

# Assessing Expectations as a Monetary/Fiscal State-Dependent Phenomenon\*

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## Abstract

We assess the impact of monetary and fiscal policy shocks on US survey-based macroeconomic expectations elicited from consumers and financial experts, within and outside low-debt states of the world. While we fail to detect a clear response to shocks in a linear model, our analysis reveals a number of state-dependent patterns. The response of consumers' expectations to the monetary and fiscal shocks we jointly consider is evident outside states of low debt but not within states of low debt where we observe little action. In particular, contractionary monetary policy shocks induce pessimistic macroeconomic expectations outside the low-debt state but not within it, suggesting that the fiscal burden matters in how monetary policy affects expectations. Furthermore, consumer expectations' responses more closely resemble those of experts outside the low-debt state, in line with consumers becoming more attentive to monetary developments when the stakes are high. Overall, our findings are in line with rationally inattentive consumers not paying attention to shocks occurring when the fiscal burden is low.

**Keywords:** policy shocks, public debt, rational inattention, fiscal theory of the price level.

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# 1 Introduction

Expectations play a key role in the way fiscal and monetary policy propagate in the economy. After all, current decisions regarding consumption and investment depend on expectations pertaining to future values of inflation and interest rates. Thus, fiscal and monetary policies can affect economic activity via their impact on expectations regarding the future. Empirically, however, relatively little is known about how people’s expectations are affected by fiscal and monetary policies.

In this paper, we utilize state-dependent models in order to assess how monetary and fiscal policy shape consumer expectations about the future.<sup>1</sup> This allows the effects of monetary and fiscal policies to vary according to the level of government debt, which will be important if people perceive these policies differently depending on the state of public finances.

Economic agents’ perceptions regarding the macroeconomic effects of monetary policy may depend on the state of public finances as in the theoretical model of Eusupi and Preston (2018) where imperfect knowledge in the form of fundamental uncertainty regarding long-run monetary and fiscal policy breaks Ricardian equivalence so that public debt matters for inflation.<sup>2</sup> As pointed out in Leeper and Leith (2016) and in Wallace (1981), different fiscal behavior does allow the same monetary policy action to have different impact.<sup>3</sup> This, in effect, renders monetary policy actions state-dependent. Leeper and Leith (2016) motivate potentially state-dependent effects of monetary policy shocks that relate to the policy regime. The central bank mainly stabilizes output and prices consistent with a standard Taylor rule in an “active” monetary policy regime, while it mainly

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<sup>1</sup>Our focus on consumers’ expectations is in line with, e.g., Coibion and Gorodnichenko (2012) and other recent literature studying how individuals process macroeconomic developments.

<sup>2</sup>Public debt impairs the intertemporal substitution channel of monetary policy so that the latter would have to be more aggressive to succeed in anchoring inflation expectations. In this setting, macroeconomic disturbances drive long-run beliefs. In line with this, their empirical model explains survey data on long-term expectations.

<sup>3</sup>As explained there, with some price stickiness along with distortionary taxation there will generally exist “pervasive interactions between monetary and fiscal policy”. The importance of the joint behavior of monetary and fiscal policies in determining inflation is thus one of the main themes there.

stabilizes debt in a “passive” monetary policy regime.<sup>4</sup> Indeed, within states of relatively high debt people may think of monetary policy as a device to stabilize public debt along the lines of the fiscal theory of the price level, rather than as a device to stabilize output and prices. For example, in an economy with high public debt nominated in its own currency, individuals might anticipate debt monetization which influences their responses to current monetary policy shocks and the way these impact on economic activity.<sup>5</sup>

The state of public finances may also influence economic agents’ perceptions regarding the macroeconomic effects of fiscal policy. If, for example, debt size induces individuals to expect debt monetization this would amplify the inflationary effects of government spending shocks at high levels of public debt. This would occur if individuals believe the fiscal authority is not committed to raise future taxation to stabilize public debt, within what Leeper and Leith (2016) and Bianchi and Ilut (2017) describe as a passive monetary/active fiscal policy regime. Alternatively, economic agents’ perceptions regarding the macroeconomic effects of fiscal policy may depend on the state of public finances if, facing relatively high debt, economic agents anticipate a consolidation to occur to bring public finances back on a sustainable path (Blanchard, 1990; Bertola and Drazen, 1993; Sutherland, 1997). This would occur if individuals believe the fiscal authority is committed to raise future taxation, within what Leeper and Leith (2016) and Bianchi and Ilut (2017) describe as an active monetary/passive fiscal policy regime with fiscal policy exhibiting Ricardian equivalence. In this case, individuals will not raise inflation expectations by much in response to higher government spending in a state of relatively high public debt.<sup>6</sup>

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<sup>4</sup>They define an active monetary policy regime as one where the monetary authority pursues its price-level objective unconstrained by government debt levels free to choose its set of control variables and the fiscal authority behaves passively to stabilize debt constrained by the monetary authority’s actions and private sector behavior. The latter combination of active monetary/passive fiscal policies delivers typical monetarist new-Keynesian results for monetary policy. Instead, a regime combining active fiscal with passive monetary policy provides results along the lines of the fiscal theory of the price level.

<sup>5</sup>Bianchi and Ilut (2017) provide evidence for a joint monetary and fiscally-driven rise and fall in inflation, and show that inflation expectations drop only when the fiscal-monetary policy mix changes to active monetary/passive fiscal in late 1981, but not in response to the disinflationary attempts in the late 60s and mid-70s and by Voleker in 1979-80.

<sup>6</sup>We also note that Perotti (1999), Corsetti et al. (2012) and Ilzetzki et al. (2013) find fiscal multipliers vary with debt, suggesting state-dependent effects of fiscal policy are indeed relevant.

Our work allows for the above-mentioned state-dependence of monetary and fiscal policy actions by considering different states determined by the debt level, while also taking into account the simultaneous effects of monetary and fiscal policy actions at any point in time.<sup>7</sup> To evaluate exogenous effects of monetary and fiscal policy on expectations, we consider Romer and Romer (2010) narrative monetary policy shocks, along with expenditure shocks in the spirit of Blanchard and Perotti (2002). We apply the local projections method put forward by Jordà (2005), introducing interaction terms that allow for the dynamics of impulse responses of expectations to vary according to the state of the economy. Using this approach we evaluate how fiscal and monetary policy affect expectations, conditional on the sustainability of public finances.

As a measure for macroeconomic expectations, we mainly use aggregated US survey data from the University of Michigan's Surveys of Consumers (Michigan Survey). This survey elicits expectations about key macroeconomic variables such as inflation, unemployment, and interest rates. We also consider survey answers regarding consumption intentions and satisfaction with government policy to infer how consumer sentiment is affected by fiscal and monetary policy. To complement our analysis conducted with consumer data, we assess the effects of these policy shocks on experts. To this effect, we use aggregated survey answers for the US from the Survey of Professional Forecasters (SPF) as in Andrade and Le Bihan (2013) and Coibion and Gorodnichenko (2015a). Comparing the results obtained with these two different sets of respondents, we proceed to evaluate potential biases in the formation of expectations of the general public like the prevalence of rational inattention motives involved in the updating of their expectations.

Our analysis uncovers a number of state-dependent patterns prevalent in these expectations data, missed altogether in a linear model ignoring state-dependent effects. In times of low public debt, consumer expectations do not react in a particularly systematic manner to monetary and fiscal policy shocks, in line with consumers being inattentive when the stakes are low. By contrast, reactions of consumer expectations are evident

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<sup>7</sup>Accounting for the effects of monetary and fiscal policy at the same time, helps avoid biased estimation of the separate impact of each of these shocks on expectations.

outside low-debt states, where consumers appear to become attentive to unanticipated changes in the fiscal burden arising due to an interest rate hike or an increase in government spending. Several intriguing observations stand out in such states.

Following a monetary tightening, consumers' expectations are largely unaffected in times of low debt in line with consumers being rationally inattentive when the stakes are low. By contrast, consumers' expectations are affected in a distinct and adverse way outside low-debt states. Consumer buying attitudes fall significantly as they worry about higher unemployment, and consumers are evidently dissatisfied with the interest rate hike surprise that raises the fiscal burden in this case. Notably, outside the low-debt state, unemployment expectations rise significantly in response to an unanticipated interest rate hike, while they fall once in the low-debt state.

The above results concur with the notion that the burden of debt is a drag on macroeconomic outcomes in times of relatively high public debt. However, the overshooting pattern exhibited by interest rate expectations suggests consumers expect that the monetary tightening will be followed by a monetary expansion that will eventually lower interest rates. This overshooting of interest rate expectations is then consistent with consumers believing that in times of relatively high debt, the primary role of the central bank is to stabilize public debt in line with the fiscal theory of the price level. In other words, consumers' expectations are consistent with the anticipation of a switch to a passive monetary policy regime where the central bank will lower interest rates to ease the fiscal burden. Interestingly, inflation expectations initially respond positively to an unexpected interest rate hike in a neo-Fisherian manner, albeit the responses are not particularly systematic.

Moreover, outside low-debt states, an increase in government spending has adverse effects on expectations consistent with the anticipation of negative effects from a future fiscal consolidation that induces consumers to paint a somewhat pessimistic picture of future macroeconomic developments. In particular, they intend to consume less, tend to believe that unemployment will go up, and become dissatisfied with economic policy. Notably, the significant fall in consumption intentions in response to higher government spending during times of relatively high debt is in stark contrast with the significant rise in

consumption intentions during times of low debt. A plausible explanation is that, facing relatively high public debt, consumers anticipate an overcompensating consolidation to follow in line with Ricardian equivalence<sup>8</sup>, and therefore expect negative macroeconomic consequences of current expenditure shocks. The marked increase in dissatisfaction with economic policy after an unexpected increase in government spending, supports this view. Interestingly, interest rate expectations fall significantly after an initial increase during the first two quarters. Since inflation expectations respond mostly positively to the government spending shock, this cannot be explained by a Taylor rule type relationship between inflation and interest rate expectations. Instead, this finding is consistent with consumers believing that, outside low-debt states, the primary role of the Fed is to stabilize public debt by lowering interest rates to ease the fiscal burden, as suggested by the fiscal theory of the price level. In other words, consumers anticipate a monetary policy response in line with a passive monetary regime.

We also find that outside low-debt states, consumers' responses to fiscal and especially to monetary policy shocks closely resemble those of professional financial and economic experts. As it is well documented that professionals' forecasts generally tend to be better than those of consumers, the resemblance of consumers' and professionals' expectations outside states of low-debt is indicative of consumers making relatively more informed forecasts within such states. This similarity within states of relatively high debt suggests such states induce consumers to be relatively more attentive vis-à-vis, e.g., monetary developments. These policy shocks are likely to affect the sustainability of public debt more directly in times of relatively high public debt which in turn potentially affects consumers via a variety of channels. Thus, the above finding suggests consumers choose to be inattentive when the stakes are low, in line with models of rational inattention such as Sims (2003).

The next section describes the data at hand. Following that, we describe our state-dependent approach to jointly estimating the impact of monetary and fiscal policy actions on inflation and other consumer and professional forecasters' expectations. The fourth

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<sup>8</sup>That is, consumers expect fiscal policy to switch to a passive regime in the future.

section presents our main empirical results along with some extensions and robustness analysis. Finally, the last section briefly concludes.

## 2 Data

### 2.1 Consumer expectations surveys

For our analysis we consider survey data from the Michigan Survey. As of 1978, a minimum of 500 telephone interviews are documented each month by the Survey Research Center at the University of Michigan. The households are selected in a way such that the sample should be representative for the U.S. population (Alaska and Hawaii are excluded from the surveys). Survey questions cover three areas: demographics, how survey respondents assess the prospects for their own financial situation, and how they view prospects for the economy in general. We use questions covering the latter.

These data are increasingly used to study expectations of the general public in a macroeconomic context (see e.g. Carvalho and Nechio, 2014; Coibion and Gorodnichenko, 2015b; Wong, 2015; Bachmann et al., 2015; Dräger et al., 2016), and are particularly well suited for our analysis. Respondents are households and their answers are presumably more representative for how people in general view economic developments, as compared to professional forecasters that are interviewed regarding macroeconomic developments in other surveys.<sup>9</sup>

We focus on survey questions that give us an indication on how people assess the macroeconomic environment, how they view their personal real income and consumption plans, and how satisfied they are with economic policy. We capture people's notion about the macroeconomic environment with questions about how people view economic activity, interest rates, and inflation over the 12 months ahead. The Michigan Survey contains two types of survey questions, questions with quantitative and questions with qualitative answers. For all questions we use cross-sectional aggregates provided by the

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<sup>9</sup>Coibion and Gorodnichenko (2015b) even argue that firms' expectations about economic activity and inflation are better approximated by household answers compared to answers from professional forecasters, since small and medium-sized enterprises usually have no professional forecasters on staff and are not likely to use professional forecasting services.

survey center.

For expected inflation we use average point estimates provided by respondents, which are elicited through the following questions:

(A12) *‘During the next 12 months, do you think that prices in general will go up, or go down, or stay where they are now? (A12b) By about what percent do you expect prices to go (up/down) on the average, during the next 12 months?’*

The remaining questions we use in our analysis are qualitative. To capture expectations about interest rates we use the following question:

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

Note that this question does not refer to a specific rate and respondents may not specifically have the monetary policy rate in mind. However, provided that the monetary policy transmission mechanism performs sufficiently well, changes in borrowing rates should be mainly due to changes in the policy rate. Hence, views about future monetary policy should be reflected in answers to this question.

The survey center aggregates individual qualitative answers using balance scores. In the case of expectations about future interest rates, the share of respondents that believe that interest rates go up is subtracted from the share of respondents that expect a decrease in interest rates.<sup>10</sup> Hence, when interest rate expectations generally go up among respondents, the index actually goes down. For our purposes, this does not warrant an intuitive interpretation of the score. Therefore, we reverse the index such that it goes up when more respondents believe that interest rates increase.<sup>11</sup>

To proxy expectations about real economic developments in a broad sense, we consider unemployment expectations. The question capturing unemployment expectations reads:

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<sup>10</sup>To have this score fluctuating around a level of 100, 100 is added.

<sup>11</sup>We subtract 100, multiply the difference between the two fractions by minus one, and add 100 again.

(A10) *‘How about people out of work during the coming 12 months. Do you think that there will be more unemployment than now, about the same, or less?’*

Similar to interest rate expectations, the balance score of unemployment expectations provided by the survey center goes up when actually relatively less people worry about higher future unemployment. Hence, to facilitate an intuitive interpretation in our context, we reverse the index in the same way than for interest rate expectations. For the remaining questions we consider the indexes as provided by the survey center.

We study the adjustment of consumption intentions using the question:

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

Finally, we proxy satisfaction with economic policy with the following question:

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

As the macroeconomic data we use, in particular expenditure data are only available with quarterly frequency, we aggregate the monthly balance scores and average point estimates for the expected inflation rate using quarterly averages.

## **2.2 Financial and economic experts expectations surveys**

The SPF elicits survey answers from a group of approximately 40 private sector economists from financial and research institutions who conduct forecasts about key macroeconomic variables. Respondents fill out a questionnaire form and provide point estimates for a number of variables and various forecasting horizons ranging from one quarter to 10 years on a quarterly basis. Note that while the Michigan Survey asks for qualitative forecasts of unemployment and interest rates, the SPF elicits point estimates.

For our analysis, we use the cross-sectional averages provided by the Federal Reserve Bank of Philadelphia. Specifically, we use the three quarter ahead forecast for the headline CPI inflation rate (denoted CPI5 in the SPF dataset), the three-month Treasury bill rate (TBILL5), and the unemployment rate (UNEMP5). Data about the expected T-Bill rate and the expected CPI inflation rates are available from the third quarter of 1981 while the expected unemployment rate is available since 1968. In the estimations with SPF data, we generally use data beginning with 1981, third quarter.

### 2.3 Measuring the state of public finances

To construct a measure of the state of public finances we consider the debt-to-GDP ratio. More specifically, we use the seasonally adjusted quarterly total federal public debt as percent of GDP to select states of relatively high public debt. However, rather than considering the rather volatile raw time series or simply selecting states using a threshold and a corresponding dummy variable, we assume a smooth transition process driving the state selection. Following Granger and Teräsvirta (1993), we employ the logistic function and evaluate the backward-looking seven quarter moving average of the debt-to-GDP ratio, which we denote  $z_t$ :

$$F(z_t) = \frac{\exp(\theta \frac{z_t - c}{\sigma_z})}{1 + \exp(\theta \frac{z_t - c}{\sigma_z})} \quad (1)$$

where  $c$  sets the proportion of the sample the economy is located in either state and  $\sigma_z$  is the standard deviation of the state variable  $z$ . In our case  $c$  is selected so that approximately two-thirds of the distribution of  $z$  is in a state of low debt. Figure 1 shows  $F(z)$  together with the debt-to-GDP ratio. The parameter  $\theta$  determines how much time the state variable spends close to the  $[0, 1]$  bounds of the process. Higher values move the model closer to a discrete regime-switching setup. We set  $\theta$  to 3 which gives an intermediate degree of intensity to the regime switching. The smooth transition process is parameterized along the lines of Auerbach and Gorodnichenko (2013), Tenreyro and Thwaites (2016) and Ramey and Zubairy (2018).<sup>12</sup>

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<sup>12</sup>We also experiment with a different specification of the smooth transition process in the robustness analysis.

## 2.4 Fiscal and monetary policy shocks

We consider measures for monetary and fiscal policy shocks that have been frequently used in the literature. To study the effects of monetary policy we consider narrative shocks along the lines of Romer and Romer (2004). As the latter shocks are available only from 1978q1 to the early 2000's, we extend the series to 2007q4 for our benchmark specifications. These shocks are innovations to monetary policy unrelated to changes in the macroeconomic environment. The intuition is to use forecasts available to the FOMC members (i.e. Greenbook forecasts) to purge changes in the policy rate from the systematic component. Specifically, we consider changes in the intended Federal Funds rate that are orthogonal to the information set of FOMC members. That is, using the Romer and Romer (2004) specification, we regress the changes in the intended Federal Funds rate on Greenbook forecast data, and retain the residuals. These monetary policy innovations are available at a monthly frequency whereas most of the data we use is only available at a lower frequency. Therefore, we transform this monthly series by utilizing quarterly averages. As the identification of monetary policy shocks is complicated by the zero lower bound, we only consider data until 2007q4 in the benchmark specification. However, to extend our sample until 2012q4 for our robustness analysis that includes the Crisis years we use an extended series of monetary policy shocks until 2012q4 in the spirit of Romer and Romer (2004) along the lines of, e.g., Alpanda and Zubairy (2018), that is constructed from a shadow short rate as in (Krippner, 2015) instead of intended changes in the Federal Funds rate. Specifically, we splice the Federal Funds rate with Krippner's Shadow Short rate in 2009q4 and use this measure as a dependent variable in the same regression from which we recovered the original Romer and Romer (2004) monetary policy shocks. The sample for this regression is restricted by the availability of Greenbook forecasts only made available with a delay.

To evaluate changes in government spending we use the Blanchard and Perotti (2002) identification scheme. This identification scheme is based on the assumption that within quarter government spending is predetermined with respect to other macroeconomic vari-

ables. Since the set of controls in the local projection estimation equation includes lagged values of GDP and government spending in addition to current government spending, the shock is simply given by the coefficient of current government spending. This is equivalent to the Blanchard and Perotti (2002) SVAR identification using a Choleski ordering in which government expenditures are ordered first. To take account of potential anticipation effects not fully captured by our identification scheme, in the robustness analysis we utilize changes in a purged measure of government spending. We purge this measure by regressing government spending on expectations about spending elicited from the SPF. We then utilize the residuals from this regression instead of the raw expenditure series in our local projections (see e.g. Ramey (2011) and Auerbach and Gorodnichenko (2012) for similar approaches).

### 3 Econometric approach

A suitable approach to study how fiscal and monetary policy affect expectations conditional on the sustainability of public finances is the local projections method put forward by Jordà (2005). This framework is very flexible and allows the dynamics of impulse responses to vary according to the state of the economy by introducing interaction terms.<sup>13</sup> The Jordà method requires estimation of a series of regressions for each horizon  $h$ . We fit the following model to the data, allowing for state-dependence and the simultaneous evaluation of the effects of expenditure and monetary policy shocks:

$$\begin{aligned}
x_{t+h}^e &= \alpha_h + \beta_h^m R\&R\ shock_t + \beta_h^e expenditures_t + \sum_{\tau=1}^2 \gamma_{h,\tau} x_{t-\tau}^e + \delta'_{\mathbf{h},\tau} \mathbf{X}_{t-\tau} \\
&+ F(z_{t-1})(\alpha_h^{state} + \beta_h^{m,state} R\&R\ shock_t + \beta_h^{e,state} expenditures_t + \\
&+ \sum_{\tau=1}^2 \gamma_{h,\tau}^{state} x_{t-\tau}^e + \delta_{\mathbf{h},\tau}^{state'} \mathbf{X}_{t-\tau}) + \kappa_h t + \lambda_h t^2 + \epsilon_{t+h}
\end{aligned} \tag{2}$$

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<sup>13</sup>Auerbach and Gorodnichenko (2013) were the first to use this technique to estimate state-dependent fiscal models, employing it in their analysis of fiscal multipliers in recessions and expansions. This approach has become one of the primary tools to study state-dependent effects of shocks (see e.g. Jordà et al., 2013; Tenreyro and Thwaites, 2016; Ramey and Zubairy, 2018; Romer and Romer, 2017).

The dependent variable is in each case one of the survey measures described in Section 2. For example, we consider survey-based consumers' expectations regarding economy-wide inflation, unemployment and interest rates. The state variable indicating the state of public finances is captured by the smooth transition function  $F(z_{t-1})$ , which we evaluate at 0 and 1 (outside low debt). Control variables are used in order to capture the state of the business cycle one quarter before people provide survey answers. More specifically, we include the logarithm of real GDP, the CPI inflation rate, and the Federal Funds rate as control variables in addition to the lagged dependent one.<sup>14</sup> We also include a recession dummy controlling for NBER recession dates as well as lagged values of the monetary policy shock and government spending. The inclusion of these variables effectively purges government spending from its systematic component. Throughout, we use the lagged value of  $\mathbf{X}$  to alleviate endogeneity issues.<sup>15</sup> In addition, we control for a linear as well as a quadratic trend. One complication associated with the Jordà method is the serial correlation in the error terms induced by the successive leading of the dependent variable. To take account of this, we use the Newey-West correction of the standard errors. The impulse response functions presented below in a state of low-debt are just the sequences of the estimated  $\beta_h^m$  and  $\beta_h^e$  coefficients. The impulse response functions to monetary and fiscal shocks respectively are the sequences of  $(\beta_h^m + \beta_h^{m,state})$  and  $(\beta_h^e + \beta_h^{e,state})$ .

## 4 Results

### 4.1 Responses of consumer expectations to fiscal and monetary policy shocks

We now consider the impulse responses of consumer expectations to contractionary government spending shocks and to interest rate hike shocks, arising from our estimation exercise described in the previous section, using a sample from 1978q1 to 2007q4. Figure 2 shows IRFs of the Michigan Survey measures to government spending shocks together

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<sup>14</sup>Whether we only include the lagged dependent or a set of lagged expectations measures in the regression does not appear to affect our results. Thus, we control only for the lagged dependent.

<sup>15</sup>Furthermore, as macroeconomic data is released with a certain lag,  $\mathbf{X}_{t-1}$  may in fact proxy the information set of agents more accurately than  $\mathbf{X}_t$ .

with one and two standard error bands.<sup>16</sup> Similarly, Figure 3 presents the impulse responses to monetary policy shocks. In each figure we present in this section, panels A, B and C refer to the respective responses of expectations regarding unemployment, inflation, and interest rates. Panel D shows consumption intentions, and Panel E the responses of consumers' satisfaction with economic policy. The first column shows the IRFs for a "straw man" linear model without any state effects.<sup>17</sup> The second column shows the IRFs inside the low-debt state, while responses outside the low-debt state are shown in the third column.

A preview of the impulse response functions reveals a number of patterns. First, the linear model without state-dependency does not exhibit much action, with the impulse responses to the shocks derived from it fluctuating around the zero line. This suggests the need to allow for the possibility of state dependent behavior in order to help detect expectations' responses to these shocks. When we do so, we find that within states of low-debt we do not get much of a response, if at all, of consumers' expectations to any of the shocks we simultaneously consider as seen in the second column of each of these figures. However, outside low-debt states of the world, the response of consumers' expectations to these shocks is in a number of cases quite striking. Below, we describe a number of specific results in relation to the above.

We first turn to the IRFs to expenditure shocks shown in Figure 2. Note that expenditures enter in log-levels and IRFs show responses to an increase in expenditures of approximately one percent. Consider the leftmost column showing the linear model. These responses are not pronounced and not particularly significant. These responses revolve insignificantly about the zero line, with the possible exception of unemployment expectations in Panel A that respond positively to the government spending shock during the sixth and seventh quarters.

The same applies to the responses in the second column of Figure 2 which show consumers' reactions inside low-debt states. In this case, the response of unemployment

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<sup>16</sup>This approximately corresponds to 68 and 96 percent confidence intervals.

<sup>17</sup>That is, in Equation 2,  $F(z_{t-1})$  is set to zero.

expectations shown in Panel A revolves insignificantly around the zero line. Moreover, we get temporary declines in inflation expectations one and four quarters after impact in Panel B, and a positive response of interest rate expectations between three and six quarters as shown in Panel C. In panel D of the figure, we observe that consumption intentions tend to respond positively over the first five quarters and significantly so three quarters after impact, while satisfaction with economic policy does not react initially and eventually goes down significantly seven quarters after the shock sets in as can be seen in Panel E. Overall, inside low-debt states, responses appear rather unsystematic, especially so as the shock sets in.

Outside the low-debt state, responses to higher expenditures, shown in the third column of Figure 2, are rather pronounced as compared to responses within the low-debt state. Consumers expect higher unemployment about five quarters after the shock sets in, as shown in Panel A of Figure 2. Moreover, they tend to expect higher inflation rates upon impact, more so at four quarters after impact, but even at seven quarters out, as evident in Panel B. Notably, after rising on impact, interest rate expectations go down and significantly so six quarters after impact as can be seen in Panel C. As inflation expectations tend to respond positively to expenditure shocks, this cannot be explained by a Taylor rule type relationship between inflation and interest rate expectations. Instead, this finding suggests that outside low-debt states, consumers believe that the primary role of the Fed is to stabilize public debt along the lines of the fiscal theory of the price level.

Furthermore, it is striking that consumers cut back on their buying attitudes significantly and are dissatisfied with economic policy as shown in Panels D and E respectively. These negative responses are evident and significant upon impact in both cases, and significantly negative at five quarters out for consumption intentions and at one year after impact for economic policy satisfaction. Importantly, the significant fall in consumption intentions in response to higher government spending in times of relatively high debt is in stark contrast with the significant rise in consumption intentions during times of low

debt.<sup>18</sup>

The last result is in line with Geiger et al. (2016) who find that people actually cut back on consumption and increase precautionary saving in response to expansionary fiscal policy in an unsustainable fiscal environment. Overall, an increase in government spending in times of relatively high debt appears to prompt consumers to paint a pessimistic picture over future economic developments. From this perspective, it appears that consumers anticipate future distortionary taxation after a current increase in government spending, which is consistent with dissatisfaction with economic policy evident in states of relatively high debt. Our results are consistent with consumers expecting monetary as well as fiscal authorities to stabilize public debt.<sup>19</sup> The latter is suggested, in particular, by the responses of interest rate expectations and satisfaction with government policy.<sup>20</sup>

Interestingly, the IRFs we observe in Figure 2 suggest positive expectation effects of negative expenditure shocks in times of high public debt, i.e. fiscal consolidations. Lower expenditures pertain to gradually lower unemployment expectations, positive consumption intentions and to the attitude that the government is doing a fair job. This reaction may plausibly be related to the so-called expectations channel via which a fiscal consolidation may exert expansionary effects (Blanchard, 1990; Bertola and Drazen, 1993; Sutherland, 1997; Ardagna, 2004).<sup>21</sup> If this channel is active, then any contractionary effects induced by the consolidation are counteracted and, if the channel is strong enough, may even lead to expansionary effects at the macroeconomic level.

Figure 3 presents the responses of consumer expectations and attitudes to monetary

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<sup>18</sup>Considering the t-statistics on the coefficient of the interaction term  $\beta_h^{e,state}$  to see whether responses are significantly different within as compared to outside the low-debt state, we observe t-statistic values well above an absolute value of two for several horizons in case of interest rate expectations as well as for consumption intentions and satisfaction with economic policy. In these instances we can reject the null that the responses inside and outside states of low debt are identical at the 95 percent confidence level. We cannot reject this null for unemployment and inflation expectations.

<sup>19</sup>In the terminology of Leeper and Leith (2016) and Bianchi and Ilut (2017), consumer expectations are thus consistent with a passive monetary/passive fiscal policy regime.

<sup>20</sup>Consumer expectations over future fiscal policy are not available.

<sup>21</sup>That is, if public debt is perceived to be unsustainable, then consumers expect a consolidation to occur in the future. In anticipation of the consolidation people build up a stock of savings to be able to compensate the expected decline in disposable income due to the future fiscal contraction. When the consolidation finally occurs, households may respond with an increase in consumption, resulting in higher aggregate demand.

policy shocks. IRFs show the reaction of consumers to an exogenous increase in the intended Federal Funds rate by one percentage point. In the linear model, consumer expectations regarding unemployment, inflation and the interest rate do not respond strongly to a monetary tightening and the responses are typically not significant. The same goes for consumption intentions and the degree of satisfaction with economic policy. More precisely, unemployment expectations in the first column of Panel A revolve around the zero line but are significantly positive, even if small in magnitude, at four and five quarters after the unanticipated interest rate hike. Inflation expectations and interest rate expectations in the first column of Panels B and C respectively, revolve insignificantly around the zero line. Finally, consumption intentions exhibit a small but significant fall six and seven quarters after impact in Panel D, while satisfaction with economic policy exhibits a small but significant increase two quarters after impact in Panel E.

Inside the low-debt state, the responses to a monetary tightening shown in the second column of Figure 3 are not very strong in magnitude as compared to the responses outside the low-debt state shown in the third column. Unemployment expectations eventually fall six quarters after impact in Panel A. Moreover, inflation expectations tend to go up on impact and again, temporarily, at seven quarters out as can be seen in the second column of Panel B. Interest rate expectations fall at about a year after impact in Panel C. Finally, consumption intentions in the second column of Panel D fall somewhat one quarter after impact, and satisfaction with economic policy goes down significantly between two and four quarters after the unanticipated interest rate hike.

The relatively weak reaction of the survey measures during times of low public debt contrasts with the responses outside the low-debt state, where we observe pronounced reactions of consumer expectations in response to monetary policy shocks. This suggests that consumers are more sensitive to changes in the policy rate once public debt is comparatively high. Moreover, in some instances, we observe different signs of the responses depending on the state the shock occurs in. For example, outside the low-debt state, unemployment expectations shown in the third column of Panel A go up and significantly so six quarters after impact, while in the low-debt state unemployment falls in the sixth

quarter. Interestingly, inflation expectations tend to respond positively on impact, but then fall six quarters after impact as can be seen in Panel B.

As evident in the third column of Panel C, outside the low-debt state, consumers expect the monetary tightening to be only temporary and to be followed by a monetary expansion indicated by the pronounced and significant overshooting pattern of interest rate expectations. Interest rates go up significantly on impact and one quarter after the shock, but then start falling becoming significantly negative between six and eight quarters out. This overshooting pattern can be rationalized by two non-mutually exclusive explanations. First, respondents might expect that the central bank will eventually attempt to stabilize unemployment by lowering interest rates to overcompensate for the current interest rate hike. Second, respondents might believe that, after all, in times of high debt the primary role of the central bank is to stabilize public debt and thus believe that the central bank will eventually lower interest rates after the initial rate hike.

Furthermore, the responses of consumer attitudes shown in Panel D and E suggest that a monetary tightening induces negative sentiments outside the low-debt state. Consumption intentions eventually fall and significantly so by the seventh quarter after impact, while satisfaction with economic policy falls significantly on impact and remains in the negative territory for at least two years. The fall in both consumer buying attitudes and satisfaction with economic policy even two years after the shock, is consistent with the notion that the burden of debt is a drag on macroeconomic outcomes in times of relatively high public debt.

The responses of the expectation measures to monetary policy shocks outside the low debt state, are broadly consistent with the predictions in Bianchi and Ilut (2017) who find that in a passive monetary/active fiscal policy regime, economic activity decreases while the inflation rate slightly increases in response to an interest rate. The Bianchi and Ilut (2017) model, however, does not predict an overshooting pattern of the policy rate.

Comparing the responses inside and outside low-debt states, it is striking that all survey measures systematically react more strongly in times of relatively high public

debt.<sup>22</sup> This is consistent with rationally inattentive consumers not paying attention to shocks occurring when the stakes are low, while they do react to macroeconomic news when public debt is relatively high. This appears plausible as fiscal and monetary policy are likely to affect sustainability and refinancing of public debt more adversely in times of relatively high public debt and consumers will be more directly affected by policy shocks in this case.

## 4.2 Responses of professionals' expectations

Responses of unemployment, inflation and interest rate expectations of professional forecasters to government spending shocks and to interest rate hike shocks are shown respectively in Panels A, B and C of Figures 4 and 5. The sample for the underlying estimation is 1981q3 to 2007q4. Professional forecasters, similar to consumers, tend to react to fiscal and monetary policy shocks more distinctly outside states of low-debt even though this difference is less pronounced than in the case of consumers. In several instances, we observe different signs of the responses depending on the state the shock occurs in. Moreover, outside the low-debt state we observe some similarities between the responses of consumers and experts.

Looking at Figure 4, we see that the responses of experts' expectations arising from the linear model shown in column 1, do not indicate much systematic reaction to government spending shocks. The responses of unemployment and interest rate expectations are insignificant at all horizons, and inflation expectations go down significantly in quarters three, six and seven. The responses inside low debt states in column 2, are a bit more evident than is the case for the linear model but not particularly systematic nor significant for the most part. Unemployment expectations in the second column of Panel A go up significantly on impact but then become insignificant at any other horizon, while interest rate expectations in Panel C go up significantly only for the eighth quarter. Inflation

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<sup>22</sup>In fact, we can reject the null that the responses to monetary policy shocks are identical for all survey measures but inflation expectations, at least for several horizons, where we observe t-statistics on the coefficient of the interaction term  $\beta_h^{m,state}$  above an absolute value of two. This suggests that the reaction of consumers to monetary policy shocks inside and outside states of low debt is distinctly different.

expectations in Panel B fall significantly in quarters three and seven, but rise significantly by quarter eight.

Outside low-debt states, expenditure shocks relate to pessimistic expectations of financial and economic experts as shown in the third column of Figure 4. A few quarters after the shock sets in, experts revise expectations about the future unemployment rate upwards, and significantly so by the eighth quarter after impact as can be seen in Panel A. Inflation expectations in the third column of Panel B go up until quarter two, but then fall and these responses become significantly negative by the sixth quarter after impact. At the same time, expectations about future interest rates go down by the sixth quarter after impact, consistent with a Taylor rule linking these to the response of inflation rate expectations described above.

Figure 5 shows expert responses to monetary policy shocks. *Vis-à-vis* monetary policy shocks we observe relatively small but mostly systematic responses in the linear model. Unemployment expectations in the first column of Panel A go down significantly initially, albeit not strongly, and then rise and significantly so in quarters six to eight. Inflation expectations in Panel B respond positively and significantly on impact and during the first two quarters. Finally, interest rates in Panel C respond positively and significantly on impact, and persistently so until about one year after impact. Taken together, these responses suggest experts appear to interpret monetary policy shocks as somewhat of a signal for an expansionary movement along the Phillips curve at least for the first couple of quarters after impact.

Inside low-debt states, the responses to an unanticipated interest rate hike shown in the second column of Figure 5 are smaller in magnitude as compared to the responses outside the low-debt state, but often significant. In Panel A, we can see that unemployment expectations fall significantly on impact and at two quarters out. Moreover, the response of inflation expectations in the second column of Panel B is positive upon impact, and the same goes for interest rate expectations in Panel C.

The responses of the expectation measures outside the low debt state, shown in the third column of Figure 5, uncover differences associated with relatively high public debt

as compared to low-debt states. In particular, outside low-debt states, monetary policy shocks induce pessimistic expectations. Outside low debt-states, experts gradually revise unemployment expectations upwards and the responses are significantly positive by the sixth quarter after impact, in stark contrast to the significant fall in unemployment expectations during low-debt states. Moreover, together with this gradual increase in unemployment expectations we observe that after going up one quarter after impact, inflation expectations go down strongly and significantly six and seven quarters after the shock. Similarly, after a small but significant initial rise, interest rate expectations fall by quarter six and significantly so by the eighth quarter after impact. The last two results for the response of inflation and interest rate expectations, are consistent with a Taylor rule linking these two series.

Overall, financial and economic experts assess the effects of fiscal and monetary policy differently depending on whether the economy is in or outside a low-debt state. Moreover, we observe similarities in the responses of consumers and experts outside the low-debt state, in particular vis-à-vis monetary policy shocks. This further supports the prevalence of rational inattention motives in the updating of consumer expectations. That is, when the stakes are low we do not observe much of a response of consumer expectations to fiscal and monetary policy shocks while experts exhibit relatively small but rather systematic responses.<sup>23</sup> Outside low-debt states, consumers responses are closer to those of professionals as they now have a higher incentive to keep track of monetary developments.

## **4.3 Robustness Analysis**

### **4.3.1 Allowing for non-linearities associated with recessions**

Non-linear responses of economic activity and other macroeconomic variables to monetary and fiscal policy shocks are at the center stage of a recent and growing strand of literature.

Empirical evidence suggests that how macroeconomic variables respond to fiscal and

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<sup>23</sup>As professional forecasters get paid to “pay attention” to the macroeconomy, they are more likely to pay attention and thus respond to fiscal and monetary policy shocks even in low debt states. Still, their responses to these shocks are much stronger outside states of low debt, suggesting they perceive these shocks as more important in such states.

monetary policy developments critically depends on whether the economy is in a state of economic slack or not (Tenreyro and Thwaites, 2016; Ramey and Zubairy, 2018). As public debt tends to go up in times of economic distress it is conceivable that, to some extent, the state-dependent effects we observe inside and outside low debt states of the world are in fact associated with economic slack. To take account of this potential relationship we add an additional state capturing recessions based on an NBER measure of these. Following e.g. Bernardini and Peersman (2018) we augment equation (2) for an additional non-linearity associated with recession periods. This effectively purges the public debt state and the interaction terms with monetary and fiscal policy shocks, from recession effects.

That is, we consider the following state-dependent regression equation that adds the state of economic slack to the debt-level state considered in our benchmark equation:

$$\begin{aligned}
x_{t+h}^e = & \alpha_h + \beta_h^m R\&R\ shock_t + \beta_h^e expenditures_t + \sum_{\tau=1}^2 \gamma_{h,\tau} x_{t-\tau}^e + \delta'_{\mathbf{h},\tau} \mathbf{X}_{t-\tau} + \\
& F(z_{t-1})(\alpha_h^{state} + \beta_h^{m,state} R\&R\ shock_t + \beta_h^{e,state} expenditures_t + \\
& \sum_{\tau=1}^2 \gamma_{h,\tau}^{state} x_{t-\tau}^e + \delta_{\mathbf{h},\tau}^{state'} \mathbf{X}_{t-\tau}) + I_{t-1}^{REC}(\alpha_h^{REC} + \beta_h^{m,REC} R\&R\ shock_t + \\
& \beta_h^{e,REC} expenditures_t + \sum_{\tau=1}^2 \gamma_{h,\tau}^{REC} x_{t-\tau}^e + \delta_{\mathbf{h},\tau}^{REC'} \mathbf{X}_{t-\tau}) + \kappa_h t + \lambda_h t^2 + \epsilon_{t+h} \quad (3)
\end{aligned}$$

The impulse response functions to monetary and fiscal shocks from estimating Equation 3 are respectively the sequences of  $(\beta_h^e + \beta_h^{e,state})$  and  $(\beta_h^m + \beta_h^{m,state})$  shown in Figures 6 and 7. Our results are robust to the inclusion of this second set of states capturing additional non-linearities in expectations' responses. Comparing Figure 6 to our benchmark Figure 2 for spending shocks and Figure 7 to Figure 3 for monetary shocks, we can see that the shapes of the impulse responses are strikingly similar. We note, however, that the shape of the response of unemployment expectations to monetary policy shocks differs in Figure 7 as compared to Figure 3 beginning at about four quarters out, both outside as well as inside the low-debt state. The response of inflation expectations to

monetary policy shocks also differs in the two figures in that this response is no longer significantly positive on impact outside the low-debt state, and in that inflation expectations now respond negatively and significantly so by the fourth quarter, within the low-debt state. Once again, we observe that the response of consumers' expectations to fiscal and monetary policy shocks is evidently stronger and sometimes even different in sign, outside states of low-debt as compared to within states of low-debt. For example, while inflation expectations respond positively to an interest rate hike shock by the fourth quarter after impact outside the low-debt state, they respond negatively and significantly so by the fourth quarter after impact within the low-debt state.

### 4.3.2 Government spending purged from anticipation effects

As the current literature provides some evidence indicating that the Blanchard and Perotti (2002) government spending shocks may be, to a certain extent, anticipated, we now consider purging these derived “shocks” from anticipation effects. Such anticipation effects would impair the interpretation of the responses of the survey measures to expenditure shocks. To evaluate the sensitivity of our results we explore how the survey measures react to shocks in the expenditure series after purging it from expected changes. To this end, we regress the expenditure series at  $t$  on forecasts of expenditures for  $t$  elicited at  $t - 1$ .<sup>24</sup> We retain the residuals from this regression and use them as the expenditure measure in Equation 2. The corresponding IRFs are shown in Figure 8. As forecasts of expenditures are only available beginning with 1981q3, the sample for the underlying estimations is 1981q4 to 2007q4.

Once again, in Figure 8 we observe a distinctly stronger response outside states of low debt as compared to within states of low debt or as compared to a linear model that ignores state dependency. The shape of the response of unemployment expectations (Panel A) and inflation expectations (Panel B) in Figure 8 exhibits somewhat different patterns as compared to Figure 2, but in both cases expectations go up as before. More precisely, unemployment expectations now go significantly up, not just marginally so, by

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<sup>24</sup>As a measure of government spending forecasts, we use the main forecast of three quarters ahead real federal government consumption expenditures and gross investment.

the eighth quarter, outside the low-debt state in the third column of Panel A in Figure 8. Moreover, they go up significantly in the fifth quarter within the low-debt state as shown in the second column of Figure 8, while no significant response was evident in the low-debt state in Figure 2. The response of inflation expectations outside the low-debt state is also somewhat different in the third column of Panel B in Figure 8 as compared to Figure 2. We no longer get a positive response on impact but now get a significant positive response by the seventh quarter.

In the case of interest rate expectations (shown in Panel C), however, the shape of the responses to these purged expenditure shocks is rather different in Figure 8 as compared to the responses to expenditure “shocks” in Figure 2. Outside the low-debt state, this response is now marginally negative on impact in Figure 8 rather than marginally positive on impact in Figure 2, significantly positive by the fifth quarter in Figure 8 rather than significantly negative by the sixth quarter in Figure 2, and finally, the response is now significantly negative by the eighth quarters rather than insignificant in the baseline model shown in Figure 2. Moreover, within the low-debt state, this response is now significantly negative around the fifth quarter in Figure 8, while it was marginally positive in the fourth and fifth quarters in Figure 2.

The shape of the response of consumption intentions (Panel D) to purged expenditure shocks in Figure 8 mostly resembles that in the respective panel of Figure 2. Outside the low-debt state, this is significantly negative on impact and lies below the zero line for quarters one to eight as before, albeit insignificantly so in this case. Within the low-debt state, this response has similar shape to the baseline case shown in the second column of Figure 2, but is now insignificant. Finally, the response of economic policy satisfaction (Panel E) in Figure 8 is again negative on impact as in Figure 2, and remains so up until the seventh quarter.

### **4.3.3 Longer sample including the zero lower bound**

Up to this point we have used data from 1978q1 to 2007q4. This avoids the structural break associated with the beginning of the Great Recession that brought about

a prolonged period of low interest rates at the zero-lower bound. Here, we explore the sensitivity of our results with respect to extending the sample length to 2012q4.<sup>25,26</sup> To construct the policy shocks we use the Federal Funds rate spliced with the Shadow Short rate (SSR) from Krippner (2015) in 2009q1 as the dependent variable in the first-stage regression in place of intended changes in the Federal Funds rate (FFR).<sup>27</sup> What we do here resembles Alpanda and Zubairy (2018), among others, that use a similar approach to extend the Romer and Romer (2004) policy shocks.

To evaluate the effects of monetary and expenditure shocks, we extend regression model 2 taking into account the zero-lower-bound in a way similar to regression model 3. One channel through which the zero-lower bound can affect the transmission of shocks is via the real interest rate and thus via the forward-looking IS curve. That is, when nominal interest rates are constrained by the zero-lower bound, shocks only affect inflation expectations while nominal interest rates remain constant. Since the transmission of shocks could easily be affected (Krugman, 1998; Eggertsson and Woodford, 2003; Eggertsson and Krugman, 2012), we account for the possibility of such a structural break in regression equation 4 below.

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<sup>25</sup>We stop at 2012q4 since green book forecasts needed in order to identify policy shocks in the spirit of Romer and Romer (2004), are published with a delay.

<sup>26</sup>The question eliciting interest rate expectations in the Michigan Survey asks for expectations over borrowing rates which remained well in positive territory during the zero-lower bound period. Hence, while the policy rate remained flat at zero, we do observe variation in borrowing rates and in interest rate expectations in particular. Thus, it should be unproblematic to study consumer interest rate expectations during the zero-lower bound.

<sup>27</sup>The SSR is the shortest maturity rate estimated from a term-structure model that suitably takes account of the discontinuity in nominal interest rates at the zero-lower bound. It is essentially equal to the FFR in conventional monetary policy environments, but can turn negative when the short term nominal interest is bounded by zero as it captures the effects of unconventional monetary policy, say quantitative easing, on longer-maturity interest rates.

$$\begin{aligned}
x_{t+h}^e &= \alpha_h + \beta_h^m R\&R\ shock_t + \beta_h^e expenditures_t + \sum_{\tau=1}^2 \gamma_{h,\tau} x_{t-\tau}^e + \delta'_{\mathbf{h},\tau} \mathbf{X}_{t-\tau} + \\
&F(z_{t-1})(\alpha_h^{state} + \beta_h^{m,state} R\&R\ shock_t + \beta_h^{e,state} expenditures_t + \\
&\sum_{\tau=1}^2 \gamma_{h,\tau}^{state} x_{t-\tau}^e + \delta_{\mathbf{h},\tau}^{state'} \mathbf{X}_{t-\tau}) + I_{t-1}^{ZLB}(\alpha_h^{ZLB} + \beta_h^{m,ZLB} R\&R\ shock_t + \\
&\beta_h^{e,ZLB} expenditures_t + \sum_{\tau=1}^2 \gamma_{h,\tau}^{ZLB} x_{t-\tau}^e + \delta_{\mathbf{h},\tau}^{ZLB'} \mathbf{X}_{t-\tau}) + \kappa_h t + \lambda_h t^2 + \epsilon_{t+h} \quad (4)
\end{aligned}$$

We show the smooth transition function corresponding capturing the state variable  $z_t$  together with the debt-to-GDP ratio in Figure 9. Figures 10 and 11 show the responses of consumer expectations to monetary and expenditure shocks. The responses in consumer expectations are remarkably similar to our baseline estimations. Overall, as in the baseline, we observe more pronounced effects of the shocks outside states of low debt. Qualitatively, the expectations measures react the same way as previously to both government spending and monetary shocks.

Quantitatively and in terms of the dynamics, we observe only minor differences compared to the baseline estimation in the responses to monetary shocks. For example, the positive response of unemployment expectations to the monetary policy shock is no longer strongly significant in the sixth quarter in Figure 11 unlike what we saw in Figure 3. We also observe a less pronounced rebound effect for interest rate expectations outside the low-debt state. That is, following the rise in interest rate expectations in response to an unanticipated interest rate hike, the fall in interest rate expectations that follows is no as deep and is no longer significant between the sixth and eighth quarters in Figure 11 as it had been in Figure 3. Moreover, consumption intentions turn into negative territory with a slight delay compared to the baseline.

## 4.4 Alternative specification of the transition process of the public debt state

The parameterization of the smooth transition process is geared towards tracing out periods during which the economy is outside a low or sustainable, state of public finances. We assume that the US economy is located in such a normal state of healthy public finances most of the time and that periods outside the low debt state are somewhat exceptional. In the baseline specification, we calibrate the parameter that governs the portion of the sample located in the high debt state,  $c$ , to the 66th percentile of the distribution of the backward-looking seven quarter moving average of the debt-to-GDP ratio. To evaluate the robustness of our analysis with respect to this parameter, we also experiment with other calibrations.

Figures 12 and 13 show the responses using a slightly different specification of  $c$ . We calibrate  $c$  with the 75th percentile of the distribution of the backward-looking seven quarter moving average of the debt-to-GDP ratio. The interpretation of our results is not affected by this alternative specification of  $c$ , as the responses virtually do not change.

## 4.5 The impact of fiscal and monetary shocks on uncertainty

While we clearly observe systematic patterns in the responses of the survey measures, we report relatively large confidence intervals of the estimated responses outside low-debt states. One reason that could potentially drive the dispersion, is rising uncertainty among respondents precipitated by fiscal and monetary developments. To evaluate this, we now run regressions with cross-sectional standard deviations of the consumer survey measures as dependent variables. To obtain cross-sectional standard deviations of survey answers we resort to micro-level data. We then use the individuals' answers to each of the survey questions introduced in section 2.1 to compute the cross-sectional standard deviation across individual respondents for each survey question.<sup>28</sup> Figures 14 and 15 show the responses of these second moments of the survey variables to contractionary

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<sup>28</sup>Qualitative answers, e.g. in the case of unemployment expectations 'more', 'about the same', and 'less', are coded as  $[-1, 0, 1]$ .

expenditure shocks and monetary policy shocks respectively.

Looking at the linear model in the first column of Figure 14, we observe that the standard deviations of the survey measures we consider are not strongly affected by fiscal policy shocks. The response of unemployment expectations is significantly negative between the third and seventh quarters, that of inflation expectations significantly negative in the second quarter, and that of interest rate expectations marginally positive in the sixth quarter. The responses for consumption intentions and economic policy satisfaction revolve insignificantly around the zero line.

Turning to the responses associated with low-debt states of the world, we observe in the second column of Figure 14 that the standard deviation is either unaffected or even goes slightly down in response to fiscal policy shocks. The standard deviation of unemployment expectations falls significantly in response to fiscal policy shocks in quarters four to six, and the standard deviation of inflation expectations and interest rate expectations both fall in quarter four. Moreover, consumption intentions fall marginally on impact and economic policy satisfaction increases marginally in quarter four.

The third column of Figure 14 shows responses of second moments of consumer expectations regarding unemployment, inflation and interest rates, as well as consumption intentions and policy satisfaction, outside low-debt states. Strikingly, in this case we observe a pronounced increase in the standard deviation of each of the three expectations measures and consumption intentions, in response to fiscal policy shocks. More precisely, the standard deviation of unemployment expectations responds positively and significantly so in quarters six and eight, while the standard deviation of inflation expectations responds positively on impact and is significantly positive in quarter seven. The response of the standard deviation of interest rate expectations is slightly negative on impact but then tends to increase becoming significantly positive in quarter six. Moreover, the response of the standard deviation of consumption intentions is significantly positive on impact and in the first quarter as well as in quarters five and six. Finally, the standard deviation for economic policy satisfaction in response to fiscal spending shocks falls and is significantly negative in quarters one to four and in quarter seven.

Next we consider the response of the standard deviations of each of the three expectations measures as well as consumption intentions and economic policy satisfaction, to a monetary policy shock. Looking at the linear model in the first column of Figure 15, we observe that the standard deviations of the survey measures we consider are largely unaffected by monetary policy shocks. The response of the standard deviation of unemployment expectations to a monetary policy shock is significantly negative but still very small in quarter one, and the response of the standard deviation of inflation and interest rate expectations is in both cases small in magnitude revolving insignificantly around zero. Moreover, the response of the standard deviation of consumption intentions is small but significantly positive between quarters four and seven, while that of economic policy satisfaction revolves insignificantly around the zero line.

Looking at the responses associated with low-debt states of the world, we observe in the second column of Figure 15 that the standard deviations of the survey measures we consider are once again largely unaffected by monetary policy shocks. The response of the standard deviation of unemployment and interest rate expectations is in both cases small in magnitude revolving insignificantly around zero, while the response of the standard deviation of inflation expectations is significantly positive but still relatively small in quarter three. Moreover, the response of the standard deviation of consumption intentions revolves insignificantly around zero, and that of economic policy satisfaction is significantly negative only in quarter three.

In the third column of Figure 15, we present responses of second moments of consumer expectations regarding unemployment, inflation and interest rates, as well as consumption intentions and policy satisfaction, outside low-debt states. Strikingly, in this case we observe a pronounced increase in the standard deviation of each of the three expectations measures and consumption intentions, in response to monetary policy shocks. The standard deviation of unemployment expectations responds positively and significantly so in quarter seven following an initial drop on impact, while the standard deviation of inflation expectations responds positively and significantly so around quarter five. The response of the standard deviation of interest rate expectations is significantly negative

on impact but then increases and becomes significantly positive in quarter six. Moreover, the response of the standard deviation of consumption intentions is positive and significantly so in quarters five and seven. Finally, the response of the standard deviation for economic policy satisfaction is negative on impact but then rises becoming significantly negative by quarter seven.

Overall, the responses outside low-debt states shown in Figures 14 and 15 indicate that monetary and fiscal policy induce a considerable amount of uncertainty in the expectations' formation process of consumers. This is in line with the notion that monetary and fiscal policy are perceived to affect public debt sustainability more directly in times of relatively high public debt, which in turn makes consumers more uncertain about the future.

## 5 Conclusion

We have set out to understand the state-dependent impact of monetary and fiscal policies on macroeconomic expectations. Based on our findings, consumer expectations' responses are evidently stronger in magnitude outside states of low debt as compared to within such states. By contrast, there is no evident response to these shocks in a linear model without state effects, pointing to the usefulness of the state-dependent methodology adopted here.

As expectations play a key role for how fiscal and monetary policy propagate in the economy, the above finding regarding state-dependence of expectations' responses to shocks, has implications for the type of macro theory models we should be considering as well as for the conduct of fiscal and monetary policy. Our findings are broadly supportive of recent non-standard models of the effects of monetary policy and the determination of inflation, such as the imperfect knowledge theory model of Eusupi and Preston (2018) and the new Keynesian theory model in Leeper and Leith (2016). The latter, for example, implies equilibrium outcomes are the result of interactions between monetary and fiscal policy and that both policies, depending on the state of the economy, play a dual role in determining the inflation rate and in stabilizing government debt. Importantly, our

findings imply it is essential to take state-dependent effects into account in order to trace the response path of consumer expectations to policy shocks.

While responses within a linear model ignoring state-dependent effects are mute, certain striking responses become apparent outside states of low debt. Our results suggest that outside low-debt states, contractionary monetary policy shocks induce pessimistic macroeconomic expectations, consistent with the notion that the burden of debt increasingly drags on macroeconomic outcomes. Notably, outside the low-debt state, unemployment expectations rise significantly in response to contractionary monetary policy shocks, while they fall once in the low-debt state. Furthermore, results obtained for consumer expectations resemble those obtained for experts more closely once the economy is outside the low-debt state, suggesting that high public debt induces consumers to be more attentive to monetary developments. This last result is then in line with the emphasis on rational inattention in theoretical work going back to Sims (2003) over the past decade and a half.

We also find that a rise in expenditures appears to induce consumers to expect a contraction, consistent with the anticipation of negative effects associated with a fiscal consolidation. Notably, the significant fall in consumption intentions in response to higher government spending in times of relatively high debt is in stark contrast with the significant rise in consumption intentions during times of low debt.

Our findings imply that it is crucial to allow for state dependence in assessing the impact of monetary and fiscal policy shocks. In particular, states determined by the level of public debt are consistent with very different impact of policy shocks. Such state-dependent effects, identified here based on the changing levels of public debt for the US over time, are likely to be even more important to consider for economies that exhibit greater heterogeneity in debt levels among them. In this spirit, it would be useful to explore in future work the issue of state-dependence across European Union economies in order to assess state-dependent effects of policy shocks characterizing economies facing strikingly different public debt levels.

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# Figures

Figure 1: State variable

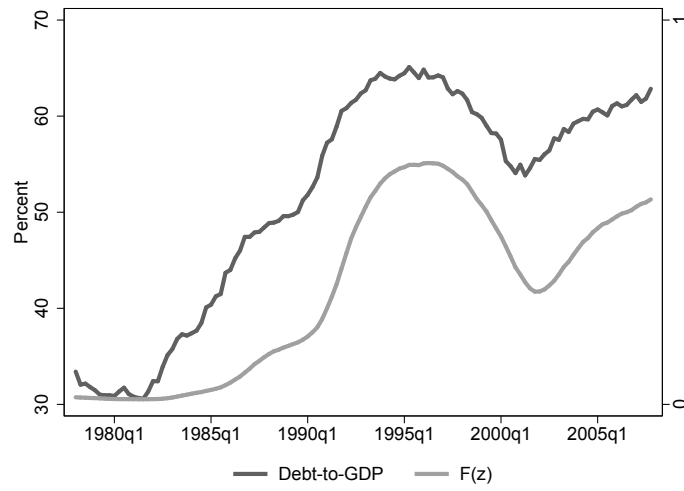
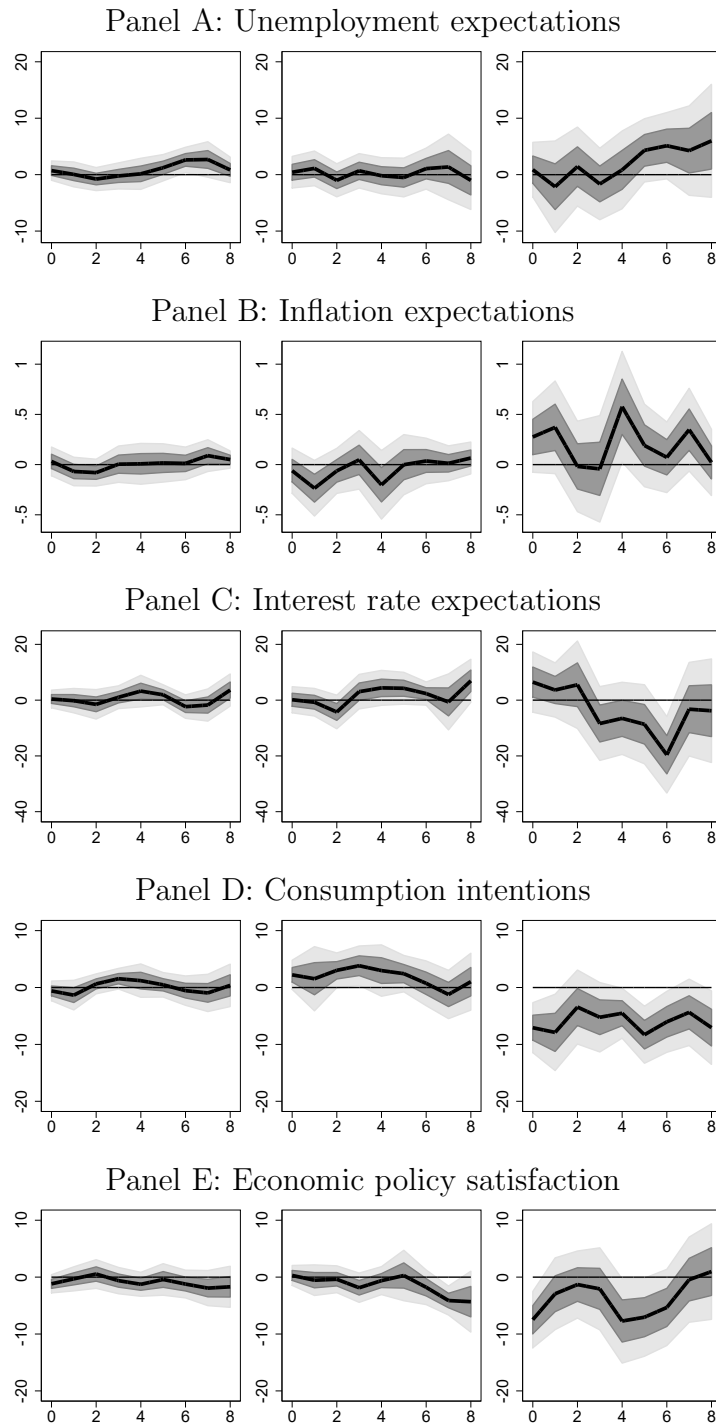
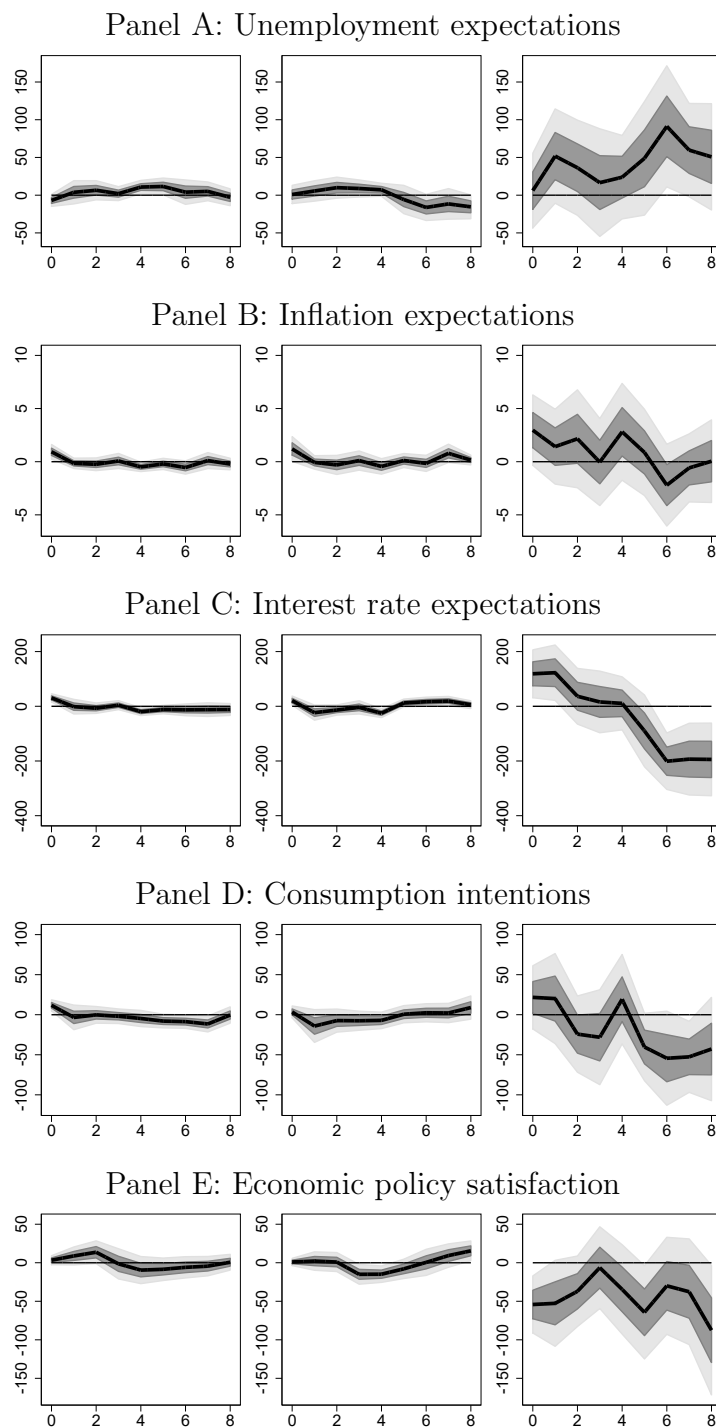


Figure 2: Consumer expectations responses to expenditure shock



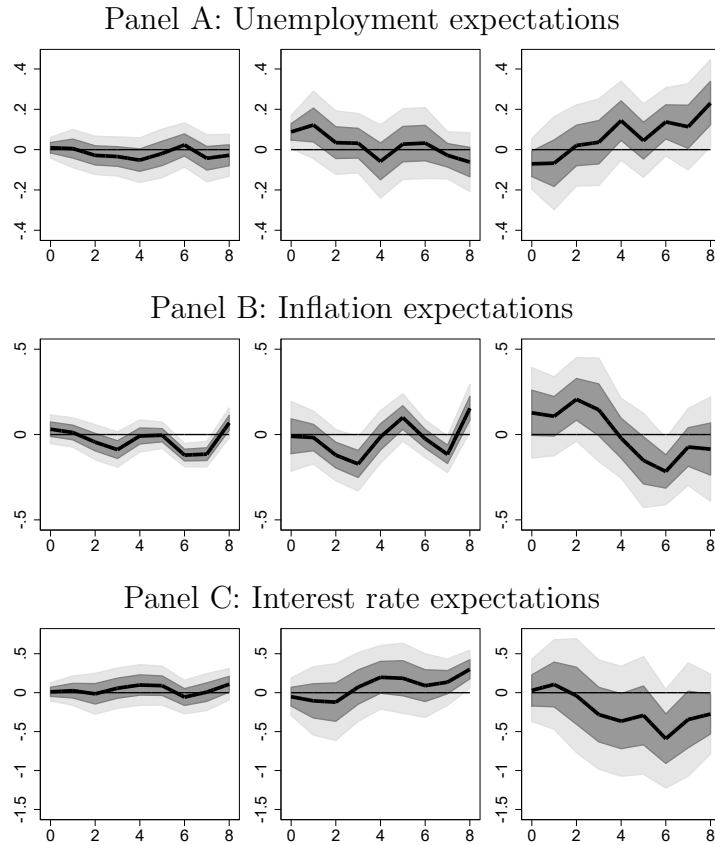
Notes: Inflation expectations are average point estimates in percent, all other survey measures are balance scores. We show responses to contractionary shocks together with one and two standard error bands. The horizontal axes is in quarters. The left column shows responses in the linear model, the middle column responses inside the low-debt state and the right column responses outside the low-debt state.

Figure 3: Consumer expectations responses to monetary policy shock



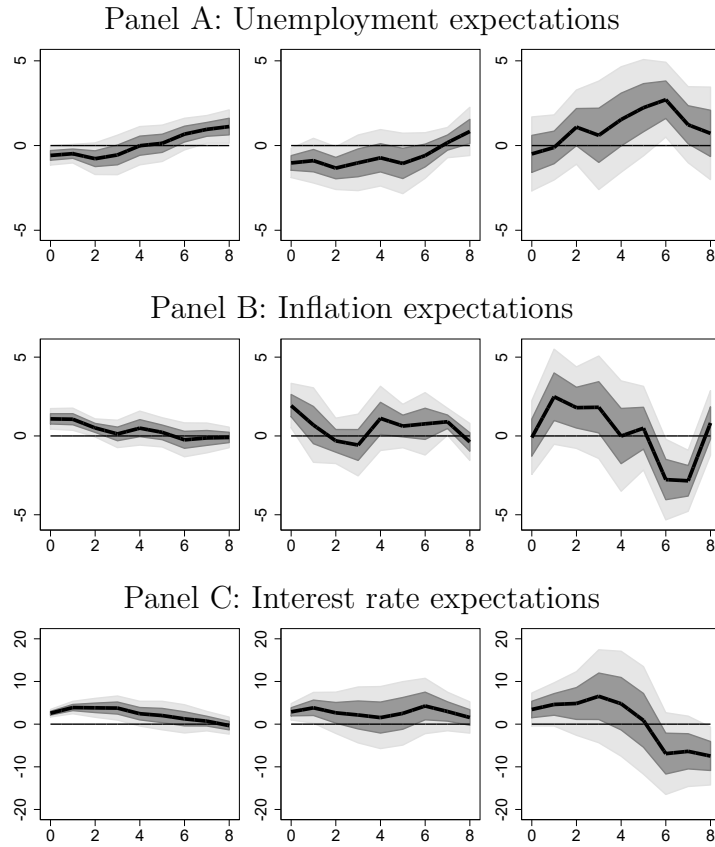
Notes: Inflation expectations are average point estimates in percent, all other survey measures are balance scores. We show responses to contractionary shocks together with one and two standard error bands. The horizontal axes is in quarters. The left column shows responses in the linear model, the middle column responses inside the low-debt state and the right column responses outside the low-debt state.

Figure 4: Expert expectations: expenditure shock



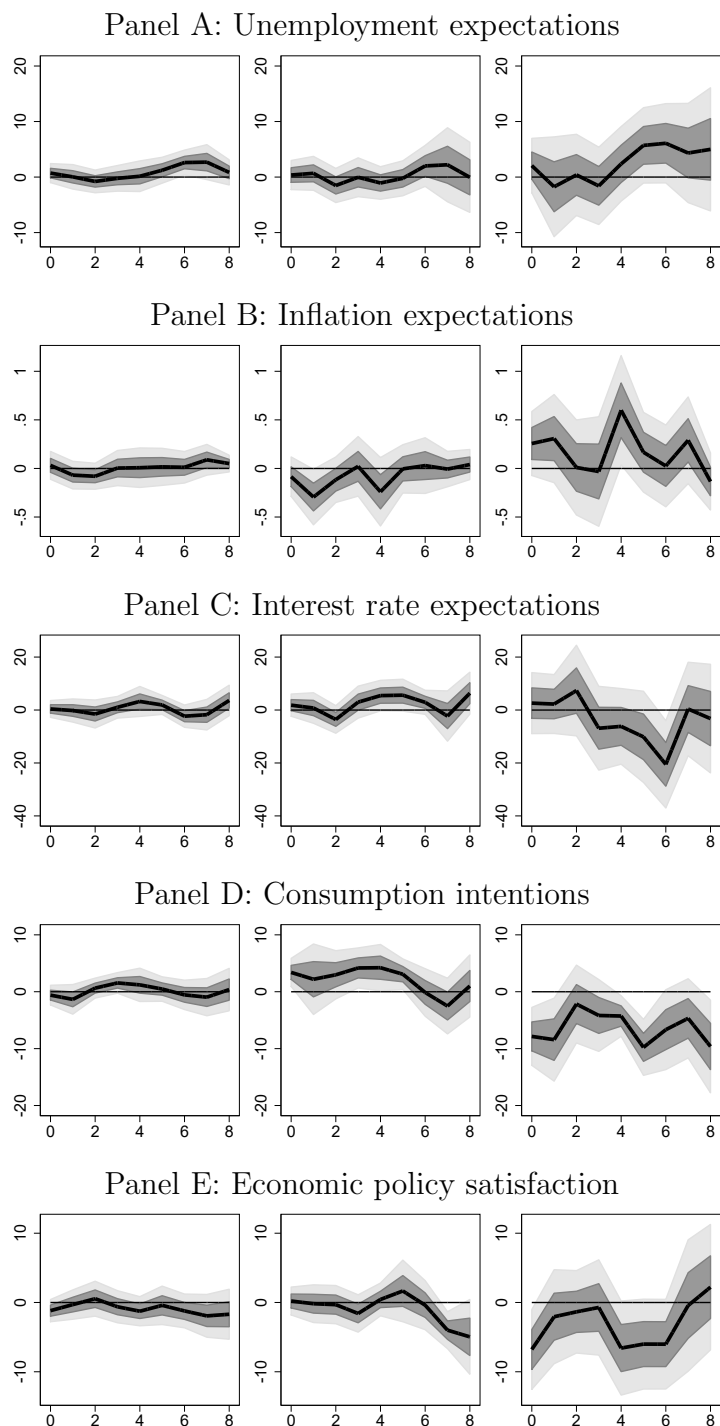
Notes: Expectation measures are average point estimates in percent. We show responses to contractionary shocks together with one and two standard error bands. The horizontal axes is in quarters. The horizontal axes is in quarters. The left column shows responses in the linear model, the middle column responses inside the low-debt state and the right column responses outside the low-debt state.

Figure 5: Expert expectations: monetary policy shock



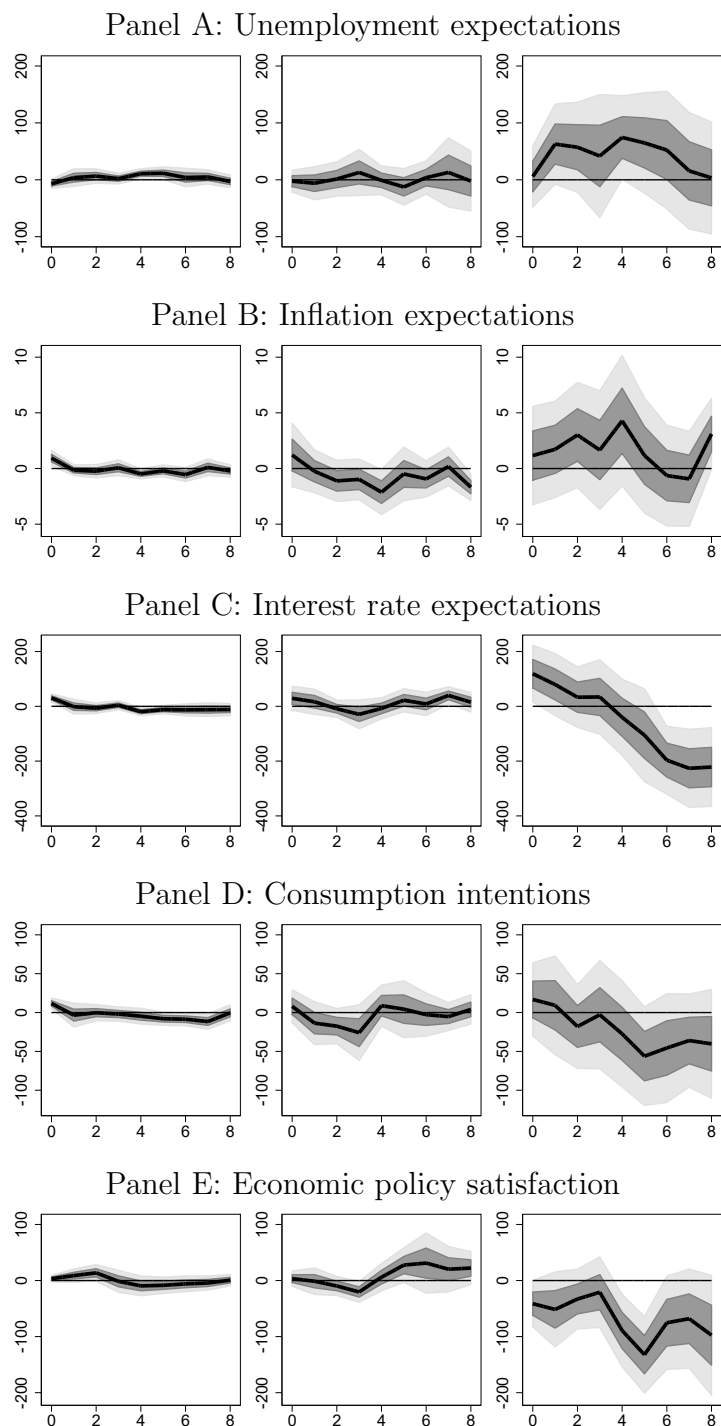
Notes: Expectation measures are average point estimates in percent. We show responses to contractionary shocks together with one and two standard error bands. The horizontal axes is in quarters. The horizontal axes is in quarters. The left column shows responses in the linear model, the middle column responses inside the low-debt state and the right column responses outside the low-debt state.

Figure 6: Consumer expectations responses to expenditure shocks (controlled for state dependency stemming from economic slack)



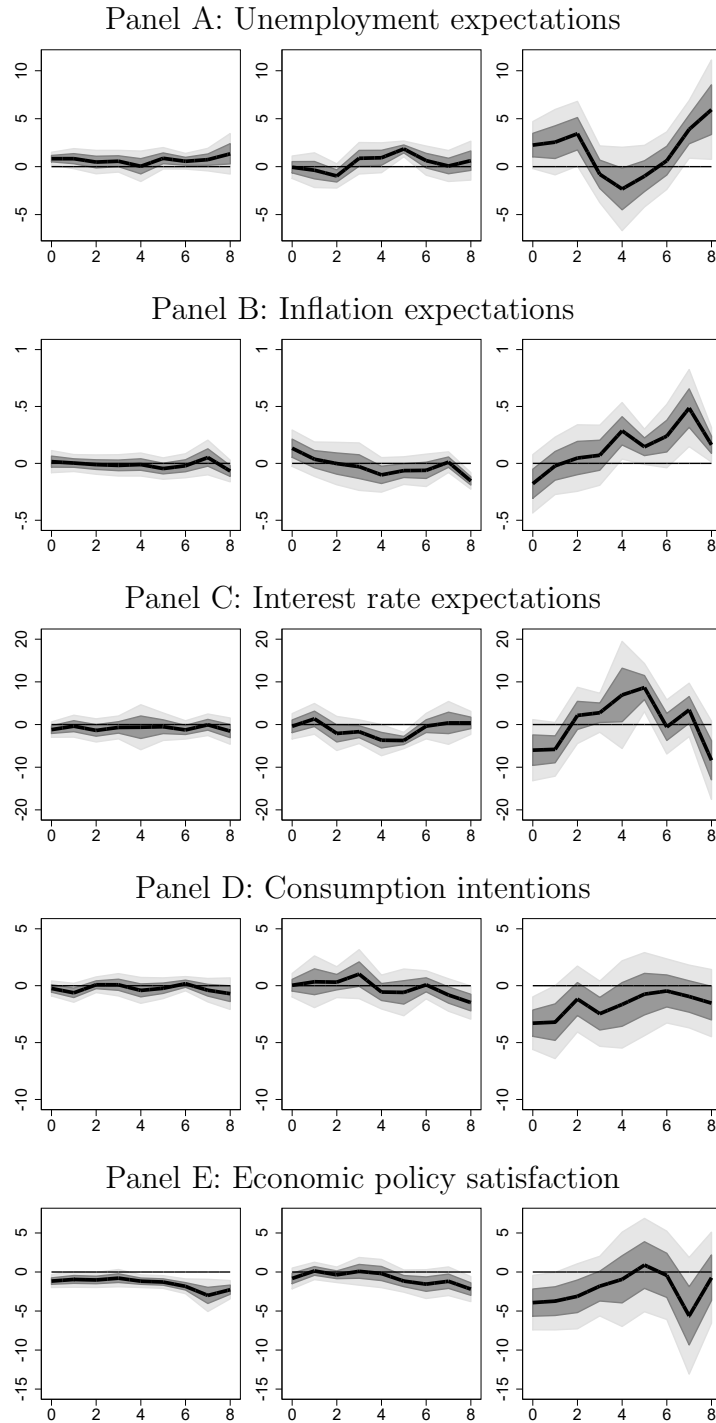
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Figure 7: Consumer expectations responses to monetary policy shocks (controlled for state dependency stemming from economic slack)



Notes: Inflation expectations are average point estimates in percent, all other survey measures are balance scores. We show responses to contractionary shocks together with one and two standard error bands. The horizontal axes is in quarters. The left column shows responses in the linear model, the middle column responses inside the low-debt state and the right column responses outside the low-debt state.

Figure 8: Consumer expectations responses to purged expenditure shocks



Notes: Inflation expectations are average point estimates in percent, all other survey measures are balance scores. We show responses to contractionary shocks together with one and two standard error bands. The horizontal axes is in quarters. The left column shows responses in the linear model, the middle column responses inside the low-debt state and the right column responses outside the low-debt state.

Figure 9: State variable

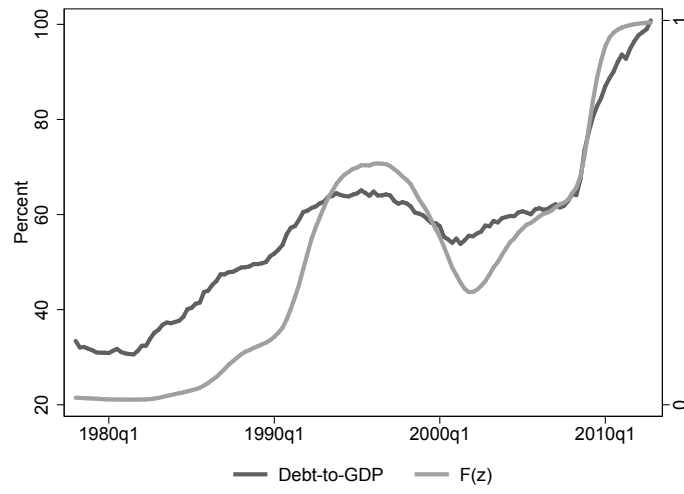
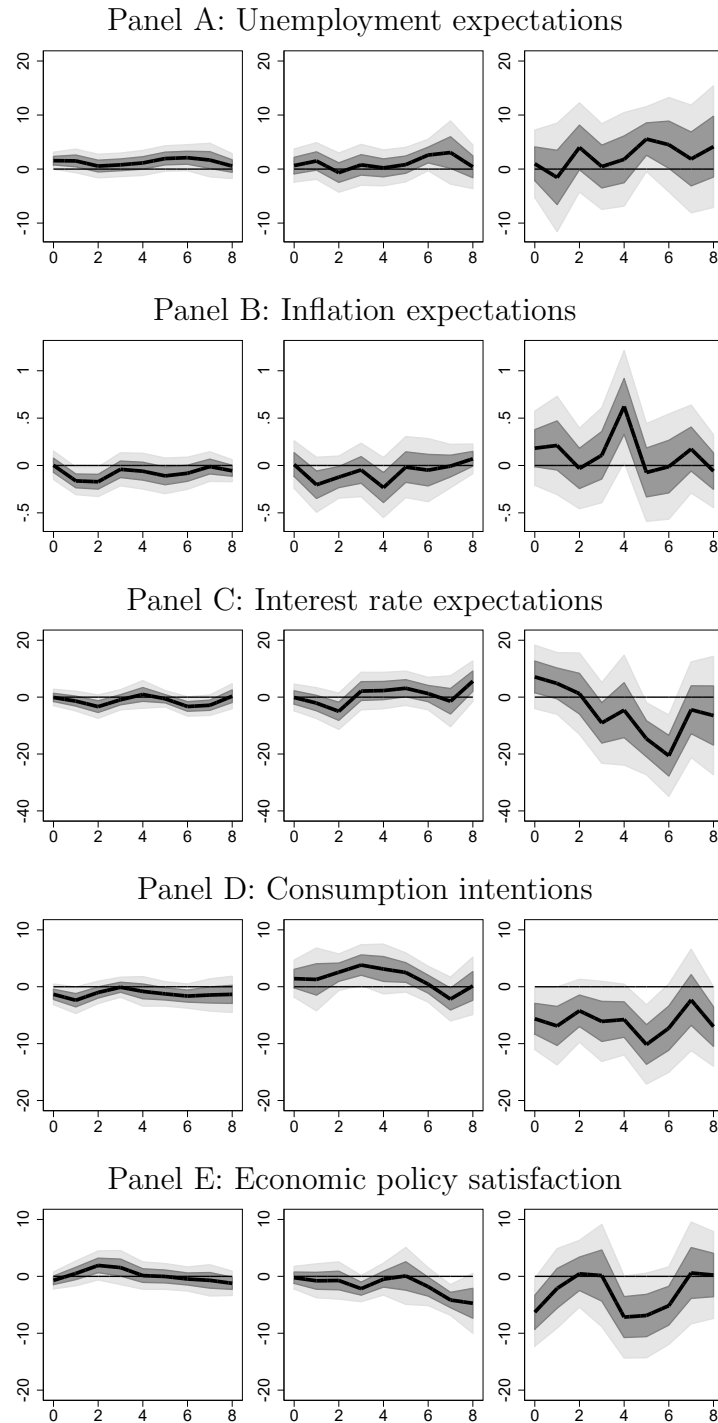
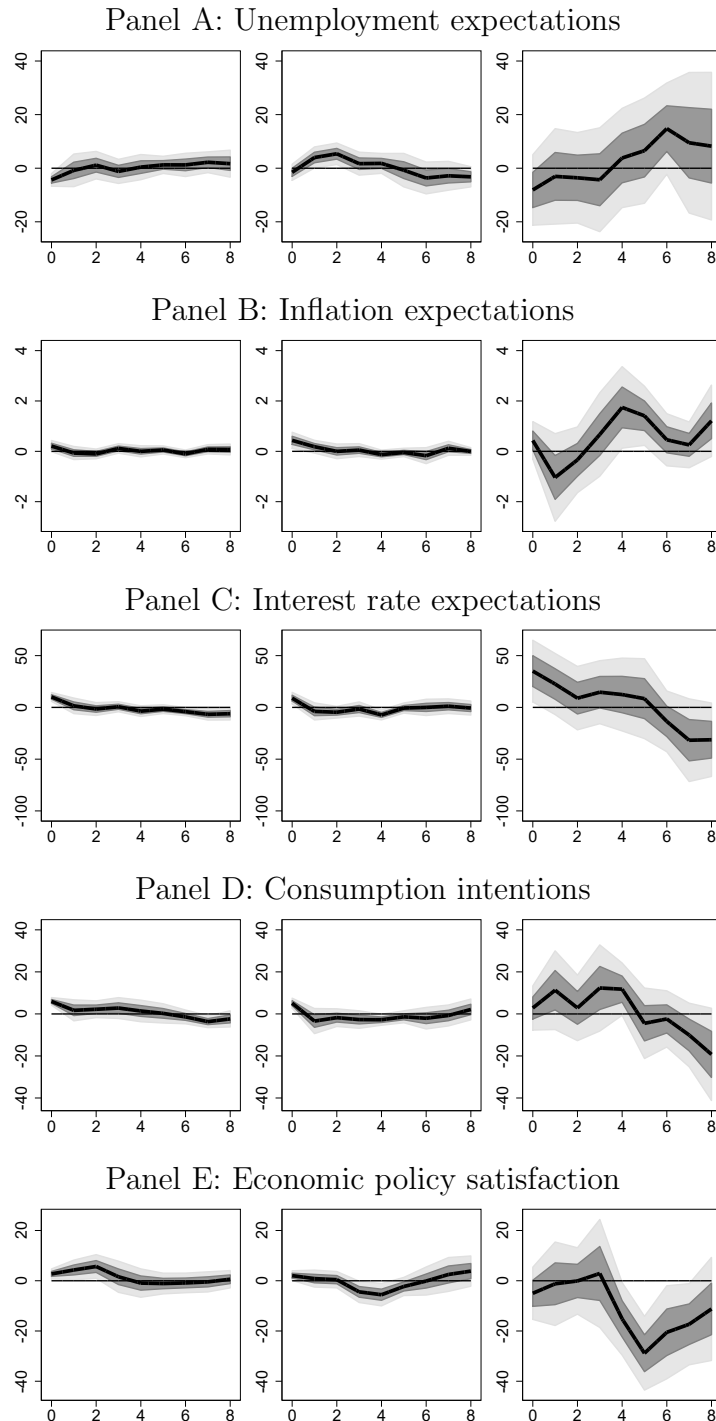


Figure 10: Consumer expectations responses to expenditure shocks (including zero-lower bound period)



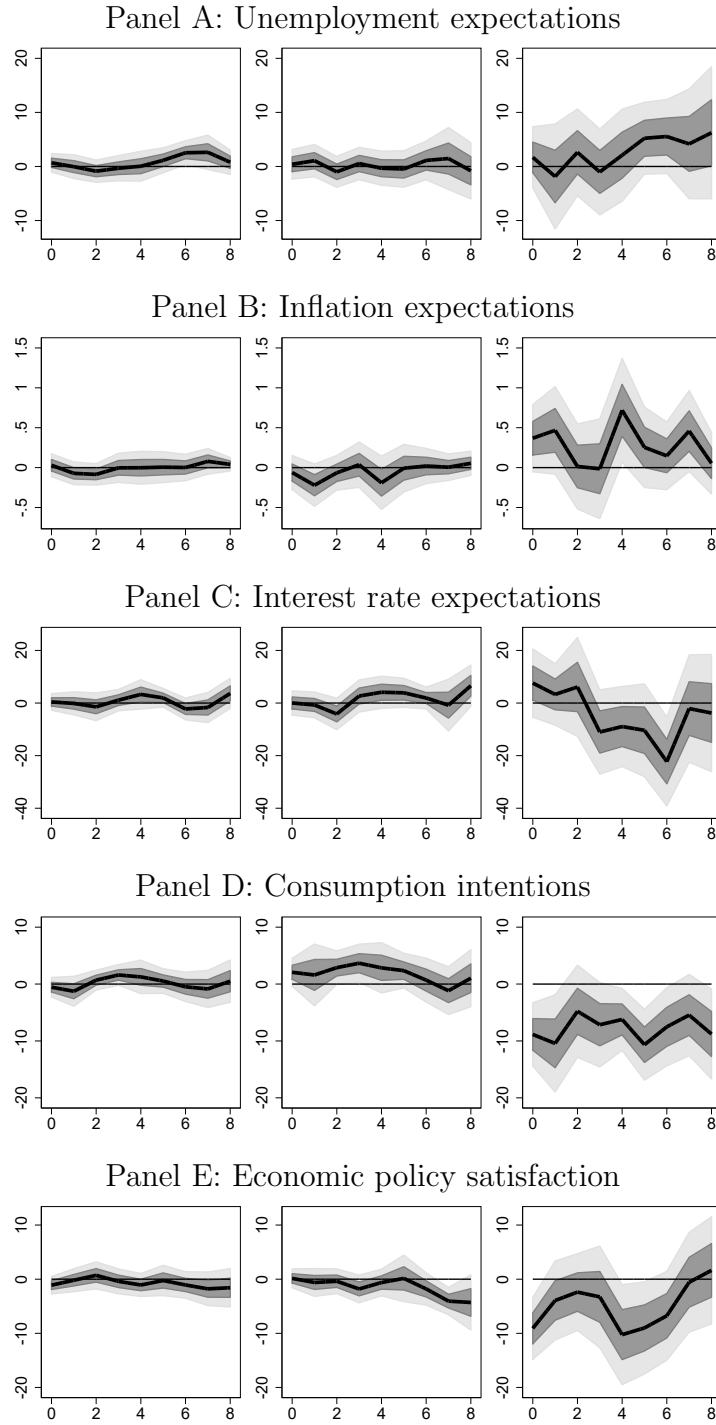
Notes: Inflation expectations are average point estimates in percent, all other survey measures are balance scores. We show responses to contractionary shocks together with one and two standard error bands. The horizontal axes is in quarters. The left column shows responses in the linear model, the middle column responses inside the low-debt state and the right column responses outside the low-debt state.

Figure 11: Consumer expectations responses to monetary policy shocks (including zero-lower bound period)



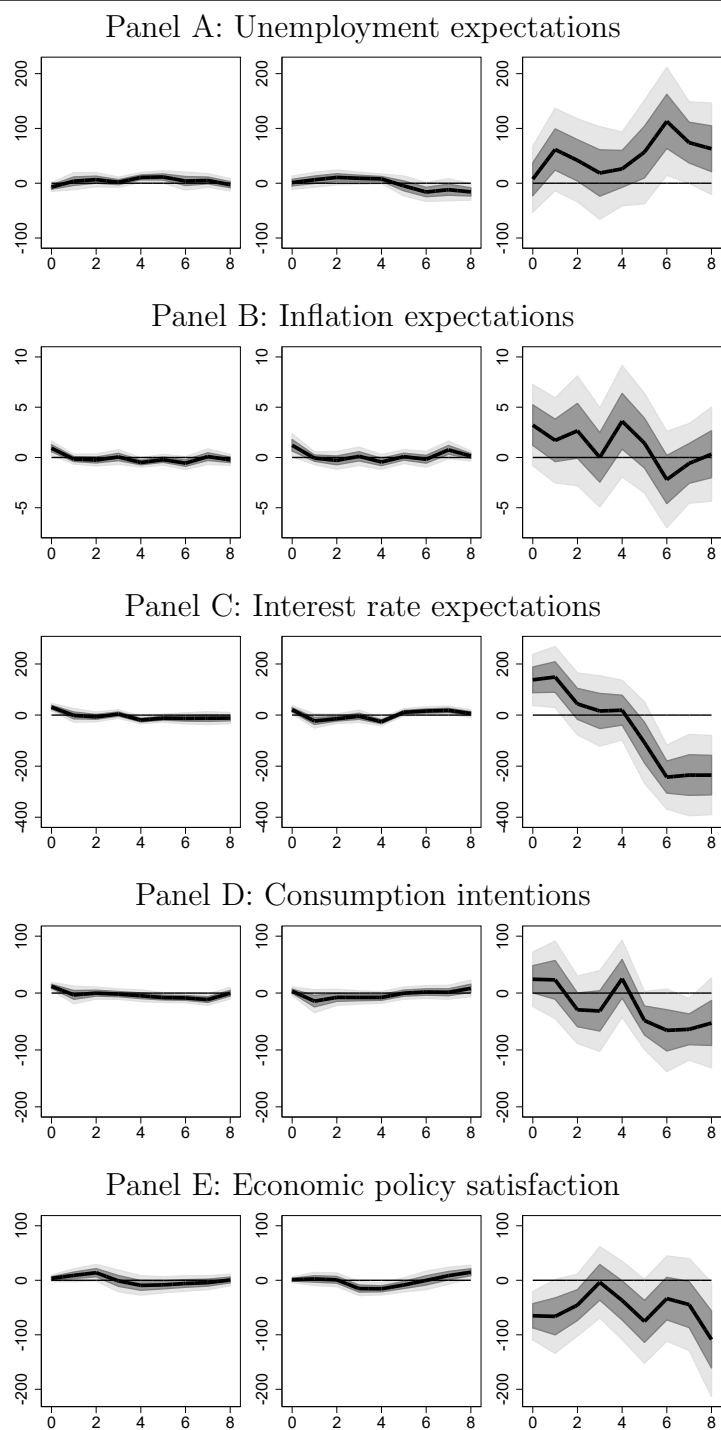
Notes: Inflation expectations are average point estimates in percent, all other survey measures are balance scores. We show responses to contractionary shocks together with one and two standard error bands. The horizontal axes is in quarters. The left column shows responses in the linear model, the middle column responses inside the low-debt state and the right column responses outside the low-debt state.

Figure 12: Consumer expectations responses to expenditure shock (higher cutoff)



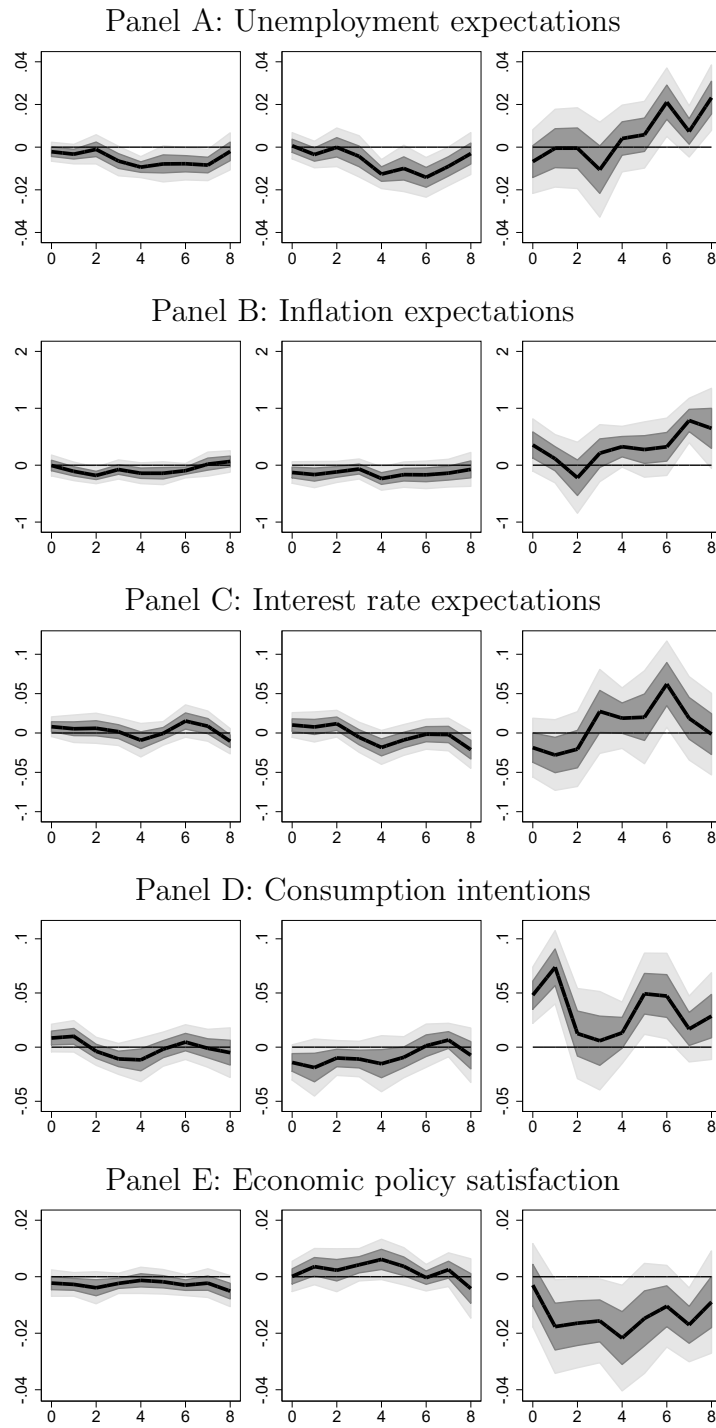
Notes: Inflation expectations are average point estimates in percent, all other survey measures are balance scores. We show responses to contractionary shocks together with one and two standard error bands. The horizontal axes is in quarters. The left column shows responses in the linear model, the middle column responses inside the low-debt state and the right column responses outside the low-debt state.

Figure 13: Consumer expectations responses to monetary policy shock (higher cutoff)



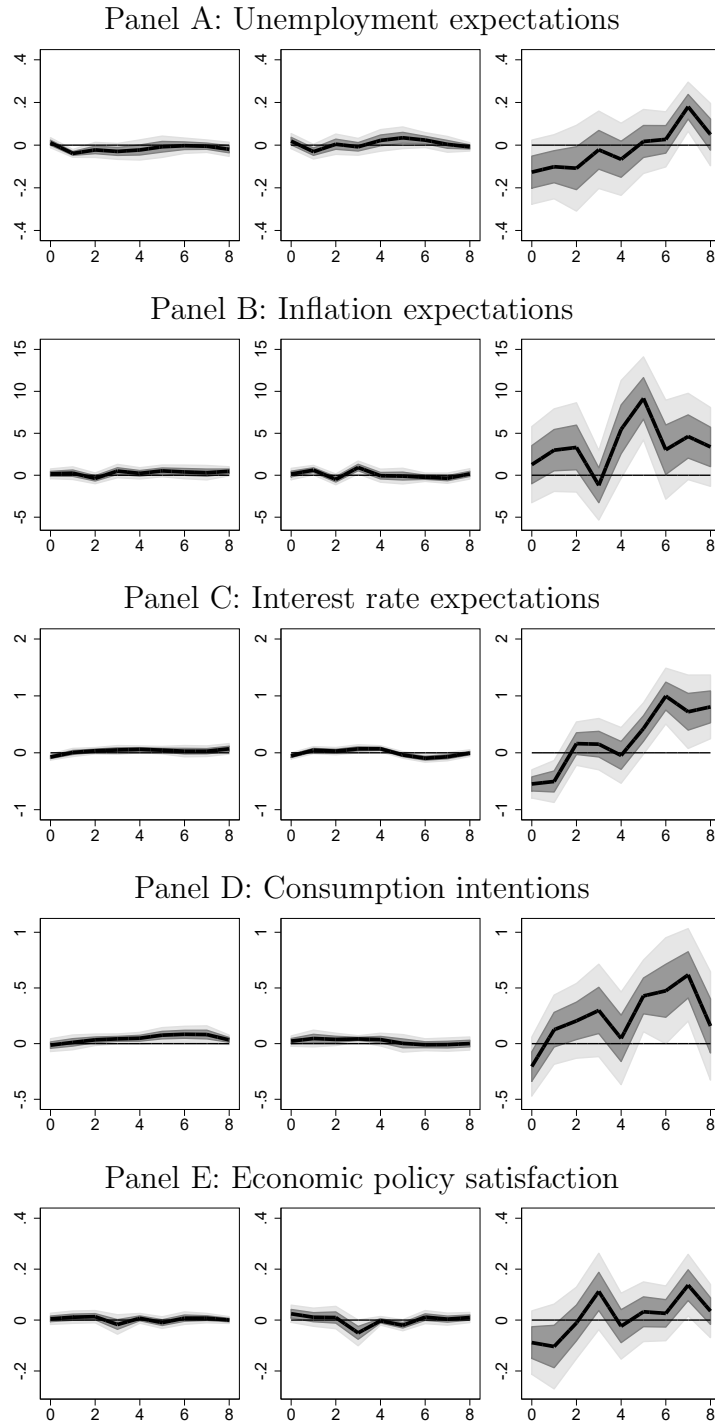
Notes: Inflation expectations are average point estimates in percent, all other survey measures are balance scores. We show responses to contractionary shocks together with one and two standard error bands. The horizontal axes is in quarters. The left column shows responses in the linear model, the middle column responses inside the low-debt state and the right column responses outside the low-debt state.

Figure 14: Responses of standard deviations to expenditure shock



Notes: Inflation expectations are elicited through point estimates, all other survey answers are qualitative and coded as  $[-1, 0, 1]$ . We show responses to contractionary shocks together with one and two standard error bands. The horizontal axes is in quarters. The left column shows responses in the linear model, the middle column responses inside the low-debt state and the right column responses outside the low-debt state.

Figure 15: Responses of standard deviations to monetary policy shock



Notes: Inflation expectations are elicited through point estimates, all other survey answers are qualitative and coded as  $[-1, 0, 1]$ . We show responses to contractionary shocks together with one and two standard error bands. The horizontal axes is in quarters. The left column shows responses in the linear model, the middle column responses inside the low-debt state and the right column responses outside the low-debt state.