

Subjective Models of the Macroeconomy: Evidence From Experts and a Representative Sample*

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Abstract

We propose a method to measure people's subjective models of the macroeconomy. Using a representative sample of the US population and a sample of experts we study how expectations about the unemployment rate and the inflation rate change in response to four different hypothetical exogenous shocks: a monetary policy shock, a government spending shock, a tax shock, and an oil price shock. While expert predictions are mostly quantitatively aligned with standard dynamic stochastic general equilibrium models and vector auto-regression evidence, there is strong heterogeneity in the predictions in the representative panel. While households predict changes in unemployment qualitatively in line with the experts for all four shocks, their predictions of changes in inflation are at odds with those of experts both for the tax shock and the interest rate shock. People's beliefs about the micro mechanisms through which the different macroeconomic shocks are propagated in the economy strongly affect how aligned their predictions are with those of the experts. More educated and older respondents form their expectations more in line with experts, consistent with roles for cognitive limitations and learning over the life-cycle. Our findings inform the validity of central assumptions about the expectation formation process and have important implications for the optimal design of fiscal and monetary policy.

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1 Introduction

A core assumption underlying rational expectations macroeconomic model is that economic agents form expectations about aggregate outcomes that are consistent with the model's equilibrium. For instance, New Keynesian models entail some form of a Phillips Curve, that is, an equilibrium relationship between unemployment and inflation. Households recognize this equilibrium relationship and expect the co-movement of the two variables to be negative in response to demand side shocks, such as government spending shocks, but positive in response to supply side shocks, such as oil price fluctuations. In this paper we study empirically people's beliefs about how inflation and unemployment respond to different types of macroeconomic shocks. Measuring households' beliefs about the co-movement of inflation and unemployment thus allows us to characterize their "subjective models" regarding a pivotal macroeconomic relationship.

Studying households' beliefs about the effects of different aggregate shocks is important for gaining a better understanding of the formation of households' expectations about aggregate unemployment and inflation. Recent evidence indicates that these expectations matter for households' consumption and financial decisions and their labor market behavior, and thereby shape aggregate outcomes (Armona et al., 2018; Bailey et al., 2017b; Conlon et al., 2018; D'Acunto et al., 2018). Understanding households' beliefs about the effects of macroeconomic shocks is also essential for assessing the effects of government and central bank policies, as the effects of such policies depend on households' (possibly consistent) forward-looking expectations of aggregate dynamics. Indeed, some of these policies, such as monetary forward guidance, aim to influence people's behavior primarily by shifting macroeconomic expectations (Coibion et al., 2018b).

Measuring people's beliefs about the co-evolution of unemployment and inflation, i.e. their subjective Phillips curves, poses several challenges. First, tailored surveys are required for the measurement of expectations. Second, measuring updating of inflation expectations in response to information about unemployment, and vice versa, is problematic as people's beliefs about the source of the changed outlook in unemployment or inflation are unrestricted. Since different shocks should result in different co-movements between inflation and unemployment, such an approach does not allow for the identification of the subjective Phillips Curve. Therefore, identification of the subjective Phillips Curve requires an approach in which people's beliefs about the occurrence of shocks are

manipulated.

We propose an approach to measure beliefs about the effects of different macroeconomic shocks among both a representative sample of the US population as well as a set of leading experts, economists from universities and policy institutions. We use hypothetical vignettes in which we ask our respondents to predict future unemployment and inflation under different hypothetical macroeconomic shocks. Our approach allows us to fix people’s beliefs about the source of the shock and to make sure that our respondents understand that the shocks are truly exogenous. Our approach allows us to identify changes in expectations, by taking differences across the different scenarios for the shock variable. It therefore enables us to difference out idiosyncratic individual level expectations about the levels of unemployment and inflation. We focus on four different exogenous shocks which are among the most commonly studied in standard DSGE models: an oil price shock, a monetary policy shock, a government spending shock, as well as a tax shock.

For each vignette, the baseline scenario elicits the respondents’ expectations about the unemployment rate and the inflation rate under the assumption that the shock variable of interest will not change over the next 12 months. Then our respondents are randomly assigned to either a “rise-scenario” or a “fall-scenario”. In the “rise-scenario” the shock variable of interest increases relative to the baseline scenario. For example, people are told that the oil price will be \$30 higher over the next 12 months or people are told that tax rates increase by 1 percentage point. In the “fall-scenario” the shock variable of interest decreases relative to the baseline scenario. For example, people are told that the oil price will be \$30 lower over the next 12 months or people are told that tax rates decrease by 1 percentage point.

We first present the predictions from the experts. The expert predictions serve several distinct purposes: First, they allow us to shed light on experts’ beliefs about the response of the US economy to different shocks, and to quantify both average and disagreement of predicted responses of unemployment and inflation. Second, the expert predictions allow us to benchmark the estimates of the respondents of the representative online panel. Experts think that both inflation and unemployment positively respond to an increase in oil prices. They expect that unemployment falls with increases in government spending, while inflation increases. Furthermore, the experts forecast that unemployment

responds positively to changes in taxes, while inflation responds negatively. Finally, our experts think that inflation drops in response to interest rate hikes, while unemployment increases. The experts' forecasts are all precisely estimated and both qualitatively and quantitatively consistent with predictions from standard DSGE models and empirical evidence from vector autoregressions. Moreover, there is relatively little disagreement among experts.

We next compare the expert predictions to those of respondents from the representative online panel. Respondents from the online panel hold very similar expectations to the experts in the oil vignette, both for unemployment and inflation. While households think that inflation positively responds to changes in government spending, they do not on average think that unemployment significantly responds to changes in government spending. The most striking deviations from expert forecasts are that consumers think that increases in the federal funds target rate will increase inflation and that a rise in income tax rates will increase inflation. Across the vignettes, households' predictions about the unemployment rate are always qualitatively aligned with those of experts, while households have more difficulty in predicting the reaction of inflation to shocks. There is substantially more disagreement among consumers than among experts. More generally, households' expectations exhibit a high degree of non-linearity: they many times expect positive and negative shocks to have asymmetric effects on inflation and unemployment, while experts think that positive and negative effects have rather symmetric effects.

We use a tailored set of mechanism questions to study the beliefs of respondents in the representative online panel about micro-mechanisms through which macroeconomic shocks are propagated. We show that these beliefs have strong predictive power for whether respondents' predictions in the vignettes are more accurate, i.e. whether they are qualitatively aligned with those of experts. Furthermore, we examine which demographics correlate with the accuracy of predictions. We find that more educated and older respondents form their expectations more in line with experts, consistent with roles for cognitive limitations and learning over the life-cycle. While incentives moderately increase the accuracy of inflation predictions, they do not on average affect unemployment predictions. Finally, people's self-reported confidence does not affect the accuracy of their predictions.

We contribute to a growing literature studying how people's macroeconomic expect-

tations are formed (Bordalo et al., 2018a,b; Coibion and Gorodnichenko, 2012, 2015a,b; Fuster et al., 2012, 2010; Mankiw et al., 2003; Manski, 2017; Tortorice, 2012). Our paper is related to Carvalho and Nechio (2014), Dräger et al. (2016) and Kuchler and Zafar (2018) who use observational data to examine how households' beliefs about unemployment, inflation and interest rates are correlated with each other. We provide the first direct, causal evidence on people's beliefs about the effects of different macroeconomic shocks on inflation and unemployment.

Another part of this literature has relied on survey experiments to study how individuals respond to the provision of information in the context of expectations about inflation (Armantier et al., 2016, 2015; Binder and Rodrigue, 2018; Cavallo et al., 2017; Coibion et al., 2019, 2018a), house prices (Armona et al., 2018; Fuster et al., 2019) and aggregate economic growth (Roth and Wohlfart, 2019). Other papers have shown that people's macroeconomic expectations are affected by their socioeconomic status (Das et al., 2017), by their personal experiences (Goldfayn-Frank and Wohlfart, 2018; Kuchler and Zafar, 2018; Malmendier and Nagel, 2011, 2016), by social interactions (Bailey et al., 2017a,b) and by their political affiliation (Mian et al., 2017).

Our findings are related to recent work by D'Acunto et al. (2019c), D'Acunto et al. (2019a) and D'Acunto et al. (2019b) who document that individuals with lower IQ display larger biases in their inflation expectations and do not take into account their inflation expectations in their consumption decisions. Roth and Wohlfart (2019) show that learning from professional forecasts about economic growth is less in line with the Bayesian benchmark for individuals with lower education. Armantier et al. (2019) find that older, more educated, more numerate and higher-income respondents more strongly anticipate the mean reversion in local gas prices. We find that households hold substantial biases in beliefs about the effects of macroeconomic shocks, and these biases are particularly pronounced for respondents with lower education. These findings lend support to macroeconomic models with behavioral agents (Gabaix, 2016). For instance, Farhi and Werning (2017) introduce bounded rationality in households' expectation formation, which mitigates the effect of monetary policy in an empirically consistent way.

Our paper methodologically contributes to the literature on macroeconomic expectation formation: we propose the use of hypothetical vignettes to characterize people's subjective beliefs about the co-movement of unemployment and inflation in response to

different macroeconomic shocks. A series of recent papers uses hypothetical vignettes to study belief formation and behavior in contexts that are hard to study in a real-world setting, for instance in the area of education and human capital (Attanasio et al., 2019; Delavande and Zafar, 2018; Wiswall and Zafar, 2017) and recently also for the study of the consumption response to changes in current or expected future economic resources (Christelis et al., 2017; Fuster et al., 2018). We contribute to the literature by applying this approach to the study of households' expectation formation about unemployment and inflation to commonly modelled shocks. We test for the relevance of incentivizing the predictions in the vignettes leveraging expert responses as an external benchmark. We find that incentives only moderately affect the accuracy of predictions, which lends support to the use of hypothetical vignettes more generally.

Finally, our evidence on the predictions from experts and the representative sample contributes to a literature studying differences in forecasts among experts and the general population (DellaVigna and Pope, 2018a,c) and the accuracy of forecasts of economic experts more generally (Camerer et al., 2018; Casey et al., 2018; DellaVigna and Pope, 2018b).

The rest of this paper is structured as follows. Section 2 provides an overview of the samples of households and experts and the survey design. In section 3 we present the benchmark evidence from standard DSGE models and VARs and compare those to experts' and households' predictions in the different vignettes. In section 4 we discuss the implications of our findings for macroeconomic modeling and policymaking. Section 5 concludes.

2 Data and Design

2.1 Samples

Representative Sample We collected a sample of 1,085 respondents that is representative of the US population in terms of education, gender, age, region and total household income in collaboration with the market research company "Research Now SSI" which is commonly used in social science research (de Quidt et al., 2018; Enke, 2017). The data were collected in February and March 2019.

Expert Sample We recruited a sample of leading economists working on macroeconomics. We invited economists who were co-authors or discussants in at least one of a series of leading conferences on macroeconomics, including the NBER annual macroeconomics conferences, the Cowles foundation conference on macroeconomics and several conferences at the SITE summer workshops.¹ In addition, we invited experts from several policy institutions and several experts in the areas of forecasting and macroeconomics more generally that we had identified. In total 179 experts completed our survey. As for the representative sample we collected all data for the expert survey in February and March 2019.

2.2 Experimental Design

2.2.1 Structure of design

Representative sample Our survey with the representative sample proceeds as follows: first, our respondents complete a series of demographic questions. Then, they make predictions about unemployment and inflation for two hypothetical vignettes. Subsequently, we measure our respondents' beliefs about how macroeconomic shocks are propagated in the economy. Before beginning the survey, we provide respondents with brief non-technical definitions of the unemployment rate and the inflation rate. Although it is unlikely that respondents have not heard of either term, it is likely that some do not have a clear idea of their meaning. It is therefore important to establish a common-ground definition of the two terms at the start.

Expert survey In the expert survey, we merely measure the respondents' predictions in two randomly selected vignettes.

2.3 Hypothetical vignettes

To measure our respondents' beliefs about the effects of different macroeconomic shocks we use hypothetical vignettes in which we ask our respondents to predict future unemployment and inflation under different scenarios. Our approach allows us to fix people's beliefs about the source of the shock and to ensure that our respondents understand

¹For details on all conferences considered by us, see Appendix D.

that the shocks are truly exogenous. We focus on four different exogenous shocks which are among the most commonly studied in standard DSGE models: an oil price shock, a monetary policy shock, a government spending shock and a tax shock.

Our participants are randomly assigned to make predictions for two out of four different hypothetical vignettes, each corresponding to one of the four different shocks. Each vignette follows the same structure. In the baseline scenario, we elicit people’s expectations about the unemployment rate in 12 months from now and the inflation rate over the next 12 months under the assumption that the shock variable of interest will remain unchanged over the next 12 months.² Our respondents are then randomly assigned to either a “rise-scenario” or a “fall-scenario” in which they predict the unemployment rate in 12 months from now and the inflation rate over the next 12 months in this hypothetical scenario. In the “rise-scenario” the shock variable of interest increases compared to the baseline scenario. In the “fall-scenario” the shock variable of interest decreases relative to the baseline scenario. In what follows, we provide details on the exact hypothetical scenarios employed in all of the four different vignettes.

Oil price shock In the baseline scenario our respondents are told to imagine that the average price of crude oil stays constant over the next 12 months. That is, on average, the price of oil over the next 12 months will be the same as the current price.

Thereafter, they are either randomly assigned to an “oil price rise scenario” or an “oil price fall scenario”. Specifically, respondents in the “oil price increase scenario” receive the following instructions:

Imagine the average price of crude oil unexpectedly rises due to problems with the local production technology in the Middle East. On average, the price will be \$30 higher for the next 12 months than the current price. That is, the price will be on average \$84 for the next 12 months.

Government spending shock In the baseline scenario our respondents are told to imagine federal government spending grows as usual over the next 12 months. That is, it grows at a rate that equals the usual growth that took place in the previous years. In

²To account for potential order effects, we cross-randomize across respondents whether they first receive the questions on the inflation rate or whether they first receive the questions on the unemployment rate. For each participant the order of the inflation and unemployment questions is fixed.

the “rise- scenario” our respondents receive the following instructions:

Imagine federal government spending unexpectedly grows to a larger extent than usual over the next 12 months due to a newly announced spending program on defense. In particular, it grows by 2.4 percentage points more than the usual growth that took place in the previous years.

The government announces: The change is temporary and occurs despite no changes in the government’s assessment of national security or economic conditions. Moreover, federal taxes do not change in response to the spending cut.

Monetary policy shock In the neutral scenario we tell our respondents to imagine that the federal funds target rate stays constant. That is, in its next meeting, the Federal Open Market Committee announces that it will keep the rate constant. In the “fall-scenario” our respondents receive the following instructions:

Imagine the federal funds target rate is unexpectedly 0.5 percentage points lower. That is, in its next meeting, the Federal Open Market Committee announces that it is reducing the rate from 2.5% to 2%.

Imagine the committee announces it does so with no changes in their assessment of the economic conditions.

Tax shock In the neutral scenario we tell our respondents to imagine that income tax rates stay constant for all US citizens over the next 12 months. In the “rise-scenario” our respondents receive the following instructions:

Imagine that income tax rates are 1 percentage point higher for all US citizens over the next 12 months. This means that the typical US household would pay about \$400 more in taxes.

The government announces: The tax change is temporary and occurs despite no changes in the government’s assessment of the economic conditions. Moreover, government spending does not change in response to the tax increase.

Measuring confidence After each vignette respondents are asked how confident they are in their predictions for the inflation rate and how confident they are in their predictions for the unemployment rate respectively on a five-point scale, ranging from “Not confident at all” to “Very Confident”.

Incentives for vignettes To examine the role of effort and attention when responding to the hypothetical vignettes, we provide a random subset of respondents in the representative sample with monetary incentives. This should increase people’s effort and the attention they pay to answering the vignettes. Specifically, before answering the questions from the hypothetical vignettes, 50 percent of our respondents are told that we have asked economic experts the same questions they will be asked and that those experts have provided their best predictions of the most likely development of both variables in the different scenarios. Our respondents are then told that one randomly selected question will be compared to the experts’ responses and that if their response is at most 0.2 percentage points away from the average response of the experts, they earn an additional \$0.50.

2.4 Discussion of the design

Main design features Identifying people’s beliefs about the co-evolution of unemployment and inflation poses several challenges. First, tailored surveys are required for the measurement of expectations. Second, measuring updating of inflation expectations in response to information about unemployment is problematic as people’s beliefs about the source of the changed outlook in unemployment are unrestricted. Since different shocks should result in different co-movements between inflation and unemployment, such an approach does not allow for the identification of subjective models. Therefore, identification of the subjective Phillips Curve requires an approach in which people’s beliefs about the occurrence of shocks are manipulated.

There are several noteworthy design features of our vignettes: First, we elicit our respondents’ expectations about unemployment and inflation using sliders. We inform them that the default positions of the sliders are the current levels of these rates. This allows us to hold constant information about the current state of the economy across respondents to some extent. Second, our approach allows us to measure changes in

expectations by taking differences across the different scenarios for the shock variable. It thereby allows us to difference out idiosyncratic individual level expectations about the levels of unemployment and inflation. Third, since we work with a general population sample we needed to trade off the precision of the vignette with the ease of understanding it. To avoid cognitive overload among the general population sample, we designed the vignettes to make them as simple to understand as possible. Fourth, we designed the vignettes to make it as clear as possible that the shocks are exogenous to the economy. For instance, we attribute the oil price shock to changes in the production technology in the Middle East, and in the interest rate scenario we explicitly state that the change in interest rates occurs with no changes in the Fed’s assessment of economic conditions. Fifth, we also fix people’s beliefs about the duration of the shocks by clarifying that the changes in taxation and government spending only last for one year. Sixth, many of our design choices are motivated by common modeling assumptions in DSGE models and by empirical evidence from VARs in order to ensure that our survey responses can be compared to these external benchmarks. For example, empirical evidence on government spending shocks often focuses on defense spending as this type of spending does not affect the economy’s productivity and does not directly redistribute resources across the income distribution. Finally, for the government spending and taxation shocks, we make it clear that the temporary nature of the shock is common knowledge by using the wording “the government announces”.

2.5 Mechanisms

In order to understand the sources of heterogeneity in updating of inflation and unemployment expectations in response to the different shocks, we measure beliefs of respondents in the representative sample about micro mechanisms through which aggregate macroeconomic shocks are propagated. We elicit people’s beliefs about the sign of the relationship of the macroeconomic shocks and a series of intermediary variables that – according to economic theory – are important propagation mechanisms. We focus primarily on questions for which there is agreement on the sign of the relationship in the economics profession, which provides us with a benchmark of what the correct answer is. We cross-randomize 50 percent of our respondents to receive a bonus payment of \$0.50 if a randomly selected question is answered correctly.

Vignette-specific mechanisms We ask questions that specifically aim to measure beliefs about the propagation mechanisms that are specific to each vignette. For example, to shed light on the reasoning behind the oil price scenario we ask our respondents how firms’ production costs usually react if the oil price increases and how households’ capacity to purchase products usually reacts if the oil price increases. For each of the questions we offer three answer categories: “it increases”; “it decreases”; “none of the above”. Related to the interest rate scenario respondents answer questions on how the financing costs of firms (i.e. the costs of borrowing money) usually react if the federal funds target rate increases and on how the interest rates that households earn on savings or pay on loans usually react if the federal funds target rate increases. To understand the mechanisms behind the tax shock, people are asked: “How does households’ capacity to purchase products (purchasing power) usually react if income tax rates increase?”

General mechanisms On top of the specific questions relating to the shocks in the vignette, we also ask a set of more general questions which are supposed to measure people’s beliefs about how shocks are propagated in the economy. For example, people are asked questions on how the unemployment rate and the inflation rate usually react if firms are willing to supply more products and/or also willing to sell at lower prices. Moreover, people are asked questions on how the unemployment rate and the inflation rate usually react if households, firms, or the government are willing to buy more products and/or also willing to buy at higher prices.

Financial literacy To examine the determinants of macroeconomic expectations we also ask three standard questions measuring our respondents’ financial literacy (Lusardi and Mitchell, 2014).

2.6 Data

Representative panel Table A1 provides summary statistics for our sample, and compares our sample to the general population using data from the 2017 American Community Survey (ACS). Our sample matches the distributions of education, gender, age, region and total household income very closely. 54 percent of our respondents are female, compared to 51 percent in the ACS. The average age in our sample is 49.8, while it is 47.4 in

the ACS. 33 percent of the respondents in our sample have at least a bachelor’s degree compared to 30 percent in the ACS. Median income in our sample is \$62,500 compared to 65,700 in the ACS.

Expert sample We collect demographic data on the 179 experts directly from their CVs³, as displayed in Table A2. 65 percent of the experts are from academic institutions, and 35 percent are from policy institutions, such as international financial institutions and central banks. 82 percent of our experts are male. 15 percent of our respondents are Assistant Professor, 7 percent are Associate Professor, 16 percent of them are Full Professor, while 15 percent are PhD students. Most of the experts identify “macroeconomics” as their main field of interest.

3 Results

3.1 Benchmarks for empirical and DSGE literature

To assess the respondents’ expectations we compile a set of quantitative benchmarks from the theoretical and empirical literatures on each shock. To this aim, we consult the papers that are considered to be seminal works or conventional results on the topic. We additionally undertake several steps and follow a set of assumptions to achieve as much comparability as possible between the literature and the survey vignettes. In this section, we discuss the sources we use to obtain the benchmarks and briefly outline the steps we undertake to make them comparable. The details of each set of calculations is contained in the appendix. Table 1 reports the benchmark changes for the unemployment rate and inflation from the theoretical and empirical literature.

General considerations For each shock, we render the multipliers implied by the literature comparable with the vignettes. To do so, we first calculate the size the shocks on impact in the first quarter from the papers relative to those in the vignettes. We then rescale the responses of output and inflation until quarter 4 accordingly. As most papers focus on output as the main variable of real activity, we translate the responses into changes in the unemployment rate using Okun’s Law. Based on recent work by

³For respondents from PhD programs and policy institutions we asked a few questions on demographics at the end of the survey.

Ball et al. (2017), we choose a coefficient of -0.4 for the relationship between output and unemployment fluctuations at yearly frequency, implying that a 1% fall in output is on average associated with a 0.4 percentage point increase in the unemployment rate. For the theoretical benchmarks, when possible we consider as an immediate benchmark the most comparable shock in a model that is widely accepted as a standard medium-size New Keynesian DSGE model. Our main choice thus is Smets and Wouters (2007) and its extension to unemployment dynamics in Galí et al. (2011).

Oil price As pointed out by Hamilton (2008), there is large uncertainty over estimates of the relationship between international oil price fluctuations and the US macroeconomy. Moreover, this relationship has evolved over time. For the empirical literature on oil prices we use as reference the structural VAR results of Blanchard and Galí (2010), who take time variation into account. The authors show that since 1984, a date conventionally considered as the beginning of the Great Moderation, the response of the US economy to oil price fluctuations has become milder. We thus derive our benchmark from the authors' post-1984 VAR results. We choose two papers as theoretical references: Bodenstein et al. (2011) and Balke and Brown (2018). Both papers model the effect of shocks to oil supply outside the US. While the former paper models the US as a purely oil-importing country, the latter treats the US as both oil-producing and oil-importing. Neither of these papers studies the impact of oil shocks on domestic inflation.

As shown in Table 1, the benchmark unemployment rate change for an oil price rise is 0.4 to 0.45 from the empirical side and 0.35 to 0.8 from the theoretical side. For inflation, we derive a benchmark rise of 1.25 to 1.5.

Government spending For the empirical literature, we start from the seminal work of Blanchard and Perotti (2002), but also rely on more recent papers such as Auerbach and Gorodnichenko (2012) and the literature review of Ramey (2011). While some of these studies focus only on government purchases, or specifically defense, others consider broader government spending. On the theoretical side, we interpret the exogenous spending shock in Smets and Wouters (2007) and Galí et al. (2011) as a government spending shock. A third source is the governments spending shock in Zubairy (2014).⁴

⁴Note that we do not use this paper as a benchmark for the response of inflation. Although inflation dynamics resulting from fiscal policy are embedded in the model, they are not discussed in detail by the author.

The reference range of values for the fall in unemployment after a rise in spending, reported in Table 1, is between -0.06 to -0.12 percentage points, while the rise in inflation (from the DSGE models) is 0.1 points.

Monetary policy As our empirical benchmark, we use the recent work of Arias et al. (2019), who apply sign and zero restrictions on the systematic component of monetary policy (i.e. the Taylor rule). The empirical literature on monetary policy shocks, particularly through VARs, has produced a large body of evidence since the late 1990's. The seminal works in the field, developing alternative identification strategies, include Bernanke and Mihov (1998), Christiano et al. (1999), Stock and Watson (2001), Romer and Romer (2004), Bernanke et al. (2005), Primiceri (2005), Uhlig (2005). With the exception of Uhlig (2005), these studies find that the response of output to a monetary policy shock is quantitatively similar to that of our chosen benchmark from Arias et al. (2019). However, they often fail to find a significant effect of monetary shocks on inflation in the short-term. This result, known as the “price puzzle”, is conventionally acknowledged to be a methodological issue rather than a robust empirical finding. As a theoretical reference, we use Smets and Wouters (2007) and Galí et al. (2011).

The unemployment benchmark change for a 50 basis point increase in the federal funds rate is between 0.2 percentage points, for the empirical benchmark, and 0.4 to 0.5 for the theoretical one. The respective values for inflation are -0.2 and -0.15.

Income tax rate For tax revenues, we consider papers applying structural VARs and narrative identifications of discretionary tax changes. These works include, Blanchard and Perotti (2002), Romer and Romer (2010), Favero and Giavazzi (2012), Mertens and Ravn (2012, 2014), and Perotti (2012). An important caveat when comparing the results is that these studies focus on tax revenues as a whole, and therefore incorporate a broad set of tax changes beyond income tax rates. To our knowledge, the only paper modeling the impact of labor income tax rate fluctuations in a New Keynesian model is Zubairy (2014).⁵

The empirical benchmark unemployment change for the increase in the income tax rate ranges between 0.2 and 0.6 percentage points, while the theoretical one is 0.06.

⁵Once again, we do not use this paper as a benchmark for the response of inflation. Although inflation dynamics resulting from fiscal policy are embedded in the model, they are not discussed in detail by the author.

3.2 Analysis

In our analysis we examine the differences in unemployment expectations, Δu_i , and differences in inflation expectations, $\Delta \pi_i$, between the baseline scenario on the one hand, and the “fall-scenario”, Fall_i , or the “rise-scenario”, Rise_i , on the other hand. For example, in the case of the unemployment rate, we estimate the following equation for each of the four vignettes separately:

$$\Delta u_i = \beta_1 \text{Rise}_i + \beta_2 \text{Fall}_i + \varepsilon_i \quad (1)$$

We employ robust standard errors throughout the paper.

3.3 Expert predictions

We first characterize the expert predictions of inflation and unemployment under the different hypothetical scenarios (see Figure 1 and Panel A of Table 2). We compare these results quantitatively to the empirical and theoretical benchmarks in Table 1.

Oil price shock Panel A of Table 2 show that experts predict that both unemployment and inflation will be higher (lower) in response to an increase (decrease) in the oil price (Columns 1 and 2). Experts predict an unemployment rate decrease (increase) of 0.13 (0.29) percentage points and an inflation rate increase (decrease) of 0.50 (0.44) percentage points in the scenario where the oil price decreases (increases) by \$30. The magnitudes of these expected changes are below those of the benchmarks.

Government spending shock Our sample of experts forecasts that unemployment will be lower (higher) and inflation will be higher (lower) in response to an exogenous decrease (increase) in government spending (Columns 3 and 4 in Table 2). The experts predict an unemployment rate decrease (increase) of 0.35 (0.35) percentage points and an inflation rate increase (decrease) of 0.34 (0.28) percentage points in the “government spending increase scenario” (“government spending decrease scenario”).

The benchmark relationship for unemployment from the literature has the same sign as that expected by the experts with a value range between 0.05 to 0.2 percentage points. The experts’ expectations therefore thus exceed the benchmark, although the difference

is not large and the confidence intervals include the upper bound of the benchmark. However, the significance of the difference may be larger when considering that the experts were surveyed at what is likely a peak of the business cycle. As shown by Auerbach and Gorodnichenko (2012), fiscal multipliers are empirically much closer to zero during business cycle peaks, while they tend to be largest during recessions. Hence, their expectations taken at what should be the point of lowest multipliers exceed the range of benchmark multipliers estimated at an “average” point of the cycle.

With respect to inflation, the benchmark from the DSGE literature is in line with the expectations qualitatively but it is also smaller in value (0.1 percentage points).

Interest rate shock Our experts predict that unemployment will be lower (higher) and inflation will be higher (lower) in response to an unexpected increase (decrease) in the interest rate (Columns 5 and 6 in Table 2). The experts predict an unemployment rate increase (decrease) of 0.35 (0.16) percentage points and an inflation rate decrease (increase) of 0.27 (0.17) percentage points in the “increase in interest rate scenario” (“decrease in interest rate scenario”).

These expectations for the change in unemployment after a monetary contraction are very close to the benchmark of 0.2 to 0.4 percentage points, while those for the expansion are just below the lower bound. Inflation expectations are also very close to the 0.15-0.20 benchmarks. Once again, considering the point of the business cycle in which the survey was conducted may provide greater perspective. As shown by Barnichon and Matthes (2016), when the labor market is tight the unemployment response to monetary shocks may be very muted while that of inflation would be amplified. Taking this into account, the expert predictions may be even closer to the benchmarks. Also the pronounced asymmetry in the response of expectations about unemployment and inflation to contractionary and expansionary shocks is consistent with the evidence in Barnichon and Matthes (2018).

Tax shock Experts on average think that unemployment will be lower and inflation will be higher in response to a decrease in taxes and that unemployment will be higher and inflation will be lower in response to a tax increase (Columns 7 and 8 in Table 2). They expect an unemployment rate increase (decrease) of 0.25 (0.22) percentage points and an inflation rate decrease (increase) of 0.20 (0.20) percentage points in the “tax increase

scenario” (“tax decrease scenario”).

The unemployment expectation is above the theoretical benchmark of 0.06 percentage points but is inside the 0.2 to 0.6 range from the empirical evidence. The experts’ view is therefore approximately mid-way between the theoretical benchmark and the mid-point of the empirical range. As mentioned before, the empirical studies we reviewed focus on tax revenues rather than income tax rates, and may therefore not be very closely comparable. Experts believe that the responses of macro variables are stronger for government spending shocks than for tax shocks⁶ This view is consistent with theoretical work such as Zubairy (2014) and Beck-friis and Willems (2017).

Subjective Phillips Curve The upper Panel of Figure 3 shows the co-movement of unemployment and inflation in response to shocks as predicted by our experts. In line with standard New-Keynesian models, experts predict a positive co-movement of unemployment and inflation in response to an oil price shock, and a negative co-movement for the other three shocks.

Measuring disagreement How much disagreement is there among experts in the different scenarios? The standard deviations of the predicted changes in unemployment and inflation, Δu and $\Delta\pi$, are relatively small (.45 and .51). Figure 2 displays violin plots, which highlight that there is relatively little disagreement among the experts.

Result 1. *Overall, the expert predictions are consistent with the predictions from standard DSGE models and we find relatively little disagreement in expert forecasts. The magnitudes of expert forecasts are broadly in the range of quantitative estimates from DSGE models and VAR evidence for most of the shocks.*

3.4 Predictions from the representative sample

Panel B of Table 2 and Figure 1 display the predictions of the inflation and the unemployment rate under the different hypothetical scenarios among respondents from the representative sample.

⁶Given that the government shock is approximately equal to 0.3% of GDP and the tax shock is close to 0.5% (see the appendix for the calculation of these sizes), the difference would be even larger if the two shocks were scaled to the same magnitude.

Oil price shock Respondents from the representative online panel make qualitatively and quantitatively similar predictions as the experts: On average, they predict an unemployment rate decrease (increase) of 0.24 (0.41) percentage points and an inflation rate decrease (increase) of 0.33 (0.77) percentage points in the scenario where the oil price decreases (increases) by \$30.

Government spending shock While consumers think that inflation falls by 0.22 percentage points in response to an exogenous reduction in government spending, they do not on average think that inflation responds to an increase in government spending, or that unemployment significantly responds to changes in government spending.

Interest rate shock While consumers think that unemployment will be 0.17 percentage points higher in response to a rise in interest rates, they expect it to remain unchanged in response to a decrease interest rates. Respondents do not expect any changes to inflation in response to a decrease in the federal funds target rate. The most striking deviation from expert forecasts is that consumers think that an increase in the federal funds target rate will increase inflation by 0.18 percentage points.

Tax shock Respondents from the representative online panel think higher (lower) taxes will increase (decrease) the unemployment rate by 0.26 (0.16) percentage points. However, they expect exogenous tax changes to change inflation in the opposite direction compared to experts. Specifically, they predict that a tax hike will increase inflation by 0.20 percentage points, while they do not predict a significant response of inflation to tax cuts.

Overall, our second main finding can be summarized as follows:

Result 2. *There is large heterogeneity in predictions in the representative panel. While for the oil price shock and the government spending shock experts and households expect qualitatively similar responses of both unemployment and inflation, there are substantial deviations in households' expectations from those of experts in the interest rate and the tax shock vignettes. Households are much better at predicting unemployment than at predicting inflation.*

Moreover, there is a lot more disagreement among consumers than among experts. The standard deviations of the predicted changes in unemployment and inflation, Δu and $\Delta \pi$,

are about twice as large as among experts (1.01 and 1.05 compared to .45 and .51). More generally, households' expectation indicate a high degree of non-linearity: they many times expect the rise and fall of the shock variable to have different effects on inflation and unemployment, while experts think that positive and negative effects have rather symmetric effects.

3.5 Beliefs about propagation mechanisms

We next provide descriptive evidence on people's beliefs about the propagation mechanism of macroeconomic shocks.

Vignette-specific mechanisms Figure 4 summarizes beliefs about the propagation mechanisms for the oil price shock. Approximately 70 percent of our respondents understand that an increase in oil prices increases the production costs of firms. 75 percent of our respondents correctly respond that an increase in production costs shifts firms' supply curve of goods and services to the left. 75 percent of our respondents correctly respond that an increase in oil price lowers the purchasing power of consumers. 70 percent of our participants give the correct answer that an increase in purchasing power of households results in a shift in aggregate demand in the economy to the right.

Figure 5 summarizes beliefs about the propagation mechanisms for the interest rate shock. 60 percent of our respondents correctly grasp that an increase in the federal funds rate results in an increase in financing costs. Approximately 75 percent of respondents think that an increase in financing costs decreases supply and about 60 percent of respondents understand that it decreases demand. Surprisingly, only 55 percent of respondents correctly respond that an increase in the federal funds rate increases interest rates on savings and loans. Similarly, only 50 percent of respondents respond that an increase in interest rates for savings and loans increases the overall demand for goods and services in the economy.

Figure 6 summarizes beliefs about the propagation mechanisms for the tax shock. 75 percent of respondents recognize that an increase in taxes lowers' households' purchasing power, and 70 percent understand that an increase in purchasing power increases the overall demand for goods and services in the economy.

Since an increase in government spending directly shifts the aggregate demand curve

in the economy, we did not include any vignette-specific mechanism questions for the government spending shock (Figure 7), but focus on the general mechanisms which we discuss below.

General mechanisms 55 percent of our respondents understand that an increase in the supply of products and services lowers inflation and 50 percent correctly respond that it decreases unemployment. 50 percent of our respondents understand that an increase in the overall demand for products and services in the economy decreases unemployment and 55 percent correctly respond that it increases inflation.

3.6 Correlates of the accuracy of expectations

What determines the accuracy of predictions of respondents in the representative sample? We code a prediction as “correct” if it is qualitatively in line with the expert forecast. $\text{accurate}(\Delta u_i)$ takes value one if the respondent predicts the shock to affect the unemployment rate in the same direction as the median expert. Similarly, $\text{accurate}(\Delta \pi_i)$ takes value one if the respondent predicts the shock to affect the inflation rate in the same direction as the median expert.

Correlates of the accuracy of expectations We next examine the correlates of the accuracy of expectations. Our key variable of interest is a z-scored transformation of the number of correct responses regarding the mechanisms through which all four different shocks are propagated through the economy, Mechanismscore_i . We estimate regressions of the following type:

$$\text{accurate}_i = \gamma_0 + \gamma_1 \text{Mechanismscore}_i + \varepsilon_i \quad (2)$$

Panel A of Table 3 shows that the accuracy of people’s beliefs about how shocks propagate through the economy are strongly and significantly related to the accuracy of predictions in the hypothetical vignettes. A one-standard deviation increase in accuracy in the mechanism questions increases the fraction of correct responses by more than 10 percentage points for the oil vignettes and approximately five percentage points for the government spending vignettes. The mechanism questions are a still significant but

weaker predictor of accuracy of predictions for the interest rate and taxation scenarios. Financial literacy is mostly not significantly related to the accuracy of macroeconomic forecasts except for predictions in the oil vignette.

Result 3. *People’s beliefs about how a shock is propagated in the economy through firms and consumers are a strong and significant predictor for whether their forecasts align with those of experts.*

Confidence Confidence in predictions of the unemployment rate and the inflation rate among respondents from the representative sample is uncorrelated with the accuracy of their responses (Table 4). Similarly, in our sample of experts we find no significant relationship between confidence and the accuracy of predictions, as defined by the consensus forecasts among experts.

Demographics Table 5 highlights that there are substantial differences in the accuracy of predictions across demographic groups. Males, older respondents, college-educated respondents, people with higher net wealth or more financial assets, and those who follow news about the economy have a significantly higher number of correct forecasts. The finding that more educated and older respondents form their expectations more in line with experts is consistent with roles for cognitive limitations and learning over the life-cycle.

Result 4. *The expectations of wealthier, higher-income, more educated and older respondents are more similar to those of experts. Confidence in the forecasts does not correlate with the accuracy of predictions neither among the respondents from the representative online panel nor among our sample of experts.*

3.7 Procedural robustness

The effect of incentives Did the incentivization affect the accuracy of predictions among respondents from the representative sample? Table A5 shows that the incentives have overall small effects on the accuracy of predictions in the hypothetical vignettes and do not affect the amount of time spent on the vignettes. While the accuracy of predictions of inflation increases by 10 percent, the prediction of unemployment is completely unaffected by incentives. The effect of incentives on the accuracy of responses does not

significantly vary with people’s trust in experts (Panel B of Table A5). Finally, incentivizing responses does not significantly affect the accuracy of people’s answers in the mechanism questions (see Panel C of A5).

Order effects We randomized both the order of vignettes as well as the order of whether unemployment or inflation questions were elicited first. We find little evidence of order effects (Table A6).

4 Implications

Modeling the expectation formation mechanism We find that households’ predictions about the effects of oil price shocks and government spending shocks on unemployment and inflation are well aligned with those of experts. More generally, households perform reasonably in predicting the responses of unemployment to macroeconomic shocks. These findings suggest that the common assumption that households know the structural parameters of the economy may be a reasonable first approximation in these domains.

However, households’ predictions about the inflation response to monetary policy shocks and to tax shocks goes into the opposite direction compared to expert forecasts. Moreover, there is a lot of disagreement in households’ predictions for all shocks. These findings lend support to models of learning in which households are uncertain and may disagree about structural parameters of the economy (Evans and Honkapohja, 2012; Milani, 2007; Orphanides and Williams, 2005). The fact that older respondents’ predictions are substantially closer to those of experts is consistent with a role for learning about structural parameters of the economy over the life-cycle.

Moreover, biases in beliefs are particularly pronounced for respondents with lower education, consistent with recent evidence by D’Acunto et al. (2019a,c). This suggests that cognitive limitations and perceptual biases could be a source of households’ disagreement with experts. These findings lend support to macroeconomic models with behavioral agents (Gabaix, 2016). For instance, Farhi and Werning (2017) introduce bounded rationality in household’s expectation formation, which mitigates the effects of monetary policy in an empirically consistent way. An open question in this context is what kinds of heuristics boundedly rational households use in their predictions. One

potential such heuristic is that both unemployment and inflation are perceived to be negative by households, and are therefore expected to increase in response to adverse economic developments. We leave the study of such heuristics to future research.

Finally, individuals with higher net wealth and higher holdings of financial assets make predictions that are closer to those of experts. Given that these individuals account for the majority of participants and assets traded in financial markets, this result is encouraging for asset pricing models assuming rationality of investors.

Fiscal and monetary policy-making Our findings have several implications for policymakers. According to our estimates, the announcement of tax cuts in the future should decrease households' unemployment expectations and lower their inflation expectations, while the announcement of a government spending program may increase people's inflation expectations but have no effects on expectations about unemployment. Changes in inflation and unemployment expectations may affect household spending in different ways, which should be reflected in differential consumption responses to the announcement of government spending programs vs tax cuts.

In general, households' difficulties in predicting changes in inflation in response to government and central bank policies highlight the importance of studying the role of communication of policy changes to consumers for the effectiveness of both fiscal and monetary policy (Coibion et al., 2019).

5 Conclusion

Drawing on a sample of experts and a large representative sample of the US population, we provide evidence on how expectations about the unemployment rate and the inflation rate change in response to four different hypothetical exogenous shocks: a monetary policy shock, a government spending shock, a tax shock, and an oil price shock.

We establish a series of novel results: First, the expert predictions are both qualitatively and quantitatively consistent with the predictions from standard DSGE models and we find relatively little disagreement in expert forecasts. Second, there is strong heterogeneity in responses to the vignettes in the representative panel. While for the oil price shock and the government spending shock experts and households expect rather similar responses in both unemployment and inflation, there are substantial deviations in house-

holds' expectations from those of experts in the interest rate and the tax shock vignettes. In general, households' predictions about unemployment are qualitatively aligned with experts' predictions, while households find it more difficult to make accurate predictions about inflation.

People's beliefs about the propagation mechanisms of the different shocks strongly predict whether their forecasts are qualitatively aligned with those of experts. We find that more educated and older respondents form their expectations more in line with experts, consistent with roles for cognitive limitations and learning over the life-cycle. Confidence in the forecasts does not correlate with the accuracy of predictions neither among the respondents from the representative online panel nor among our sample of experts.

Our evidence has important implications for the effectiveness of monetary policy and fiscal policy and highlight the importance of heterogeneity in expectation formation among households. This heterogeneity in turn may imply a large degree of variation in the effectiveness of monetary policy and fiscal policy in shifting expectations and behavior for different subpopulations of interest.

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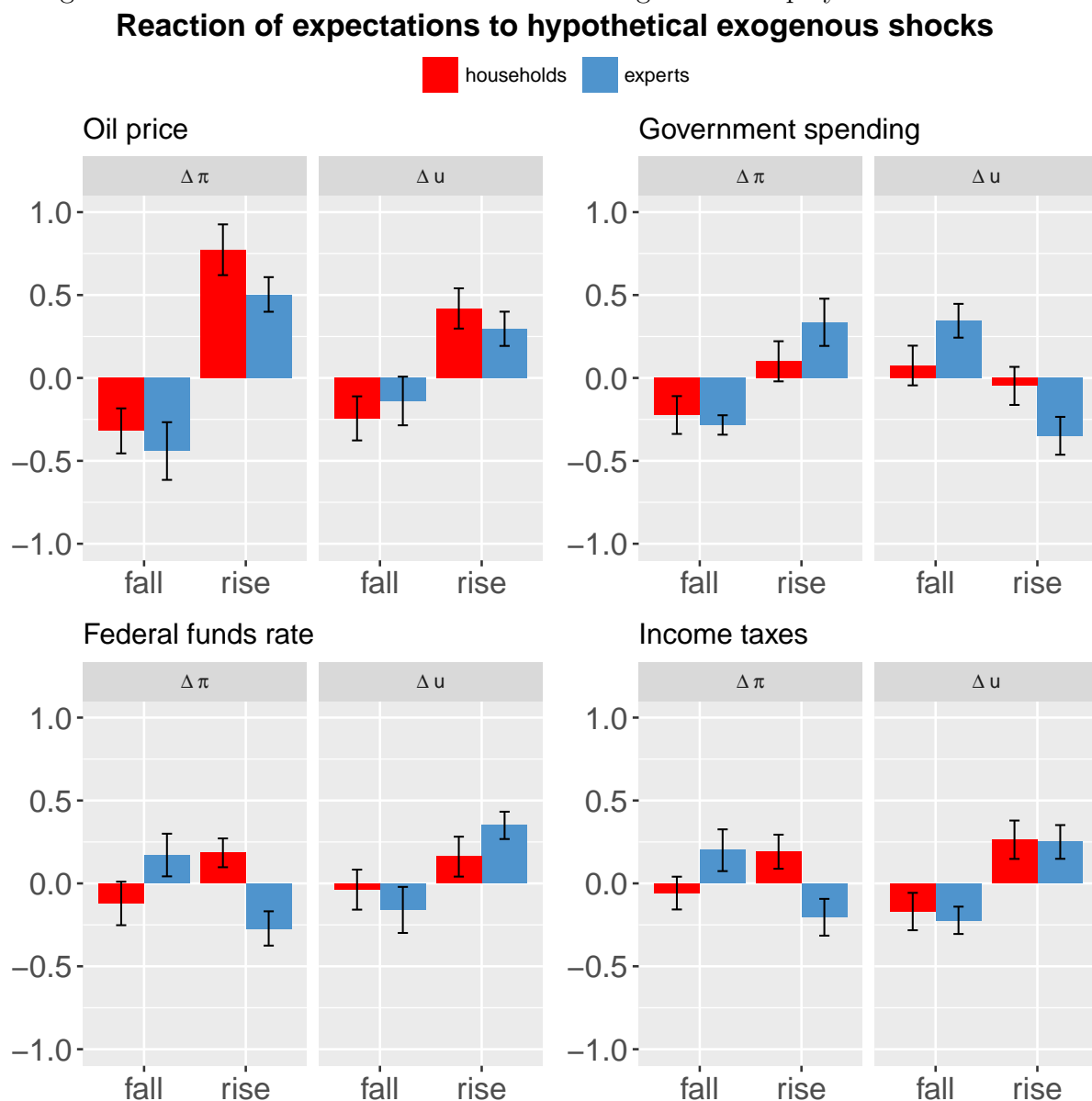
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Main Figures

Figure 1: Overview of raw data: Predicted changes in unemployment and inflation

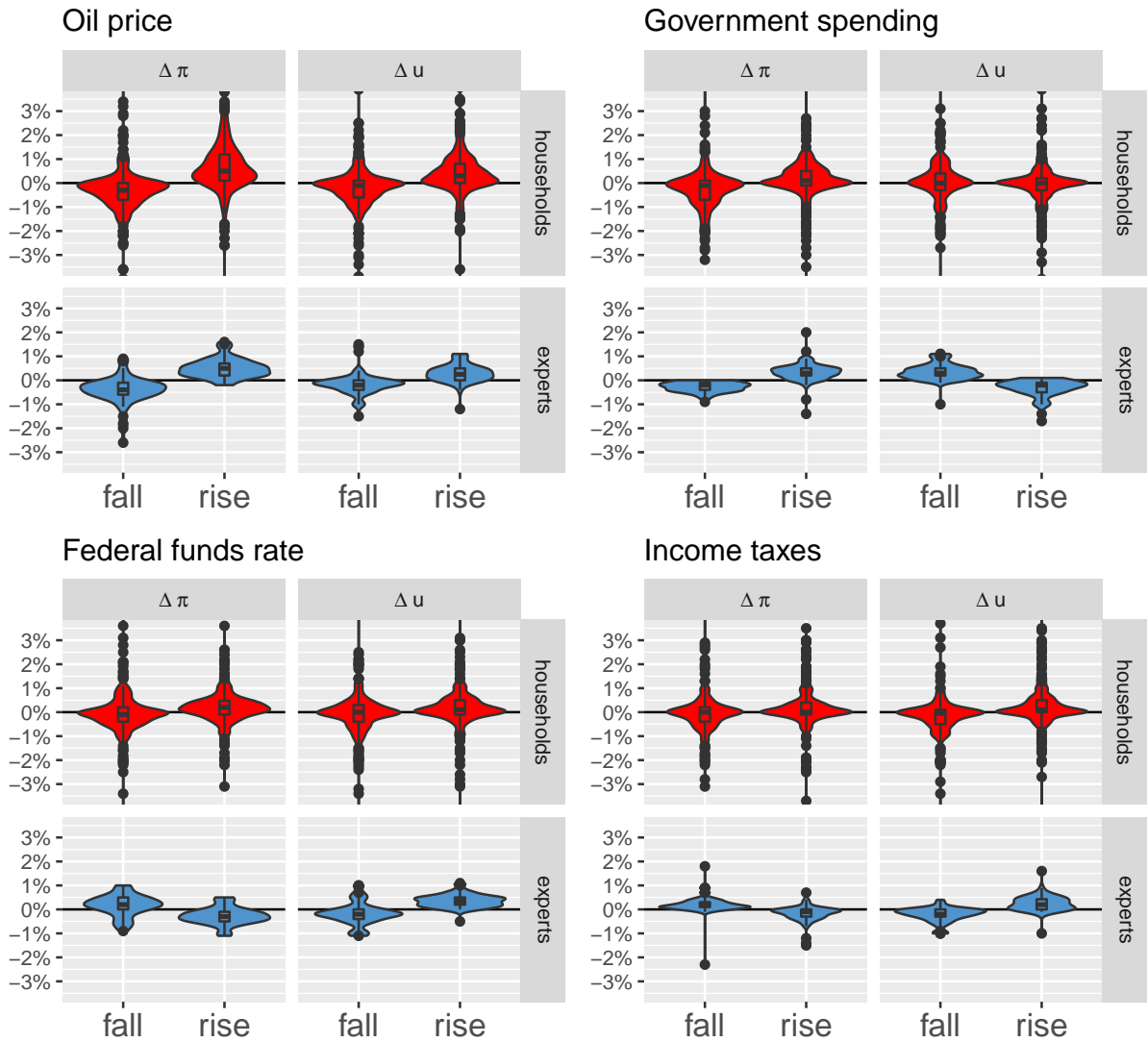


Notes: This figure provides an overview of changes in the expectations about the unemployment rate and the inflation rate for the “rise” and “fall” scenarios for each of the different vignettes separately. The red bars show the mean responses for experts while the blue bars show the responses from our expert survey. Error bars show the 1.96 confidence intervals. Δu denotes the expected change in the unemployment rate compared to the baseline scenario. $\Delta \pi$ denotes the expected change in the inflation rate compared to the baseline scenario.

Figure 2: Violin plot: Predicted changes in unemployment and inflation

Distribution of expectation reactions

households experts

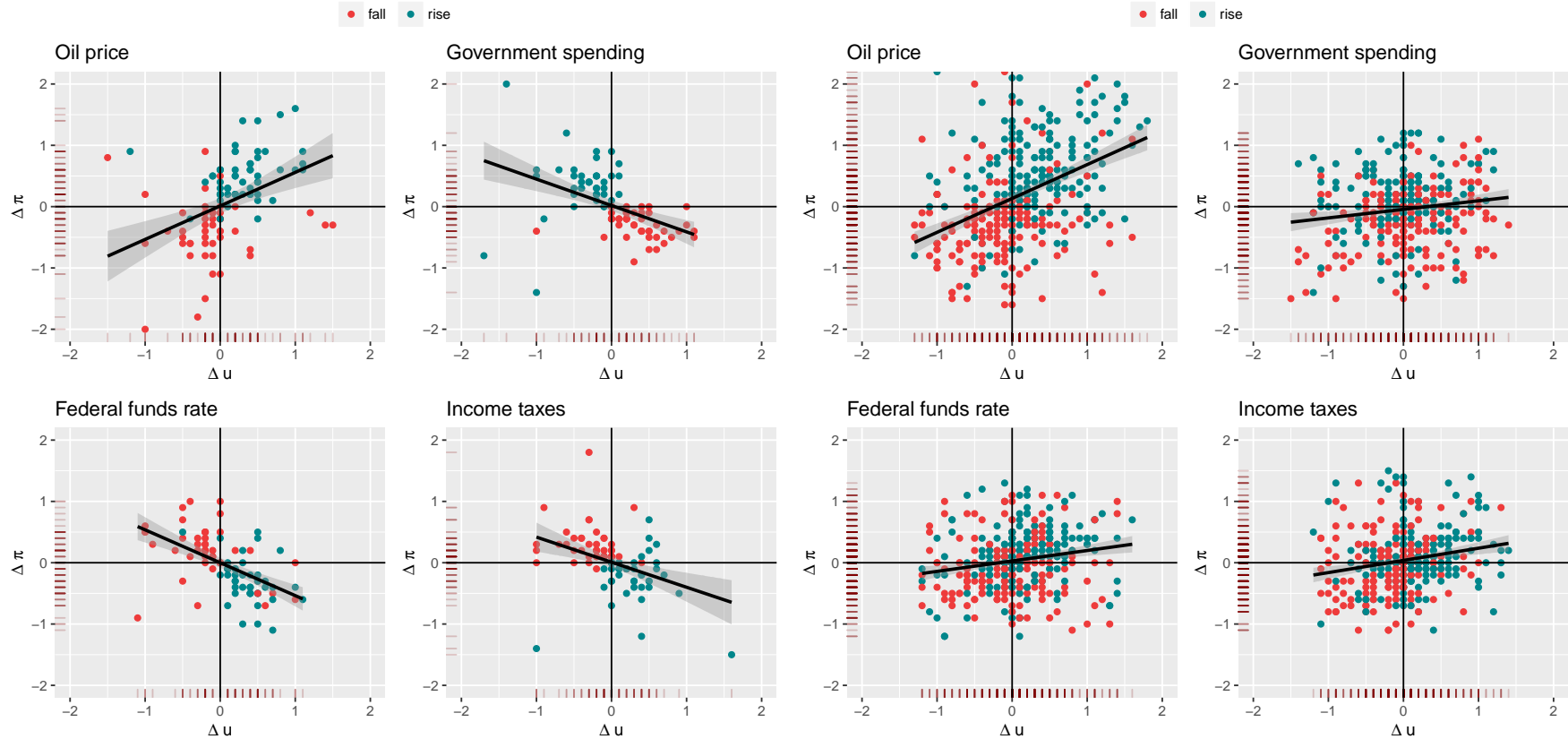


Notes: This figure displays violin plots of the changes in expectations about the unemployment rate and the inflation rate for the “rise” and “fall” scenarios for each of the different vignettes separately.

Figure 3: Predicted co-movement of unemployment and inflation: Experts and rep. sample

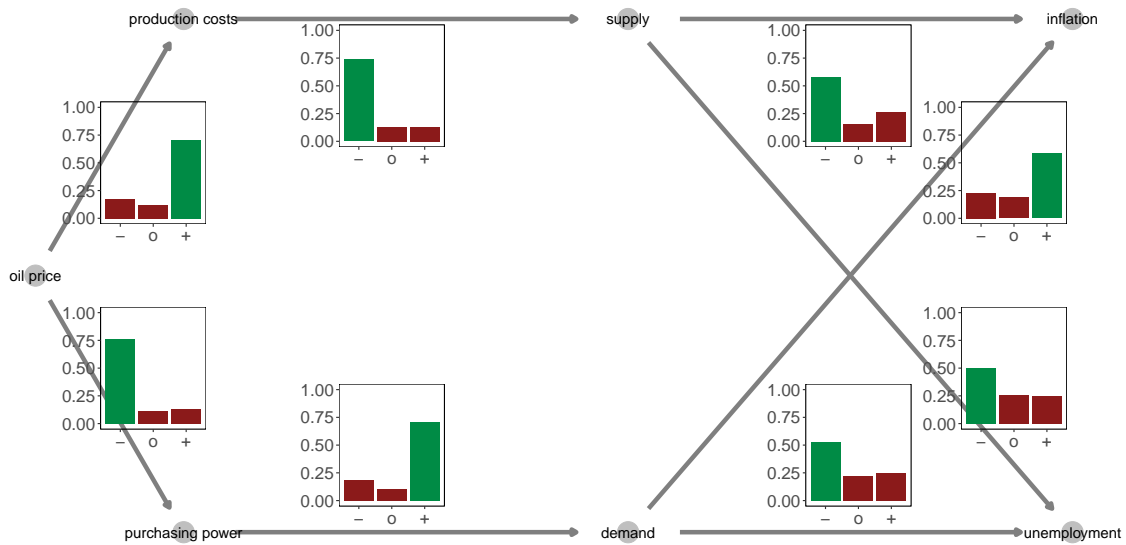
Co-movement of changes in experts' infl. and unemp. expectations

Co-movement of changes in households' infl. and unemp. expectations



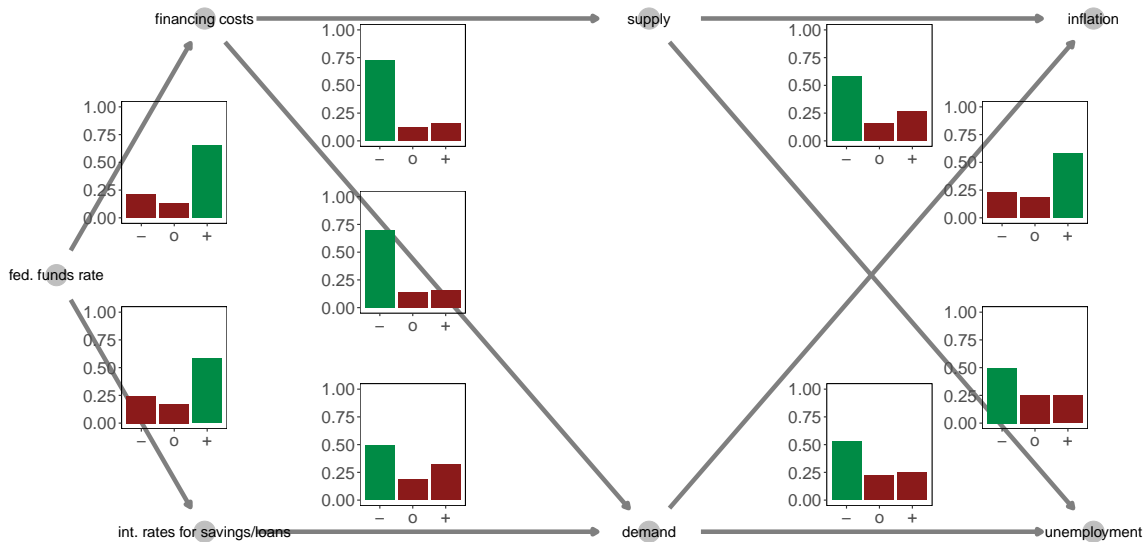
Notes: This figure shows the co-movement of changes in the unemployment rate and changes in the inflation rate for each of the different vignettes separately. The upper panel shows the results for the sample of experts, while the lower panel displays results for the representative online sample.

Figure 4: Beliefs about propagation mechanisms: Oil price



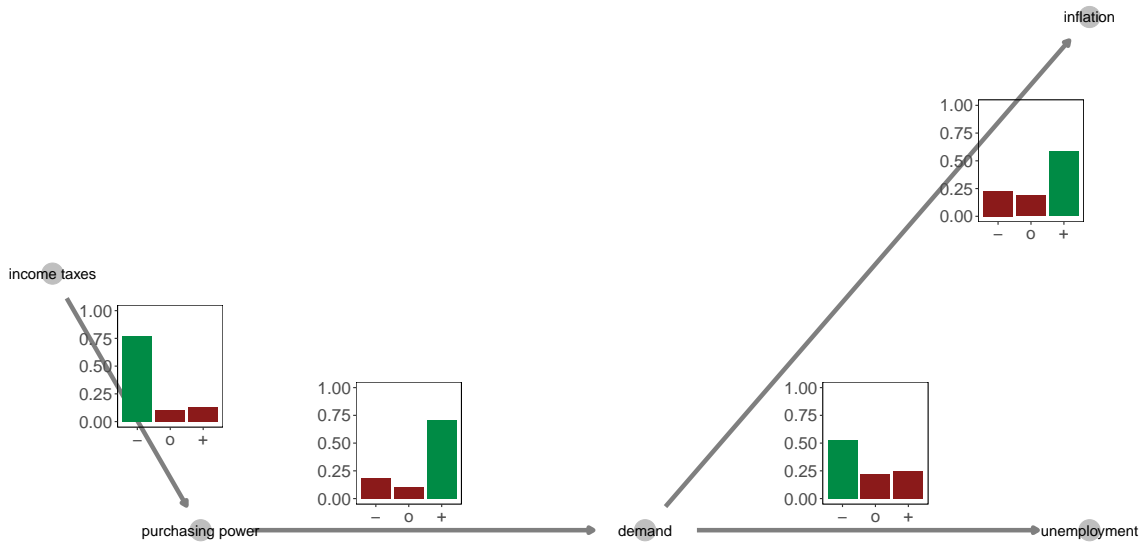
Notes: This figure uses data from the representative online panel and shows people’s responses to the mechanism questions related to the oil vignette. “+” indicates that people expect a positive association between two variables; “-” indicates that people expect a negative association between two variables. “0” indicates that people expect neither a positive nor a negative association. The green bar shows the fraction of correct responses, while the red bar shows the fraction of incorrect responses for each of the questions separately.

Figure 5: Beliefs about propagation mechanisms: Interest rate



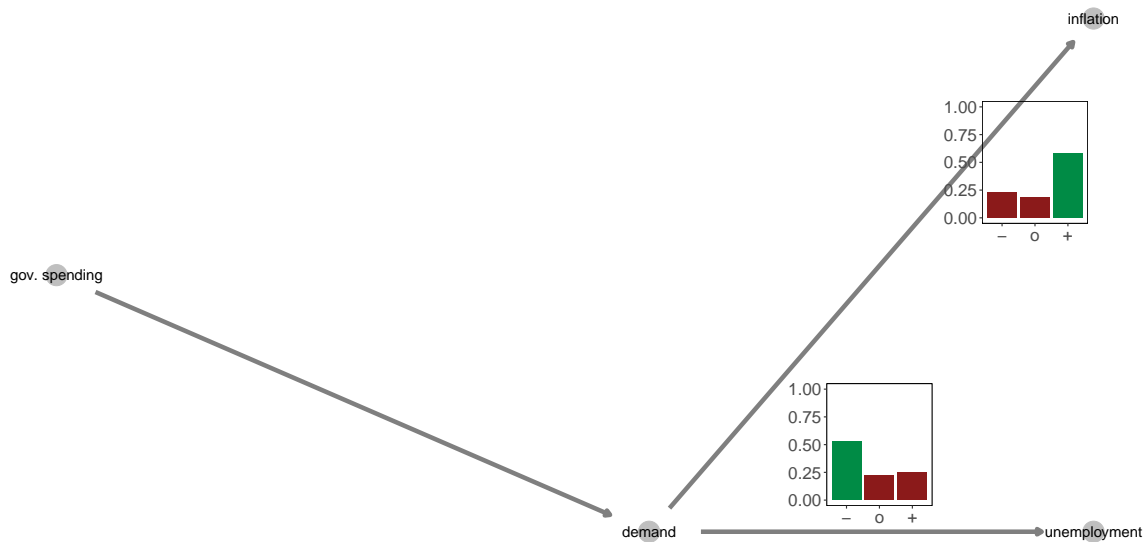
Notes: This figure uses data from the representative online panel and shows people’s responses to the mechanism questions related to the interest rate vignette. “+” indicates that people expect a positive association between two variables; “-” indicates that people expect a negative association between two variables. “0” indicates that people expect neither a positive nor a negative association. The green bar shows the fraction of correct responses, while the red bar shows the fraction of incorrect responses for each of the questions separately.

Figure 6: Beliefs about propagation mechanisms: Tax change



Notes: This figure uses data from the representative online panel and shows people’s responses to the mechanism questions related to the tax rate vignette. “+” indicates that people expect a positive association between two variables; “-” indicates that people expect a negative association between two variables. “0” indicates that people expect neither a positive nor a negative association. The green bar shows the fraction of correct responses, while the red bar shows the fraction of incorrect responses for each of the questions separately.

Figure 7: Beliefs about propagation mechanisms: Government spending



Notes: This figure uses data from the representative online panel and shows people’s responses to the mechanism questions related to the government spending vignette. “+” indicates that people expect a positive association between two variables; “-” indicates that people expect a negative association between two variables. “0” indicates that people expect neither a positive nor a negative association. The green bar shows the fraction of correct responses, while the red bar shows the fraction of incorrect responses for each of the questions separately.

Main Tables

Table 1: Benchmarks for the sign and size of expected unemployment and inflation rate changes.

Shock	Benchmarks				
		Unemployment Response		Inflation Response	
		Sign	Value (p.p.)	Sign	Value (p.p.)
Oil Price Rise (50% rise)	Theory	+	0.35 to 0.8		
	Empirical	+	0.45	+	1.25 to 1.5
Government Spending Rise (1.5% higher growth)	Theory	-	-0.06 to -0.13	+	0.1
	Empirical	-	-0.1 to -0.2		
Interest Rate Rise (0.5 bp)	Theory	+	0.4 to 0.5	-	-0.15
	Empirical	+	0.2	-	-0.2
Tax Rate Rise (1 p.p.)	Theory	+	0.06		
	Empirical	+	0.2 to 0.6		

Notes: The table reports the benchmark changes in the unemployment rate and the inflation rate four quarters after the shock. The benchmarks are derived from an analysis of the theoretical and empirical literatures on these shocks, adjusting the values to be comparable to the size of the shocks in the survey. Empty fields indicate that – to the best of our knowledge – there was no robust and rigorous evidence on the effect of a given shock on the respective outcome variable of interest. Appendix C contains details on the papers surveyed for this exercise and the calculations used to derive the values.

Table 2: Beliefs about effects of different shocks

Panel A: Experts								
	oil price		gov. spending		fed. funds rate		income taxes	
	$\Delta\pi$	Δu	$\Delta\pi$	Δu	$\Delta\pi$	Δu	$\Delta\pi$	Δu
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
fall	-0.441*** (0.089)	-0.139* (0.075)	-0.284*** (0.030)	0.345*** (0.052)	0.171*** (0.066)	-0.160** (0.071)	0.200*** (0.064)	-0.223*** (0.042)
rise	0.504*** (0.053)	0.296*** (0.053)	0.336*** (0.073)	-0.349*** (0.058)	-0.272*** (0.053)	0.350*** (0.042)	-0.204*** (0.057)	0.250*** (0.052)
Observations	105	105	94	94	91	91	101	101
R ²	0.465	0.213	0.418	0.464	0.248	0.333	0.181	0.339

Panel B: Households								
	oil price		gov. spending		fed. funds rate		income taxes	
	$\Delta\pi$	Δu	$\Delta\pi$	Δu	$\Delta\pi$	Δu	$\Delta\pi$	Δu
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
fall	-0.319*** (0.069)	-0.244*** (0.068)	-0.224*** (0.058)	0.075 (0.061)	-0.121* (0.067)	-0.038 (0.062)	-0.058 (0.050)	-0.170*** (0.058)
rise	0.773*** (0.078)	0.419*** (0.062)	0.100 (0.062)	-0.048 (0.059)	0.184*** (0.044)	0.161*** (0.061)	0.191*** (0.052)	0.263*** (0.059)
Observations	527	527	513	513	551	551	535	535
R ²	0.199	0.098	0.032	0.004	0.027	0.013	0.028	0.052

Panel C: Differences in households' and experts' expectation reactions								
	oil price		gov. spending		fed. funds rate		income taxes	
	$\Delta\pi$	Δu	$\Delta\pi$	Δu	$\Delta\pi$	Δu	$\Delta\pi$	Δu
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
fall	-0.319*** (0.069)	-0.244*** (0.068)	-0.224*** (0.058)	0.075 (0.061)	-0.121* (0.067)	-0.038 (0.062)	-0.058 (0.050)	-0.170*** (0.058)
rise	0.773*** (0.078)	0.419*** (0.062)	0.100 (0.062)	-0.048 (0.059)	0.184*** (0.044)	0.161*** (0.062)	0.191*** (0.053)	0.263*** (0.059)
fall×expert	-0.122 (0.112)	0.105 (0.101)	-0.060 (0.065)	0.270*** (0.080)	0.292*** (0.093)	-0.122 (0.093)	0.258*** (0.081)	-0.053 (0.071)
rise×expert	-0.270*** (0.094)	-0.123 (0.081)	0.235** (0.095)	-0.301*** (0.082)	-0.456*** (0.069)	0.189** (0.074)	-0.395*** (0.077)	-0.013 (0.078)
Observations	632	632	607	607	642	642	636	636
R ²	0.212	0.103	0.049	0.027	0.036	0.024	0.036	0.061

Notes: This table provides an overview of expected changes in the unemployment rate and the inflation rate for the “rise” and “fall” scenarios for each of the different vignettes separately. Panel A provides evidence from the expert sample. Panel B displays responses from the representative online panel. Panel C shows the differences in responses between experts and the representative panel. Δu denotes the expected change in the unemployment rate compared to the baseline scenario. $\Delta\pi$ denotes the expected change in the inflation rate compared to the baseline scenario.

Table 3: Accuracy of predictions

Panel A: Total mechanism score (MS)												
	oil price			gov. spending			fed. funds rate			income taxes		
	$\Delta\pi\checkmark$ (1)	$\Delta u\checkmark$ (2)	both \checkmark (3)	$\Delta\pi\checkmark$ (4)	$\Delta u\checkmark$ (5)	both \checkmark (6)	$\Delta\pi\checkmark$ (7)	$\Delta u\checkmark$ (8)	both \checkmark (9)	$\Delta\pi\checkmark$ (10)	$\Delta u\checkmark$ (11)	both \checkmark (12)
MS	0.121*** (0.022)	0.081*** (0.025)	0.092*** (0.023)	0.062** (0.026)	0.053** (0.026)	0.037* (0.020)	-0.015 (0.024)	0.072*** (0.025)	0.033** (0.015)	0.016 (0.024)	0.039 (0.027)	0.027 (0.018)
fin. lit.	0.048** (0.024)	0.058** (0.026)	0.081*** (0.025)	-0.015 (0.027)	0.015 (0.026)	0.013 (0.021)	0.006 (0.024)	-0.029 (0.026)	-0.020 (0.017)	0.010 (0.024)	-0.006 (0.026)	-0.001 (0.018)
Constant	0.711*** (0.019)	0.595*** (0.021)	0.469*** (0.021)	0.552*** (0.022)	0.423*** (0.022)	0.211*** (0.018)	0.293*** (0.020)	0.492*** (0.021)	0.113*** (0.014)	0.334*** (0.020)	0.515*** (0.022)	0.157*** (0.016)
Observations	521	521	521	508	508	508	543	543	543	532	532	532
R ²	0.119	0.066	0.098	0.012	0.017	0.014	0.001	0.014	0.007	0.002	0.005	0.005

Panel B: Vignette specific mechanism scores (MS)												
	oil price			gov. spending			fed. funds rate			income taxes		
	$\Delta\pi\checkmark$ (1)	$\Delta u\checkmark$ (2)	both \checkmark (3)	$\Delta\pi\checkmark$ (4)	$\Delta u\checkmark$ (5)	both \checkmark (6)	$\Delta\pi\checkmark$ (7)	$\Delta u\checkmark$ (8)	both \checkmark (9)	$\Delta\pi\checkmark$ (10)	$\Delta u\checkmark$ (11)	both \checkmark (12)
MS vig.	0.074*** (0.026)	0.052* (0.028)	0.052* (0.028)	-0.026 (0.025)	0.042* (0.024)	0.018 (0.019)	0.032 (0.024)	0.049* (0.026)	0.039*** (0.015)	-0.008 (0.024)	0.051** (0.026)	0.013 (0.019)
MS other	0.065*** (0.025)	0.041 (0.028)	0.052* (0.027)	0.081*** (0.029)	0.027 (0.028)	0.027 (0.020)	-0.051** (0.023)	0.033 (0.026)	-0.003 (0.016)	0.022 (0.025)	-0.000 (0.028)	0.017 (0.019)
fin. lit.	0.048** (0.024)	0.057** (0.026)	0.081*** (0.025)	-0.016 (0.027)	0.016 (0.026)	0.014 (0.021)	0.005 (0.025)	-0.029 (0.026)	-0.021 (0.017)	0.010 (0.024)	-0.006 (0.026)	-0.001 (0.018)
Constant	0.710*** (0.019)	0.595*** (0.021)	0.469*** (0.021)	0.549*** (0.022)	0.420*** (0.022)	0.209*** (0.018)	0.293*** (0.020)	0.493*** (0.021)	0.113*** (0.014)	0.335*** (0.021)	0.517*** (0.022)	0.158*** (0.016)
Observations	521	521	521	508	508	508	543	543	543	532	532	532
R ²	0.119	0.066	0.098	0.017	0.020	0.014	0.009	0.014	0.011	0.003	0.009	0.005

Notes: This Table provides an overview of the accuracy of predictions of households separately for the four different vignettes. $\Delta u\checkmark$ takes value 1 if the expected change in the unemployment rate is the same as the one from the mean expert forecast. $\Delta\pi\checkmark$ takes value 1 if the expected change in the inflation rate is the same as the one from the mean expert forecast. *both* \checkmark takes value 1 if both the expected change in the inflation rate and the expected change in the unemployment rate are the same as the one from mean expert forecast.

Table 4: Correlates of accuracy in predictions

Panel A: Experts								
	oil price		gov. spending		fed. funds rate		income taxes	
	$\Delta\pi\checkmark$	$\Delta u\checkmark$	$\Delta\pi\checkmark$	$\Delta u\checkmark$	$\Delta\pi\checkmark$	$\Delta u\checkmark$	$\Delta\pi\checkmark$	$\Delta u\checkmark$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
confidence	0.039 (0.042)	0.037 (0.059)	0.019 (0.060)	0.039 (0.059)	0.035 (0.070)	0.064 (0.066)	0.045 (0.069)	0.090 (0.061)
Constant	0.888*** (0.031)	0.704*** (0.047)	0.832*** (0.040)	0.811*** (0.041)	0.741*** (0.047)	0.798*** (0.043)	0.723*** (0.048)	0.697*** (0.048)
Observations	105	105	94	94	91	91	101	101
R ²	0.008	0.004	0.002	0.008	0.004	0.017	0.005	0.021

Panel B: Households								
	oil price		gov. spending		fed. funds rate		income taxes	
	$\Delta\pi\checkmark$	$\Delta u\checkmark$	$\Delta\pi\checkmark$	$\Delta u\checkmark$	$\Delta\pi\checkmark$	$\Delta u\checkmark$	$\Delta\pi\checkmark$	$\Delta u\checkmark$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
confidence	0.010 (0.023)	-0.012 (0.025)	-0.018 (0.024)	-0.016 (0.023)	0.021 (0.021)	0.048** (0.023)	0.039* (0.021)	0.027 (0.023)
Constant	0.708*** (0.020)	0.597*** (0.021)	0.547*** (0.022)	0.422*** (0.022)	0.297*** (0.020)	0.493*** (0.021)	0.338*** (0.020)	0.518*** (0.022)
Observations	527	527	513	513	551	551	535	535
R ²	0.000	0.001	0.001	0.001	0.002	0.008	0.006	0.003

Panel C: Determinants of households' confidence					
	avg. confidence	avg. confidence: oil price	avg. confidence: gov. spending	avg. confidence: fed. funds rate	avg. confidence: income taxes
	(1)	(2)	(3)	(4)	(5)
female	-0.328*** (0.054)	-0.283*** (0.076)	-0.414*** (0.081)	-0.336*** (0.078)	-0.281*** (0.082)
age	-0.001 (0.002)	0.002 (0.003)	-0.002 (0.003)	0.002 (0.003)	-0.005* (0.003)
std. ln(inc.)	0.074** (0.029)	0.118*** (0.041)	0.034 (0.044)	0.067* (0.040)	0.077* (0.045)
college	-0.040 (0.058)	-0.069 (0.078)	0.009 (0.088)	-0.037 (0.081)	-0.070 (0.089)
Constant	0.219** (0.101)	0.095 (0.147)	0.346** (0.146)	0.056 (0.149)	0.396** (0.155)
Observations	1,008	501	488	517	510
R ²	0.047	0.051	0.059	0.047	0.037

Notes: This table provides an overview of correlates of confidence in the predictions across vignettes. A forecast is classified as "correct" if it follows the same qualitative direction as the mean expert forecast.

Table 5: Demographic correlates of accuracy in predictions

	Total amount of correct forecasts								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
female	-0.102 (0.065)								-0.042 (0.075)
age		0.235*** (0.066)							0.164** (0.080)
college			0.193*** (0.065)						0.054 (0.080)
income				0.101 (0.071)					-0.003 (0.082)
net wealth					0.210*** (0.070)				0.037 (0.114)
fin. wealth						0.216*** (0.069)			0.103 (0.110)
econ. rel.							0.042 (0.067)		-0.011 (0.078)
follow n.								0.168** (0.067)	0.029 (0.082)
Constant	2.008*** (0.049)	1.859*** (0.041)	1.871*** (0.043)	1.932*** (0.040)	1.873*** (0.049)	1.859*** (0.048)	1.932*** (0.042)	1.882*** (0.042)	1.832*** (0.081)
Observations	1,063	1,063	1,063	1,008	896	942	1,049	1,049	870
R ²	0.002	0.012	0.008	0.002	0.010	0.010	0.000	0.006	0.018

Notes: This table uses data from the representative online panel, and provides an overview of correlates of demographic characteristics with the accuracy of predictions in the vignettes.

Online Appendix: Subjective Models of the Macroeconomy: Evidence from Experts and a Representative Sample

Peter Andre¹ Carlo Pizzinelli²

Christopher Roth³ Johannes Wohlfart⁴

Summary of the online Appendix

Section A provides additional figures. Figure A.1 provides an overview of the raw data in the different scenarios. Figure A.2 shows the raw data of people's confidence in their predictions across scenarios. Section B shows additional tables. Tables A1 and A2 provide summary statistics for the covariates of the representative online panel and the expert sample respectively. Tables A3 and A4 provide summary statistics for the main outcome questions in the representative online panel and the expert sample respectively. Table A5 displays the effect of incentives. Table A6 displays order effects. Section C provides details on the papers surveyed for this exercise and the calculations used to derive the values. Section D provides additional details on the expert survey. Section E provides a full set of experimental instructions for the experiments conducted with the representative online panel.

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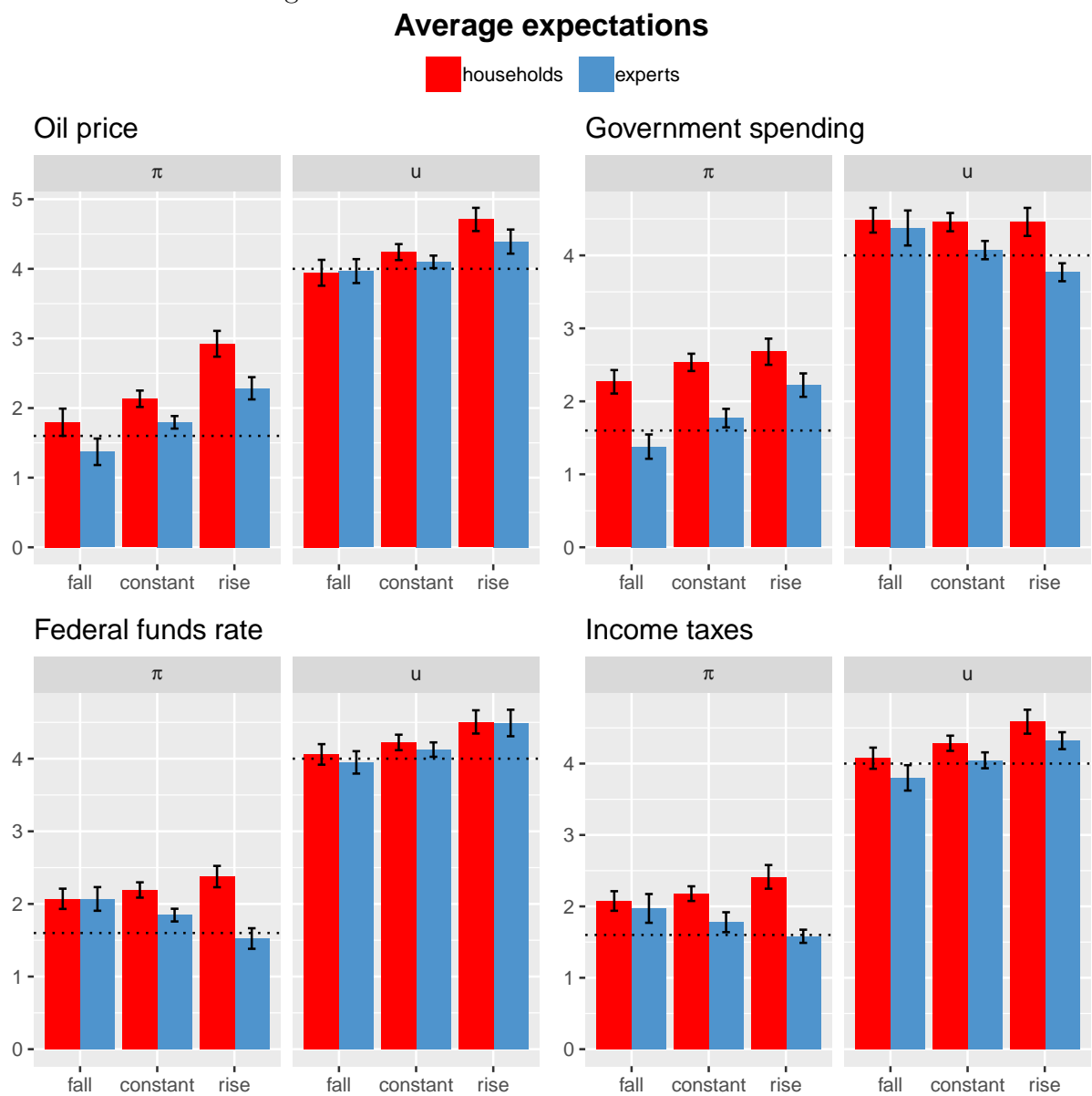
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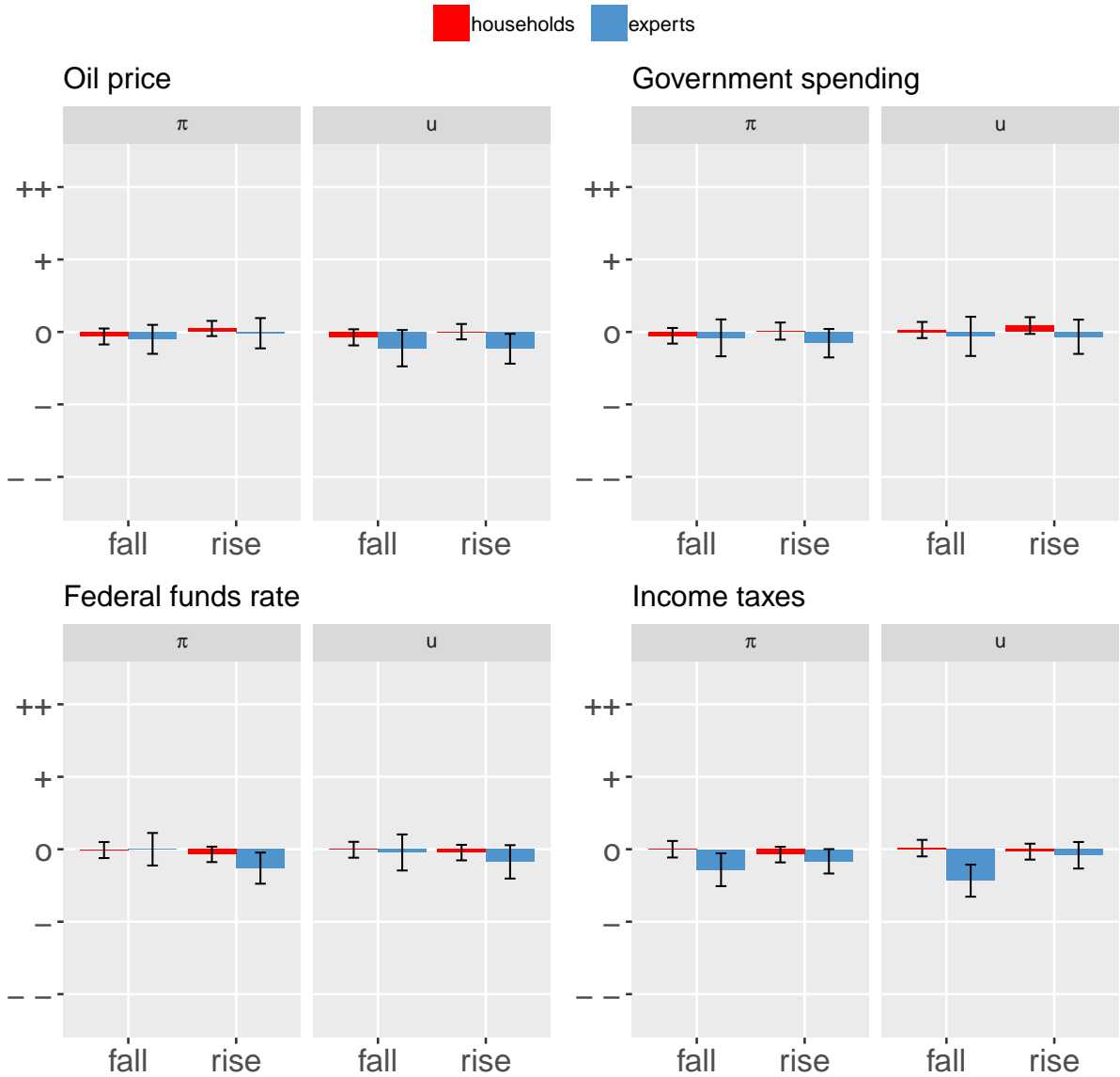
A Additional figures

Figure A.1: Overview of raw data: Predictions



Notes: This Figure provides an overview of the raw data for experts and respondents from the representative sample across the different vignettes.

Figure A.2: Overview of raw data: Confidence in predictions
Confidence in inflation and unemployment expectations



Notes: This figure provides an overview of the raw data on confidence in the predictions of the unemployment and inflation rate across the different scenarios.

B Additional tables

Table A1: Comparison of the representative online panel with the 2017 American Community Survey

Variable	ACS (2017)	Rep. online panel
Female	0.51	0.54
Age	47.43	48.81
At least bachelor's degree	0.30	0.33
Household net income (median)	65,700	62,500
Northeast	0.18	0.23
Midwest	0.21	0.20
South	0.38	0.39
West	0.24	0.18

Notes: This table compares the distributions of individual characteristics in our sample and in the ACS.

Table A2: Summary statistics: Covariates in the expert sample

	Mean	SD	Median	Min.	Max.	Obs.
Male	0.82	0.39	1.00	0.00	1.00	179
Assistant Professor	0.15	0.35	0.00	0.00	1.00	179
Associate Professor	0.07	0.25	0.00	0.00	1.00	179
Full Professor	0.16	0.37	0.00	0.00	1.00	179
PhD Student	0.15	0.35	0.00	0.00	1.00	179
Economist at Policy Institution	0.35	0.48	0.00	0.00	1.00	179
Economist at University	0.65	0.48	1.00	0.00	1.00	179

Notes: This Table provides an overview the summary statistics of the expert sample.

Table A3: Summary statistics: Outcomes in the representative online Panel

	Mean	SD	Median	Min.	Max.	Obs.
Unempl.: Oil constant	4.26	1.34	4.00	0.00	10.00	534
Unempl.: Oil rise	4.72	1.38	4.50	0.80	10.00	276
Unempl.: Oil fall	3.97	1.51	3.95	0.00	10.00	258
Infl.: Oil constant	2.16	1.38	1.80	-2.00	8.00	534
Infl.: Oil rise	2.93	1.53	2.50	-2.00	8.00	276
Infl.: Oil fall	1.81	1.57	1.50	-2.00	8.00	258
Unempl.: Gov constant	4.47	1.43	4.10	0.90	10.00	522
Unempl.: Gov rise	4.45	1.51	4.00	1.20	10.00	253
Unempl.: Gov fall	4.53	1.43	4.30	0.00	10.00	269
Infl.: Gov constant	2.55	1.35	2.10	-0.60	8.00	522
Infl.: Gov rise	2.67	1.41	2.30	-0.40	8.00	253
Infl.: Gov fall	2.31	1.35	1.90	0.00	8.00	269
Unempl.: Int constant	4.25	1.29	4.00	0.00	10.00	565
Unempl.: Int rise	4.53	1.35	4.30	0.10	10.00	289
Unempl.: Int fall	4.10	1.20	4.00	0.80	8.00	276
Infl.: Int constant	2.21	1.26	1.80	-0.30	8.00	565
Infl.: Int rise	2.40	1.28	2.00	-0.50	8.00	289
Infl.: Int fall	2.11	1.19	1.90	-1.30	8.00	276
Unempl.: Tax constant	4.29	1.24	4.00	0.00	10.00	549
Unempl.: Tax rise	4.60	1.39	4.30	1.30	10.00	281
Unempl.: Tax fall	4.08	1.21	4.00	0.10	10.00	268
Infl.: Tax constant	2.19	1.21	1.90	-2.00	8.00	549
Infl.: Tax rise	2.43	1.38	2.00	-0.30	8.00	281
Infl.: Tax fall	2.07	1.11	1.90	-2.00	7.00	268
Confidence unemployment: Oil	-0.03	0.90	0.00	-2.00	2.00	534
Confidence unemployment: Gov	0.06	0.93	0.00	-2.00	2.00	522
Confidence unemployment: Int	-0.01	0.92	0.00	-2.00	2.00	565
Confidence unemployment: Tax	-0.00	0.93	0.00	-2.00	2.00	549
Confidence inflation: Oil	0.00	0.89	0.00	-2.00	2.00	534
Confidence inflation: Gov	-0.02	0.92	0.00	-2.00	2.00	522
Confidence inflation: Int	-0.04	0.92	0.00	-2.00	2.00	565
Confidence inflation: Tax	-0.03	0.92	0.00	-2.00	2.00	549
Total correct: Predictions	1.95	1.06	2.00	0.00	4.00	1085
Total correct: unemployment	1.01	0.75	1.00	0.00	2.00	1085
Total correct: inflation	0.94	0.70	1.00	0.00	2.00	1085
Total correct: both	0.47	0.62	0.00	0.00	2.00	1085
Fraction: Correct mechanism questions	0.63	0.22	0.69	0.00	1.00	1085

Notes: This Table provides an overview the summary statistics of the representative online panel.

Table A4: Summary statistics: Outcomes in the expert sample

	Mean	SD	Median	Min.	Max.	Obs.
Unempl.: Oil constant	4.10	0.46	4.00	2.90	5.50	103
Unempl.: Oil rise	4.40	0.65	4.40	2.30	6.00	55
Unempl.: Oil fall	3.97	0.61	3.90	3.00	5.90	48
Infl.: Oil constant	1.80	0.47	1.60	1.00	3.90	103
Infl.: Oil rise	2.28	0.60	2.20	1.20	4.00	55
Infl.: Oil fall	1.38	0.67	1.40	-1.00	3.10	48
Unempl.: Gov constant	4.07	0.61	4.00	0.00	5.50	94
Unempl.: Gov rise	3.77	0.41	3.80	2.30	5.00	45
Unempl.: Gov fall	4.38	0.84	4.40	0.00	6.10	49
Infl.: Gov constant	1.77	0.61	1.80	-2.00	5.10	94
Infl.: Gov rise	2.22	0.54	2.20	0.90	4.30	45
Infl.: Gov fall	1.38	0.58	1.40	-2.00	2.00	49
Unempl.: Int constant	4.13	0.47	4.00	3.00	5.90	90
Unempl.: Int rise	4.50	0.62	4.40	3.50	6.70	45
Unempl.: Int fall	3.95	0.52	3.90	2.80	5.00	45
Infl.: Int constant	1.84	0.42	1.80	0.70	3.80	90
Infl.: Int rise	1.52	0.49	1.50	0.00	3.00	45
Infl.: Int fall	2.07	0.55	2.00	1.30	3.50	45
Unempl.: Tax constant	4.05	0.56	4.00	0.00	5.00	101
Unempl.: Tax rise	4.32	0.41	4.30	3.50	5.20	48
Unempl.: Tax fall	3.80	0.65	3.90	0.00	5.00	53
Infl.: Tax constant	1.78	0.70	1.60	-2.00	6.70	101
Infl.: Tax rise	1.58	0.32	1.50	1.00	2.50	48
Infl.: Tax fall	1.97	0.73	2.00	-2.00	4.40	53
Confidence unemployment: Oil	-0.22	0.84	0.00	-2.00	2.00	103
Confidence unemployment: Gov	-0.06	0.89	0.00	-2.00	2.00	94
Confidence unemployment: Int	-0.12	0.82	0.00	-2.00	2.00	90
Confidence unemployment: Tax	-0.27	0.76	0.00	-2.00	1.00	101
Confidence inflation: Oil	-0.06	0.76	0.00	-2.00	1.00	103
Confidence inflation: Gov	-0.12	0.80	0.00	-2.00	2.00	94
Confidence inflation: Int	-0.13	0.77	0.00	-2.00	2.00	90
Confidence inflation: Tax	-0.23	0.73	0.00	-2.00	2.00	101
Total correct: Predictions	3.36	1.53	3.00	0.00	8.00	174
Total correct: unemployment	1.62	0.87	2.00	0.00	4.00	174
Total correct: inflation	1.74	0.86	2.00	0.00	4.00	174
Total correct: both	1.39	0.94	1.00	0.00	4.00	174

Notes: This Table provides an overview the summary statistics of the expert sample.

Table A5: The effect of incentives

Panel A: Incentives						
	total $\Delta\pi\checkmark$	total $\Delta u\checkmark$	total both \checkmark	total \checkmark	time instructions	time vignettes
	(1)	(2)	(3)	(4)	(5)	(6)
incentives	0.087** (0.043)	-0.000 (0.046)	0.076** (0.038)	0.087 (0.065)	-0.537 (10.361)	38.589*** (13.236)
Constant	0.894*** (0.030)	1.015*** (0.033)	0.433*** (0.026)	1.909*** (0.045)	112.689*** (9.261)	165.001*** (6.490)
Observations	1,063	1,063	1,063	1,063	1,063	1,063
R ²	0.004	0.000	0.004	0.002	0.000	0.008

Panel B: Incentives crossed with subjective perception of expert accuracy						
	total $\Delta\pi\checkmark$	total $\Delta u\checkmark$	total both \checkmark	total \checkmark	time instructions	time vignettes
	(1)	(2)	(3)	(4)	(5)	(6)
incentives	0.081* (0.044)	-0.000 (0.046)	0.077** (0.038)	0.081 (0.066)	-0.812 (10.419)	38.939*** (13.004)
incentives \times exp. acc.	-0.021 (0.031)	-0.044 (0.033)	-0.034 (0.027)	-0.065 (0.049)	7.507 (6.665)	13.360 (16.770)
Constant	0.897*** (0.030)	1.013*** (0.034)	0.433*** (0.026)	1.910*** (0.045)	112.906*** (9.351)	164.871*** (6.537)
Observations	1,049	1,049	1,049	1,049	1,049	1,049
R ²	0.004	0.002	0.005	0.003	0.001	0.010

Panel C: Incentives for the mechanism questions		
	total mechanism score	time mechanism questions
	(1)	(2)
incentives	0.035 (0.066)	13.637 (14.873)
Constant	-0.024 (0.054)	234.530*** (11.090)
Observations	1,063	1,063
R ²	0.000	0.001

Notes: This table provides an overview of the effect of incentives on the accuracy of responses. A forecast is classified as “correct” if it follows the same qualitative direction as the mean expert forecast.

Table A6: Robustness: Order effects

Panel D: Order effects on forecasts of households								
	oil price		gov. spending		fed. funds rate		income taxes	
	$\Delta\pi$	Δu	$\Delta\pi$	Δu	$\Delta\pi$	Δu	$\Delta\pi$	Δu
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
fall	-0.445*** (0.136)	-0.141 (0.115)	-0.294*** (0.097)	0.073 (0.104)	-0.208** (0.092)	0.072 (0.090)	-0.146* (0.078)	-0.167* (0.097)
rise	0.869*** (0.145)	0.474*** (0.106)	-0.016 (0.128)	-0.155 (0.101)	0.210*** (0.072)	0.081 (0.100)	0.096 (0.098)	0.272*** (0.101)
fall \times u. first	0.119 (0.140)	-0.054 (0.135)	0.162 (0.115)	0.198* (0.120)	-0.015 (0.146)	-0.291** (0.127)	0.040 (0.100)	-0.085 (0.116)
rise \times u. first	-0.073 (0.155)	-0.108 (0.129)	0.108 (0.119)	0.155 (0.126)	-0.015 (0.089)	0.039 (0.124)	0.024 (0.107)	-0.042 (0.122)
fall \times 2nd vig.	0.128 (0.140)	-0.143 (0.135)	-0.036 (0.117)	-0.210* (0.121)	0.198 (0.145)	0.077 (0.126)	0.142 (0.102)	0.093 (0.116)
rise \times 2nd vig.	-0.134 (0.156)	-0.022 (0.124)	0.147 (0.124)	0.090 (0.117)	-0.039 (0.090)	0.130 (0.123)	0.153 (0.108)	0.018 (0.121)
Observations	527	527	513	513	551	551	535	535
R ²	0.202	0.101	0.040	0.020	0.033	0.025	0.036	0.054

Panel E: Order effects on forecasts of experts								
	oil price		gov. spending		fed. funds rate		income taxes	
	$\Delta\pi$	Δu	$\Delta\pi$	Δu	$\Delta\pi$	Δu	$\Delta\pi$	Δu
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
fall	-0.641*** (0.110)	-0.137 (0.093)	-0.323*** (0.053)	0.384*** (0.085)	0.156 (0.112)	-0.255** (0.122)	0.227** (0.112)	-0.268*** (0.085)
rise	0.583*** (0.093)	0.099 (0.104)	0.433*** (0.102)	-0.143* (0.082)	-0.348*** (0.116)	0.329*** (0.093)	-0.207*** (0.067)	0.240*** (0.065)
fall \times u. first	0.069 (0.183)	-0.009 (0.152)	-0.038 (0.064)	-0.024 (0.117)	-0.052 (0.123)	0.126 (0.128)	-0.138 (0.156)	0.060 (0.091)
rise \times u. first	-0.138 (0.111)	0.123 (0.105)	-0.191 (0.148)	-0.208 (0.127)	0.100 (0.115)	0.065 (0.092)	0.240* (0.134)	-0.160 (0.125)
fall \times 2nd vig.	0.204 (0.199)	-0.053 (0.164)	0.113* (0.064)	-0.067 (0.117)	0.076 (0.131)	0.066 (0.136)	0.104 (0.161)	0.015 (0.093)
rise \times 2nd vig.	-0.029 (0.119)	0.276** (0.108)	0.031 (0.148)	-0.232* (0.133)	0.113 (0.116)	0.011 (0.097)	-0.158 (0.109)	0.163 (0.107)
fall \times 3rd+ vig.	0.699*** (0.255)	0.262 (0.281)	0.062 (0.081)	0.107 (0.148)	0.170 (0.112)	-0.058 (0.139)	0.012 (0.128)	0.074 (0.143)
rise \times 3rd+ vig.	0.025 (0.149)	0.196 (0.143)	-0.221 (0.306)	-0.186 (0.158)	-0.152 (0.191)	-0.161 (0.104)	-0.289 (0.287)	-0.016 (0.287)
Observations	105	105	94	94	91	91	101	101
R ²	0.514	0.271	0.461	0.502	0.273	0.348	0.233	0.371

Notes: This table provides analyzes the relevance of order effects.

C Details on the derivation of the theoretical and empirical benchmarks

In this sections we provide details on the assumptions and calculations used to turn the empirical and theoretical evidence on each shock into comparable multipliers. We use an Okun's Law coefficient of -0.4, based on Ball et al. (2017), which implies a 0.4 percentage point rise in unemployment associated to a 1 percent fall in output over the course of a year. Below, Δy_4 indicates a percent fall in output over four quarters, and $\Delta\pi_4$ and Δu_4 are the respective four quarter changes of inflation and the unemployment rate in percentage points.⁵ In each case, the following five key steps are involved: 1) identifying the size of the shock in the source paper(s), 2) identifying the size of the response of the variables of interest in the source paper(s), 3) determining the size of the shock in the vignettes, 4) rescaling the shocks from the source papers to be of the same size as those from the vignettes, 5) translating output changes into unemployment changes when needed. All calculations contain a small degree of approximation.

Oil price - Empirical Source: Blanchard and Galí (2010), Figure 1, Panel B (i.e. post-84). 1) Shock is 10% change in price. 2) $\Delta y = -0.2$, $\Delta\pi = 0.25$. 3) Size of shock in vignette 57% so we multiply the original shocks by 5 or 6. 4) $\Delta y = -1$ to -1.2 , $\Delta\pi = 1.25$ to -1.5 . 5) Okun's Law: $\Delta u = 0.4$ to 0.45 .

Oil price - Empirical Source: Bodenstein et al. (2011), Figure 2. 1) Shock is 8% change in price 2) $\Delta y = -0.15$. 3) Size of shock in vignette 57% so we multiply the original shocks by 6 or 7. 4) $\Delta y = -0.9$ to -1.05 5) Okun's Law: $\Delta u = 0.35$ to 0.4 .

Source: Balke and Brown (2018), Figure 3. 1) Shock is 2.5% change in price 2) $\Delta y = -0.1$. 3) Size of shock in vignette 57% so we approximately multiply the original shocks by 20. 4) $\Delta y = -2$ 5) Okun's Law: $\Delta u = 0.8$.

Government spending - Empirical Source: Blanchard and Perotti (2002), Ramey (2011) and sources therein, Auerbach and Gorodnichenko (2012). 1) Shock is 1% of

⁵In the case of government and tax shocks in the model of Galí et al. (2011), the responses of output and unemployment exhibited very low persistence, likely due to the specification of the shock process itself. We therefore opted for using the average change over for four quarters rather than the change in the fourth quarter only.

GDP 2) $\Delta y=0.8$ to 1.5. 3) Size of shock in vignette is 1.5% of 4.2 trillion of government spending. US 2018 GDP is 20.89 trillion according to the Bureau of Economic Analysis, so the shock is about 1.5% of 20% of GDP, which is 0.3% of GDP. So we divide the original shock by 3. 4) $\Delta y=-.3$ to .) Okun's Law: $\Delta u = 0.8$.

Government spending - Theory Source: Galí et al. (2011), Figure 3. 1) Size of shock is 0.47, with exogenous spending formulated in percent of output, so it can be interpreted as 0.5% of GDP. 2) $\Delta u=-0.1$, $\Delta\pi=0.2$. 3) To rescale, multiply by 2 to make it 1% of GDP and divide by 3 to make it comparable to the vignette. 4) $\Delta u=0.06$, $\Delta\pi=0.12$.

Source: Smets and Wouters (2007), Figure 2. 1) Size of shock is 0.5, with exogenous spending formulated in percent of output, so it can be interpreted as 0.5% of GDP. 2) $\Delta y=0.3$, $\Delta\pi=0.15$. 3) To rescale, multiply by 2 to make it 1% of GDP and divide by 3 to make it comparable to the vignette. 4) $\Delta y=0.18$, $\Delta\pi = 0.1$. 5) Okun's Law: $\Delta u=-0.07$

Source: Zubairy (2014), Table 2. 1) Size of shock is 1% of GDP. 2) $\Delta y=1$. 3) Divide by 3 to make it comparable to the vignette. 4) $\Delta y=0.3$. 5) Okun's Law: $\Delta u=-0.12$

Monetary policy - Empirical Source: Arias et al. (2019) Figure 5 (i.e. estimation on full post-WWII sample, imposing a zero restriction on the systematic response of monetary policy to commodity prices). 1) Shock size is 0.25 percentage points. 2) $\Delta y=-0.25$, $\Delta\pi=-0.1$. 3) To make the shock comparable to the vignette, we multiply by 2. 4) $\Delta y=-0.5$, $\Delta\pi=-0.2$. 5) Okun's Law: $\Delta u=0.2$.

Monetary policy - Theory Source: Galí et al. (2011), Figure 3. 1) Size of shock is 0.15 percentage points 2) $\Delta u=-0.15$, $\Delta\pi=-0.05$. 3) We approximately multiply by 3.3 to make it comparable to the vignette. 4) $\Delta u=0.5$, $\Delta\pi=-0.15$.

Source: Smets and Wouters (2007), Figure 2. 1) Size of shock is 0.175. 2) $\Delta y=-0.35$, $\Delta\pi=-0.05$. 3) We approximately multiply by 3.3 to make it comparable to the vignette. 4) $\Delta y=1$, $\Delta\pi = 0.16$. 5) Okun's Law: $\Delta u=0.4$

Tax rate change - Empirical Source: Blanchard and Perotti (2002), Romer and Romer (2010), Favero and Giavazzi (2012), Mertens and Ravn (2012, 2014), and Perotti (2012). 1) Shock size is a 1% of GDP increase in tax revenue. 2) Range of empirical

output multipliers at 4 to 6 quarters is 1 to 3 percent of GDP. 3) The shock size in the vignette is approximately 0.5 percent of GDP. So we divide by 2 to make the shock comparable to the vignette. 4) $\Delta y=0.5$ to 1.5. 5) Okun's Law: 0.2 to 0.6.

Tax rate change - Theory Source: Zubairy (2014), Table 2. 1) Size of shock is 1% of GDP. 2) $\Delta y=0.32$. 3) Divide by 2 to make it comparable to the vignette. 4) $\Delta y=0.15$. 5) Okun's Law: $\Delta u=-0.06$

D Details on the expert survey

We compiled a list of participants of the following conferences:

- SITE Macroeconomics of Uncertainty and Volatility (2018, 2017, 2016)
- SITE Macroeconomics and Inequality (2018)
- Cowles macro conference (2018, 2017, 2016)
- NBER Annual Conference on Macroeconomics (2018, 2017, 2016)
- ifo Conference on “Macroeconomics and Survey Data” (2018, 2017, 2016)
- Venice Summer Institute on Expectation Formation (2018)
- Workshop on Subjective Expectations NY Fed (2016)

We also recruited a sample of graduate students in macroeconomics from the following institutions:

- University of Bonn
- Goethe University Frankfurt
- University of Oxford

Finally, we also recruited a sample of economists from the following policy institutions:

- The Federal Reserve Board, Washington D.C.
- The International Monetary Fund, Washington D.C.
- Bank for International Settlements, Basel
- Deutsche Bundesbank, Frankfurt
- European Central Bank, Frankfurt
- ifo centre, Munich

Below is a list of some of institutions that our experts have as their main institution: Kellogg School of Management, Northwestern University, University of Cologne, Haverford College, University of Minnesota, Ross School of Business, University of Michigan, Federal Reserve Bank of Boston, University of Amsterdam, Boston University, Questrom School of Business, Federal Reserve Bank of St. Louis, Goethe University Frankfurt, LMU Munich, University of Notre Dame, University of California, San Diego, University of Oxford, Temple University, International Monetary Fund, University of Toronto, Carleton University, Yale University, Federal Reserve Board, University of Copenhagen, University of Bologna, Georgia Institute of Technology, Atlanta, Statistics Norway, Deutsche Bundesbank, Frankfurt School of Finance & Management, Johns Hopkins University, Baltimore, Brandeis University, Federal Reserve Bank of Cleveland, Bank of England, MIT Sloan School of Management, Rand Corporation, University of Copenhagen, International Monetary Fund, Swiss National Bank, Department of Economics, Boston College, University of Reading, UNC Kenan-Flagler Business School, Bonn Graduate School of Economics, Institute for Employment Research Friedrich-Alexander University (FAU), Erlangen-Nuremberg, College of Business, Clemson University, ifo Institute Munich, Stockholm University, Banque de France/ University of Nantes, Uppsala University, World Bank, University of St.Gallen, Austrian Institute of Economic Research, Copenhagen Business School, University of Erlangen-Nürnberg, Federal Reserve Bank of Minneapolis, NYU Stern School of Business, University of Bonn, Mannheim University, University of Manchester, University College London, University of Lausanne, Arizona State University, University of Birmingham, Federal Reserve Bank of Chicago, European Central Bank, Bank for International Settlements, Basel, University of Maryland, Amsterdam School of Economics, Columbia University, Christian Albrechts University at Kiel, Princeton University, Stockholm School of Economics, University of Chicago, Booth School of Business, University of Warwick, Leibniz University Hannover, University of Heidelberg, University of Copenhagen, Northwestern University, New York University, Federal Reserve Bank of Minneapolis, Deutsche Bundesbank, Indiana University, Karlsruhe Institute of Technology, European Central Bank

E Experimental instructions

Introductory explanations

About this study

This study is about your **beliefs about the future development of the US economy**, in particular the **unemployment rate** and the **inflation rate**.

Your first task will be to estimate the future development of both of these rates in hypothetical scenarios.



Incentive explanation

About this study

You can earn additional panel points based on the accuracy of your responses in this first task.

We have asked economic experts the same questions you will be asked. They were also invited to assess the future development of the unemployment and inflation rate under the same scenarios that you will encounter. They have provided us with their best predictions of the most likely development of both variables in the different scenarios.

To encourage accuracy, you may earn additional panel points if your responses are close to the experts' responses.

Specifically, your response to one randomly selected question will be compared to the experts' responses. If your response is at most 0.2 percentage points away from the average response of the experts, you will earn additional panel points equivalent to the value of \$0.50.

Thus, throughout the survey please keep in mind that **the more accurate your responses, the higher the chance is that you earn additional panel points.**

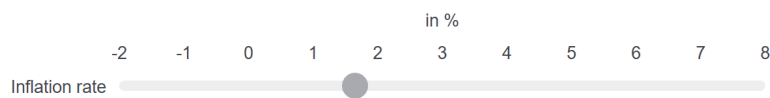
(Possible rewards will be calculated and transferred a few weeks after the survey is completed.)



Explanation on how to respond

How to respond

In the following, we will often ask you how high you think the unemployment and inflation rates will be in the future. You will respond on scales that look as follows:



The default positions of the sliders correspond to the current level of the respective rates. The unemployment rate is currently at 4.0%. The inflation rate is currently at 1.6%.

To answer a question, move the slider to the desired value. If you think that the rate will stay at its current value, simply click on the slider so that your response is registered. Your response will also be displayed in numbers on the right side of the slider.

Finally, please note that the scale for the unemployment rate ranges from 0% to 10%, while the scale for the inflation rate ranges from -2% to 8% to account for the possibility of deflation.



The main part of the survey begins when you press on the next button. Please try to **make your responses as accurate as possible.**

It is very important for the success of our research that you answer to the best of your knowledge and read the questions very carefully before answering.



Definitions

The **unemployment rate** is a measure of the amount of unemployment in a country. It is defined as the fraction of people who are unemployed out of all people that are willing to work, or, put differently, the percentage of people who are willing to work that do not have a job. The current unemployment rate in the United States is 4.0%. This means that 4.0% of Americans who are willing to work are unemployed. In other words, out of 1000 Americans who want to work, 40 do not have a job.

The **inflation rate** measures how much prices in the economy rise from year to year. It is defined as the yearly growth of the general price level of goods and services. The current inflation rate in the United States is 1.6%. This means that, on average, prices for goods and services rose by 1.6% in the last 12 months which is to say that a typical bundle of goods and services that cost \$1000 last year costs \$1016 today. If the inflation rate is negative, it is referred to as deflation. This means that goods and services become less expensive from one year to the next.



Oil price vignette

Oil price: introduction

The price of crude oil

The following scenarios deal with the price of crude oil. In the last week, the price of one barrel of crude oil averaged \$54.



Oil price: baseline scenario

We would like you to think about the following hypothetical scenario.

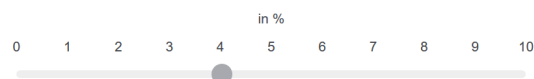
Scenario: Oil price stays constant

Imagine that the average **price of crude oil** stays **constant** over the next 12 months. That is, on average, the price of oil over the next 12 months will be the same as the current price.

Unemployment rate

Under this scenario, what do you think the US **unemployment rate** will be 12 months from now?

Note: The default position of the slider is the current level of the unemployment rate: 4.0%



Inflation rate

Under this scenario, what do you think the US **inflation rate** will be over the next 12 months?

Note: The default position of the slider is the current level of the inflation rate: 1.6%



Oil price: fall scenario

We would like you to think about the following hypothetical scenario.

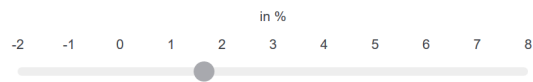
Scenario: Oil price falls

Imagine the average **price of crude oil** unexpectedly **falls** due to improvements in the local production technology in the Middle East. On average, the price will be \$30 lower **for the next 12 months** than the current price. That is, the price will be on average \$24 for the next 12 months.

Inflation rate

Under this scenario, what do you think the US **inflation rate** will be over the next 12 months?

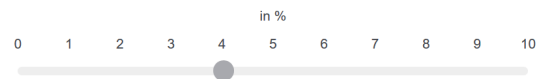
Note: The default position of the slider is the current level of the inflation rate: 1.6%



Unemployment rate

Under this scenario, what do you think the US **unemployment rate** will be 12 months from now?

Note: The default position of the slider is the current level of the unemployment rate: 4.0%



Oil price: rise scenario

We would like you to think about the following hypothetical scenario.

Scenario: Oil price rises

Imagine the average **price of crude oil** unexpectedly **rises** due to a problem with the local production technology in the Middle East. On average, the price will be \$30 higher **for the next 12 months** than the current price. That is, the price will be on average \$84 for the next 12 months.

Unemployment rate

Under this scenario, what do you think the US **unemployment rate** will be 12 months from now?

Note: The default position of the slider is the current level of the unemployment rate: 4.0%



Inflation rate

Under this scenario, what do you think the US **inflation rate** will be over the next 12 months?

Note: The default position of the slider is the current level of the inflation rate: 1.6%



Government spending vignette

Government spending vignette: introduction

Federal government spending

The following scenarios deal with yearly federal government spending. In the 2018 financial year, the federal government spent roughly \$4.2 trillion on diverse issues such as social security, health, military, or education. This amounts to roughly 1/3 of the value of all final goods and services produced by the US economy in one year (known as the gross domestic product).

Government spending typically increases every year, reflecting the general growth of the economy. For the last 50 years, for instance, it increased by an average of 2.9% each year.



Government spending: baseline scenario

We would like you to think about the following hypothetical scenario.

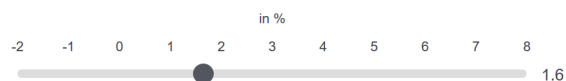
Scenario: Government spending grows as usual

Imagine **federal government spending grows as usual** over the next 12 months. That is, it grows at a rate that equals the usual growth that took place in the previous years.

Inflation rate

Under this scenario, what do you think the US **inflation rate** will be over the next 12 months?

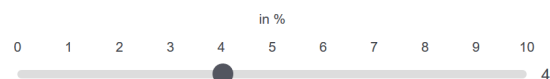
Note: The default position of the slider is the current level of the inflation rate: 1.6%



Unemployment rate

Under this scenario, what do you think the US **unemployment rate** will be 12 months from now?

Note: The default position of the slider is the current level of the unemployment rate: 4.0%



Government spending: fall scenario

We would like you to think about the following hypothetical scenario.

Scenario: Government spending grows less

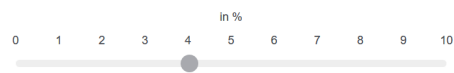
Imagine **federal government spending** unexpectedly **grows to a smaller extent** than usual over the next 12 months due to **cuts in spending** on defense. In particular, it grows by 2.4 percentage points less than the usual growth that took place in the previous years.

The government announces: The change is temporary and occurs despite no changes in the government's assessment of national security or economic conditions. Moreover, **federal taxes** do not change in response to the spending cut.

Unemployment rate

Under this scenario, what do you think the US **unemployment rate** will be 12 months from now?

Note: The default position of the slider is the current level of the unemployment rate: 4.0%



Inflation rate

Under this scenario, what do you think the US **inflation rate** will be over the next 12 months?

Note: The default position of the slider is the current level of the inflation rate: 1.6%



Government spending: rise scenario

We would like you to think about the following hypothetical scenario.

Scenario: Government spending grows more

Imagine **federal government spending** unexpectedly **grows to a larger extent** than usual over the next 12 months due to a newly announced **spending program** on defense. In particular, it grows by 2.4 percentage points more than the usual growth that took place in the previous years.

The government announces: The change is temporary and occurs despite no changes in the government's assessment of national security or economic conditions. Moreover, federal taxes do not change in response to the spending program.

Inflation rate

Under this scenario, what do you think the US **inflation rate** will be over the next 12 months?

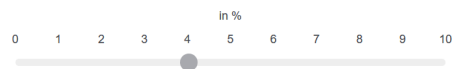
Note: The default position of the slider is the current level of the inflation rate: 1.6%



Unemployment rate

Under this scenario, what do you think the US **unemployment rate** will be 12 months from now?

Note: The default position of the slider is the current level of the unemployment rate: 4.0%



Interest rate vignette

Interest rate vignette: introduction

The federal funds target rate

The following scenarios deal with the federal funds target rate. This is the most **important interest rate in the economy**. The value of the rate influences how “costly” it is for banks to acquire money, thereby influencing interest rates on other important financial products such as savings accounts, consumer loans, mortgages, or loans to firms.

The federal funds target rate is the interest rate frequently discussed in the news. It is set by the Federal Open Market Committee (FOMC), which normally meets eight times a year. Currently, the rate is 2.5%.



Interest rate: baseline scenario

We would like you to think about the following hypothetical scenario.

Scenario: Federal funds target rate stays constant

Imagine the **federal funds target rate** stays **constant**. That is, in its next meeting, the Federal Open Market Committee announces that it will keep the rate constant.

Imagine the committee announces it does so with no changes in their assessment of the economic conditions.

Unemployment rate

Under this scenario, what do you think the US **unemployment rate** will be 12 months from now?

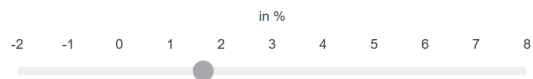
Note: The default position of the slider is the current level of the unemployment rate: 4.0%



Inflation rate

Under this scenario, what do you think the US **inflation rate** will be over the next 12 months?

Note: The default position of the slider is the current level of the inflation rate: 1.6%



Interest rate: fall scenario

We would like you to think about the following hypothetical scenario.

Scenario: Federal funds target rate falls

Imagine the **federal funds target rate** is unexpectedly **0.5 percentage points lower**. That is, in its next meeting, the Federal Open Market Committee announces that it is reducing the rate from 2.5% to 2%.

Imagine the committee announces it does so with no changes in their assessment of the economic conditions.

Unemployment rate

Under this scenario, what do you think the US **unemployment rate** will be 12 months from now?

Note: The default position of the slider is the current level of the unemployment rate: 4.0%



Inflation rate

Under this scenario, what do you think the US **inflation rate** will be over the next 12 months?

Note: The default position of the slider is the current level of the inflation rate: 1.6%



Interest rate: rise scenario

We would like you to think about the following hypothetical scenario.

Scenario: Federal funds target rate rises

Imagine the **federal funds target rate** is unexpectedly **0.5 percentage points higher**. That is, in its next meeting, the Federal Open Market Committee announces that it is raising the rate from 2.5% to 3%.

Imagine the committee announces it does so with no changes in their assessment of the economic conditions.

Unemployment rate

Under this scenario, what do you think the US **unemployment rate** will be 12 months from now?

Note: The default position of the slider is the current level of the unemployment rate: 4.0%



Inflation rate

Under this scenario, what do you think the US **inflation rate** will be over the next 12 months?

Note: The default position of the slider is the current level of the inflation rate: 1.6%



Taxation vignette

Taxation vignette: introduction

The federal income tax rates

The following scenarios deal with the income tax rates in the US. The tax rates specify the percentage of their income that households need to pay to the federal government. At present, a typical household pays 21.1 percent of its income to the federal government in taxes.



Taxation: baseline scenario

We would like you to think about the following hypothetical scenario.

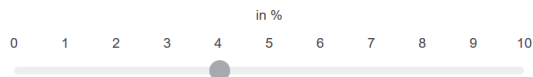
Scenario: Income tax rates stay constant

Imagine that **income tax rates** stay **constant** for all US citizens over the next 12 months.

Unemployment rate

Under this scenario, what do you think the US **unemployment rate** will be 12 months from now?

Note: The default position of the slider is the current level of the unemployment rate: 4.0%



Inflation rate

Under this scenario, what do you think the US **inflation rate** will be over the next 12 months?

Note: The default position of the slider is the current level of the inflation rate: 1.6%



Taxation: fall scenario

We would like you to think about the following hypothetical scenario.

Scenario: Income tax rates decrease

Imagine that **income tax rates** are **1 percentage point lower** for all US citizens over the next 12 months. This means that the typical US household would **pay about \$400 less in taxes**.

The government announces: The tax change is temporary and occurs despite no changes in the government's assessment of the economic conditions. Moreover, government spending does not change in response to the tax cut.

Unemployment rate

Under this scenario, what do you think the US **unemployment rate** will be 12 months from now?

Note: The default position of the slider is the current level of the unemployment rate: 4.0%



Inflation rate

Under this scenario, what do you think the US **inflation rate** will be over the next 12 months?

Note: The default position of the slider is the current level of the inflation rate: 1.6%



Taxation: rise scenario

We would like you to think about the following hypothetical scenario.

Scenario: Income tax rates increase

Imagine that **income tax rates** are **1 percentage point higher** for all US citizens over the next 12 months. This means that the typical US household would **pay about \$400 more in taxes**.

The government announces: The tax change is temporary and occurs despite no changes in the government's assessment of the economic conditions. Moreover, government spending does not change in response to the tax increase.

Unemployment rate

Under this scenario, what do you think the US **unemployment rate** will be 12 months from now?

Note: The default position of the slider is the current level of the unemployment rate: 4.0%



Inflation rate

Under this scenario, what do you think the US **inflation rate** will be over the next 12 months?

Note: The default position of the slider is the current level of the inflation rate: 1.6%



Example vignette with incentives

Government spending: baseline scenario - with incentives

We would like you to think about the following hypothetical scenario.

Scenario: Government spending grows as usual

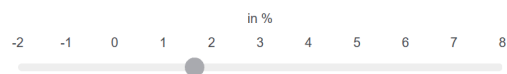
Imagine **federal government spending grows as usual** over the next 12 months. That is, it grows at a rate that equals the usual growth that took place in the previous years.

Reminder: If your answer to the following questions is at most 0.2 percentage points away from the average responses of the experts, you can earn additional panel points.

Inflation rate

Under this scenario, what do you think the US **inflation rate** will be over the next 12 months?

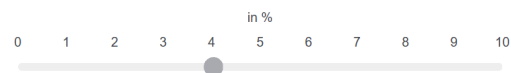
Note: The default position of the slider is the current level of the inflation rate: 1.6%



Unemployment rate

Under this scenario, what do you think the US **unemployment rate** will be 12 months from now?

Note: The default position of the slider is the current level of the unemployment rate: 4.0%



Government spending: fall scenario - with incentives

We would like you to think about the following hypothetical scenario.

Scenario: Government spending grows less

Imagine **federal government spending** unexpectedly **grows to a smaller extent** than usual over the next 12 months due to **cuts in spending** on defense. In particular, it grows by 2.4 percentage points less than the usual growth that took place in the previous years.

The government announces: The change is temporary and occurs despite no changes in the government's assessment of national security or economic conditions. Moreover, federal taxes do not change in response to the spending cut.

Reminder: If your answer to the following questions is at most 0.2 percentage points away from the average responses of the experts, you can earn additional panel points.

Inflation rate

Under this scenario, what do you think the US **inflation rate** will be over the next 12 months?

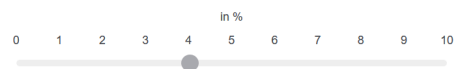
Note: The default position of the slider is the current level of the inflation rate: 1.6%



Unemployment rate

Under this scenario, what do you think the US **unemployment rate** will be 12 months from now?

Note: The default position of the slider is the current level of the unemployment rate: 4.0%



Government spending: rise scenario - with incentives

We would like you to think about the following hypothetical scenario.

Scenario: Government spending grows more

Imagine **federal government spending** unexpectedly **grows to a larger extent** than usual over the next 12 months due to a newly announced **spending program** on defense. In particular, it grows by 2.4 percentage points more than the usual growth that took place in the previous years.

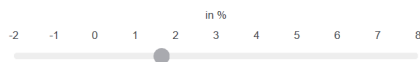
The government announces: The change is temporary and occurs despite no changes in the government's assessment of national security or economic conditions. Moreover, federal taxes do not change in response to the spending program.

Reminder: If your answer to the following questions is at most 0.2 percentage points away from the average responses of the experts, you can earn additional panel points.

Inflation rate

Under this scenario, what do you think the US **inflation rate** will be over the next 12 months?

Note: The default position of the slider is the current level of the inflation rate: 1.6%



Unemployment rate

Under this scenario, what do you think the US **unemployment rate** will be 12 months from now?

Note: The default position of the slider is the current level of the unemployment rate: 4.0%

