 to 2016:11		Sample 1984:1 to 2012:01	
	Coefficient	Marg. Effect At ZLB	Coefficient	Marg. effect
Inflation expectations	-0.00098	-0.0034	-0.0016	-0.0046
Interaction term	-0.0104		-0.0103	
ZLB Dummy	0.0874		0.0920	
Expected financial situation of the household	0.0299	0.0091	0.0270	0.0104
Expected real household income	0.0276	0.0084	0.0196	0.0075
Expected change in the nominal interest rate	0.0426	0.0129	0.0433	0.0167
Expected 1Y aggregate business conditions	0.1300	0.0395	0.1300	0.0500
Expected 5Y aggregate business conditions	0.0621	0.0189	0.0622	0.0240
Expected unemployment	-0.0728	-0.0222	-0.0641	-0.0245
Current financial situation	0.1166	0.0355	0.1197	0.0461
Economic policy trust	0.1167	0.0355	0.1097	0.0423
Expected 1Y aggregate business conditions (index)	0.0022	0.0007	0.0021	0.0008

First, looking at the results for the sample period until December 2012 one observes slight differences in the coefficient values on both 1-year expected inflation as well as on some of the control variables compared to the ones from the baseline specification of Bachmann et al (2015). Especially the coefficient on 1-year inflation expectations has become even more negative, increasing from a value of -0.0009 to approximately

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[15] The table displays only a short version of the estimation results.

-0.0016. However, this change is to be expected considering the signs and significance levels of the coefficients of the omitted variables. The significance levels of the coefficients remain unchanged, except the one of the dummy variable for region "West" and the respondent's college degree, which are now significant at the 1 percent level. Overall, the values of the coefficients remain very close to the ones of the initial baseline specification and preserve their signs.

The author also calculates state-dependent marginal effects when the zero lower bound becomes binding and in normal times. In this model specification, a one percentage point increase in expected inflation leads to a decrease in the probability that the respondent will answer is it a good time to spend on durables by app. 0.05 percentage points, when the nominal interest rate is different from zero. Compared to Bachmann et al estimate, this observed marginal effect is stronger. The marginal effect of one-year inflation expectations remains almost unchanged when the zero lower bound is binding (-0.0046). The rest of the marginal effects of the control variables do not strongly deviate from their values as measured by Bachmann et al (2015).

As mentioned before, the aim of the paper is to compare two estimations - before and after expanding the zero lower bound period included in the sample. The author adds data from 2013:01 to 2016:11 and increases the number of observations to 78 756. Since in the relevant period the Federal Funds Rate remained continuously at historically low levels close to zero one could regard it as fixed and thus double the period when the zero lower bound is binding. Supposedly, US households have realized the policy regime change to fixed nominal rates after almost 8 years, then one should observe a change in the coefficient of one-year inflation expectations and of the interaction term. If increased inflation expectations work in the expected direction, then the estimates should become less negative. Indeed, when considering the results, the former has fallen slightly in absolute value from -0.00163 to -0.00098, whereas the coefficient of the interaction term remains unchanged. This result may support the proposition that consumers need to experience a longer period when nominal rates are practically fixed at zero, in order to adjust their spending behavior and act according to Fisherian logic. Still, the change is too small in absolute value and the coefficient remains not statistically significant for one to speak of an abrupt change in household's spending behavior.

Overall, the results largely support the assumptions on the relationship between inflation expectations and reported readiness to spend on durables made so far in the paper. One observes slight changes in the coefficient estimates of the control variables. However, the main robust determinants of the household's spending behavior continue to be the idiosyncratic expectations about both idiosyncratic and aggregate economic conditions, such as household's expectations of future business conditions, its current financial situation and its trust in governments policies. It seems that the expectations about the own real income play an important role as they have a positive and significant coefficient of 0.0296. This is a very interesting consideration. On the one hand, we clearly see that households do distinguish between real and nominal values and take those into account. The estimated coefficients on both the expected real household income and the expected change in nominal interest rate confirm this to a great extent. However, we still observe a counterintuitive relationship with respect to expected inflation. One again, this points out to the theory that households suffer from nominal illusion and do not differentiate between real and nominal interest rates resp. do not realize the role of expected inflation for the formation of the real interest rate.

The rest of the coefficients experience only small changes and preserve their expected sign. Interestingly, the coefficient of the zero lower bound dummy remains positive and statistically significant. This means that all other things equal, there is a higher probability that consumers display more favorable buying attitude in the period during 2008-2016. As Bachmann et al[16] point out, although counterintuitive this may mean that unconventional policy measures in the relevant period have influenced positively consumer spending behavior.

Turning to the marginal effects, the following should be noted. In normal times, a one percentage point higher inflation expectations decreases the probability of the household having a favorable attitude towards spending by 0.03 pp. Compared to the previous estimation (-0.05) this effect is slightly lower in absolute value. So is the marginal effect of one-year inflation expectations when the zero lower bound is binding: -0.0034 compared to -0.0047. However, the effects are statistically significant only when the zero lower bound dummy takes unity. Even though we observe that the measured effects have become less negative, still their magnitude is too small compared to the marginal effect of other control variables. For example, all

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[16] Bachmann, Berg, Sims, 2015.

other things equal, an individual who expects favorable business conditions in the following year, is by 0.0394 pp more likely to spend more on durables.

All in all, even though the coefficients of the variables as modeled in the baseline specification experience some alterations as though consumers are beginning to change the way their expectation formation influences their spending behavior, those changes are too small in absolute value for one to draw affirmative conclusions. One can summarize that in periods of positive interest rates, increased inflation expectations have practically no effect on households' spending decisions, whereas in times when the zero lower bound becomes binding, the effect is negative and small in absolute value.

In order to track the evolution of the inflation-expectations-current spending relationship over time the author estimates the model specification for each year separately from 1984 to 2016. The results are displayed in Figure 1 and 2, which show the point estimates for the coefficient on the one-year inflation expectations and its marginal effect, respectively. The estimates are predominantly negative, not statistically significant and do not strongly deviate in the relevant period. To that extent they confirm the assumptions on the observed relationship already made in the previous part of this paper. However, it is interesting to point out that after a negative peak in 2012, the coefficient values seem to become somewhat less negative and even achieve a positive value for 2016. One observes a similar development for the marginal effect. In this line of thoughts one could argue that households may perceive increased inflation expectations as favorable for current spending on durables in the late part of the sample.
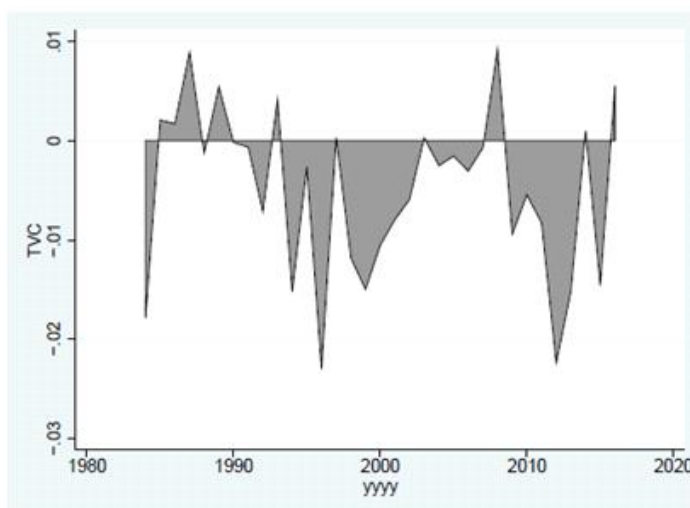

Figure 1: Time-varying coefficient of expected inflation. Sample period: 1984:1 to 2016:11
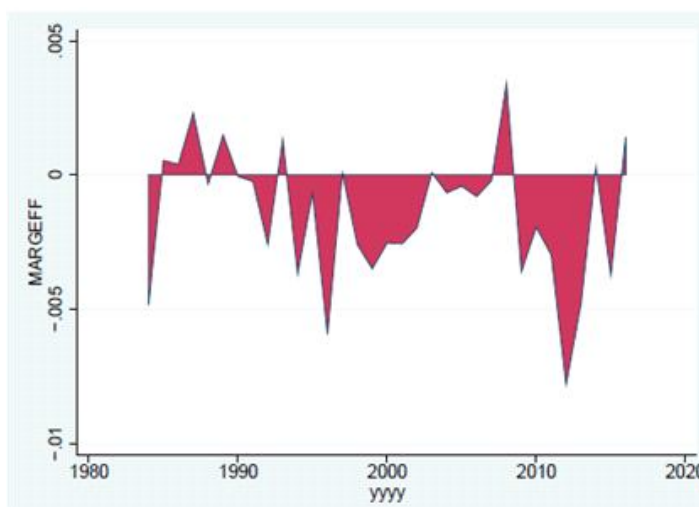

Figure 2: Time-varying marginal effect of expected inflation. Sample period: 1984:1 to 2016:11

Conclusion

The results of both estimations provide some well-founded empirical evidence on the relationship between expected inflation and individual readiness to spend on durables. It seems that in normal times households place more value on the anticipated idiosyncratic and aggregate economic conditions rather than on inflation expectations. In contrast, when the zero lower bound becomes binding the effect of inflation expectations becomes negative. Even though the estimates are rather stable over time, at the end of the sample period one observes a slight change in the positive direction of the marginal effect of 1-year inflation expectations, respectively the coefficient in the baseline specification has become somewhat less negative. This may imply that the consumers begin to understand the regime change from a Taylor rule to a fixed nominal policy interest rate and this influences their behavior in the direction predicted by common theory. However, those changes are too small in absolute value for one to argue that households are abruptly altering their spending attitudes.

These conclusions may posses some very important implications for where the focus of monetary policy should be placed. In recent years, the argument for engineering higher inflation expectations to stir economic activity has gained a lot of supporters on both the political and economic front. However, it seems that monetary authorities are facing a challenge which needs to be overcome for this transmission channel to work.

Two observations should be noted. On the one hand, there is some significant empirical evidence on the theory of nominal illusion. This means that central bankers have to overcome an educational barrier in order for the desired consumption-boosting effect of in-creased inflation expectations to occur. On the other hand, the weak heterogeneity of the estimations across different socio-demographic groups points more towards the proposition that people do understand the aim of such policies but interpret them as "bad signs". If this is true, then central banks have to overcome an even greater communication barrier to ensure their policies are indeed efficient and work in the desired direction.

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