The Signaling Effects of Fiscal Announcements in Japan*

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Abstract

A large fiscal stimulus announcement may signal to the private sector how pessimistic the government is about the severity of a recession, impairing the stabilizing effects of the stimulus. Using a theoretical model, we show that these signaling effects occur when the stimulus exceeds expectations and are more noticeable during periods of high economic uncertainty. Analysis of a new dataset of daily stock prices and fiscal news in Japan supports these predictions. We introduce a method to identify fiscal news with different degrees of signaling and find that such signaling effects weaken or, in extreme cases, even undermine the stabilizing impact of the announcements.

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1. Introduction

Fiscal policy is widely regarded as a key tool for stabilizing business cycles. During the COVID-19 pandemic, for instance, many countries enacted substantial fiscal packages to support their economies amidst the widespread crisis. However, assessing the effectiveness of these stabilization policies is inherently difficult, as they are typically implemented in response to endogenous developments, such as a recession. Consequently, the size of these interventions likely reflects policymakers' assessments of the economic outlook. This implies that the announcement of a large fiscal stimulus may be interpreted by the private sector as an indication that the government views the recession as particularly severe. Such an interpretation may worsen private sector expectations about the economic outlook, potentially weakening the stabilizing effects of the fiscal intervention. The objective of this paper is to assess whether these signaling effects are supported by a newly constructed dataset of fiscal news in Japan and to provide the first quantification of these effects for fiscal policy.

We first develop a stylized model to illustrate the theoretical mechanism underlying the signaling effects of fiscal policy. This model provides critical insights that inform the design of our empirical analysis on the signaling role of fiscal policy and yields four central predictions. First, signaling effects emerge when there is asymmetric information between policymakers and the private sector, and when policy actions are interpreted as responses to evolving economic conditions. Second, the magnitude of signaling effects increases with the level of prior uncertainty held by the private sector. Third, signaling effects dampen (or magnify) the impact of a policy action if the private sector expected a smaller (or larger) intervention before the government reveals the size of the fiscal intervention. Fourth, signaling effects do not necessarily reverse the impact of economic policies. A fiscal expansion may still increase output, even if the signaling mechanism partially dampens its effect.

We construct a novel dataset that combines the daily Nikkei 225 index, narrative records of the twenty-one fiscal packages announced by the Japanese government between June 2009 and December 2022, and professional forecasters' projections of government spending from

monthly surveys. These packages were introduced in response to events that threatened to worsen the economic outlook, such as the 2011 earthquake or the COVID-19 pandemic. We use articles from the *Nikkei* newspaper, Japan's leading economic and business daily, to identify the date on which the size of each package first became public.

We focus on Japan because its orderly and predictable process for adopting fiscal packages provides an ideal setting for identifying signaling effects. Each package goes through three stages. At the order stage, the Prime Minister instructs the Cabinet or the ruling parties to prepare a package. At the size stage, the final size of the package becomes public, typically at a meeting of the government and the ruling parties or in a press conference by the Prime Minister. At the ratification stage, the Cabinet approves the supplementary budget that finances the package, after which the Diet passes the budget without revisions. The key institutional feature is that the size of a package is disclosed at the size stage and is not renegotiated thereafter, which allows us to identify the date on which the size first becomes public.[1] We examine the response of stock prices on that date and combine it with the revision in professional forecasters' expectations of government spending between the surveys conducted immediately before and after the announcement, which measures whether, and by how much, the announcement surprised the private sector.

An important preliminary step is to establish how stock prices respond to fiscal news in the absence of signaling effects. To this end, we consider three announcements of public spending that were unrelated to the business cycle and therefore, according to the theory, carried no signal about the government's view of the economic outlook.[2] Stock prices rose in response to each of the three. This positive response of stock prices is not obvious, since news of higher public spending might also raise expectations of future tax increases, such as taxes on dividends or capital gains, or the perceived risk of sovereign default. Stock prices

[1] While fiscal announcements may, in principle, reflect the political orientation of the ruling party rather than an assessment of the economy, the packages examined in this study were introduced in direct response to events that threatened the economic outlook, and were designed primarily to support recovery regardless of specific political agendas.

[2] These are the selection of Japan as the host of the 2019 Rugby World Cup, of Tokyo as the host city of the 2020 Olympic Games, and of Osaka as the host city of the 2025 World Exposition, each of which entailed public investment in infrastructure.

respond markedly differently to the twenty-one fiscal packages: the responses range from positive to strongly negative and average close to zero. Since the stock price response in the absence of signaling effects is positive, a muted or negative response to the packages is what one would expect if their announcement conveyed an adverse signal.

Our daily regressions confirm this interpretation. Following the theory, we relate the change in stock prices on the day the size of a package becomes public to the revision in expected government spending and to the level of uncertainty prevailing before the announcement, measured by the Nikkei VI, the implied volatility of the Nikkei 225. We find that the fiscal announcement that is combined with an upward revision in expected spending lowers stock prices, and that this response is significantly more negative when uncertainty is high: the effect of a fiscal announcement, which triggers a revision in expected government spending that is one standard deviation above average, is about 0.3 percent at an average level of uncertainty and about 1.1 percent when uncertainty is one standard deviation above its mean. This state dependence is evidence of the signaling effects predicted by the theory. It appears only at the size stage; no such pattern is found at the order stage, when the size is not yet known, or at the ratification stage, when it is already known. We show that the pattern is not driven by sovereign risk, since the volatility of government bond futures does not rise on announcement days, nor by macroeconomic news arriving around the announcement, since the revisions in expected spending are essentially unrelated to macroeconomic data surprises and purging them of such surprises leaves the results unchanged. Whether the pattern reflects the anticipation of higher taxes is examined in the VAR analysis, where the response of tax revenues is left unrestricted.

We then quantify the signaling effects of fiscal news on economic activity by estimating a threshold vector autoregression (VAR). We develop a novel identification strategy that distinguishes fiscal news by the strength of its signaling effects. Following the theory, we identify two types of fiscal news shocks through sign restrictions on the co-movement between the revision in expected government spending and the change in stock prices at the size stage: fiscal news with significant signaling effects, on which an upward revision is accompanied

by a fall in stock prices, or a downward revision by a rise, and fiscal news with minor signaling effects, on which the two move in the same direction. Since the theory predicts that signaling effects are stronger under high uncertainty, we estimate the VAR separately for periods of high and low uncertainty, measured by the dispersion of household expectations in the *Consumer Confidence Survey*, a monthly survey conducted by the Cabinet Office. Under high uncertainty, output rises in response to fiscal news with minor signaling effects and falls in response to news with significant signaling effects: news that raises expected government expenditure growth by 10 basis points lowers real GDP by about 0.5 percent at the trough. Under low uncertainty, output does not fall in response to either type of news. Neither type of news generates a sustained increase in tax revenues in either regime, which indicates that the contraction in output does not reflect the anticipation of higher taxes. These results indicate that signaling effects weaken the ability of fiscal policy to stabilize the economy when uncertainty is high and, in extreme cases, can offset or even reverse the expansionary impact of an announced stimulus.

Our identification strategy differs from that of the existing literature on signaling effects in a way that is worth emphasizing. Studies of central bank communication (e.g., Campbell et al., 2012, 2017; Nakamura and Steinsson, 2018) have sought to detect signaling effects by asking whether private sector expectations react with the "wrong sign," that is, a sign that standard economic models cannot explain. As our stylized model shows, this criterion is too restrictive: signaling effects may merely moderate the impact of a policy rather than reverse it, in which case expectations react with the "right sign" and the wrong-sign criterion does not detect them. We instead distinguish fiscal news by the strength of its signaling effects and compare the macroeconomic effects of news with strong and weak signaling. This differential approach detects signaling effects whether or not they are strong enough to reverse the impact of policy.

Our analysis is closely related to studies that investigate the signaling effects of economic policies. In this realm of research, several studies focus on the signaling effects of announcements about monetary policy, studying the role of incomplete information (Vick-

ers, 1986; Romer and Romer, 2000), inflation expectations (Melosi, 2017; Nakamura and Steinsson, 2018; Jarocinski and Karadi, 2020; Andrade and Ferroni, 2021), unconventional monetary policies (Campbell et al., 2012, 2017; D'Amico and King, 2013), and monetary and non-monetary news in monetary announcements (Cieslak and Schrimpf, 2019; Gáti, 2023; Gáti and Handlan, 2024). Melosi (2017) develops and estimates a structural model in which monetary policy has signaling effects. Bauer and Swanson (2023) challenge the relevance of signaling effects in monetary policy, arguing that apparent information effects may reflect the simultaneous response of the policymaker and of markets to public macroeconomic news. Our setting and identification address this concern in three ways. First, unlike FOMC decisions, which are closely timed to macroeconomic data releases, the size of a Japanese fiscal package is disclosed at a stage of the legislative process that is separate from the events that prompted it. Second, the revisions in expected government spending that we use are essentially unrelated to macroeconomic data surprises, and purging them of such surprises leaves our results unchanged (Section 5.3). Third, our identification does not rest on a uniform fall in stock prices but on its dependence on uncertainty, a pattern that a generic response to public news does not produce.

The paper is connected to an extensive literature seeking to measure the efficacy of fiscal policy using various identification strategies and relying on different fiscal instruments. Blanchard and Perotti (2002) and Mountford and Uhlig (2009) pioneered new methods to identify fiscal shocks in VAR models. Rotemberg and Woodford (1992), Ramey and Shapiro (1998), Edelberg et al. (1999), Burnside et al. (2004) use military spending to capture variation in fiscal policy which is arguably exogenous to the business cycle. Fisher and Peters (2010), Ramey (2011), Owyang et al. (2013), Ben Zeev and Pappa (2017), Ramey and Zubairy (2018), Ghassibe and Zanetti (2022), and Jo and Zubairy (2025) focus on military news shocks. Romer and Romer (2010) rely on narrative methods to identify tax shocks. Their work spurred a number of papers that considerably expanded our understanding of the effects of tax shocks on the economy – see e.g., Favero and Giavazzi (2012) and Mertens and Ravn (2011, 2012, 2013, 2014). Oh and Reis (2012) study the multipliers associated with

government transfers. Hausman (2016) investigates the effects of the large veterans' bonus of 1936 on consumption spending. Romer and Romer (2016) look at the macroeconomic effects of changes in Social Security benefit payments. Perotti (2011), Forni and Gambetti (2014), and Ascari et al. (2023) include series of fiscal news or changes in expectations about future fiscal variables in a VAR to study the economic effects of these events, and Morita (2017) does so for Japan. Morita (2026) studies the effects of Japanese fiscal policy under the effective lower bound. All these papers seek to identify changes in fiscal policy that are orthogonal to the state of the economy and therefore, by construction, carry no signal about the government's view of it. Our focus is instead on the component of fiscal policy that responds to economic conditions, which is precisely the component that can give rise to signaling effects.

Closer to our focus on expectations are the few studies of fiscal policy communication. Ricco et al. (2016) argue that the government's ability to communicate the future path of spending clearly to market participants affects the efficacy of fiscal policy. Using the *Survey of Professional Forecasters*, they measure the coordination effects of fiscal communication through forecasters' disagreement and show that the output response is muted when disagreement is high. De Fiore et al. (2024) study how households' expectations shape the macroeconomic effects of a fiscal stimulus. Neither study considers the signaling effects of fiscal policy, that is, the possibility that the announcement itself changes the private sector's view of the state of the economy, which is the object of the present analysis. This possibility rests on imperfect information, whose role in the formation of expectations has been studied extensively in the context of monetary policy: Ellingsen and Soderstrom (2001), Woodford (2002), Adam (2007), Gorodnichenko (2008), Nimark (2008), Lorenzoni (2009), Blanchard et al. (2013), Melosi (2014), Okuda et al. (2021), Gambetti et al. (2025), among others, show that imperfect information is critical to the formation of expectations about inflation and to the conduct of monetary policy. We study an implication of imperfect information for the effects of fiscal policy.

The remainder of the paper is organized as follows. Section 2 develops a stylized model

and derives the predictions of the theory of signaling effects. Section 3 describes the dataset of fiscal announcements compiled from narrative records, the professional forecasts of government spending, and the measures of uncertainty. Section 4 compares the response of stock prices to fiscal packages with the response to announcements of public spending unrelated to economic conditions. Section 5 tests the predictions of the theory using daily stock prices, documents the interplay between uncertainty and signaling effects, and addresses alternative explanations. Section 6 estimates a threshold VAR that quantifies the effects of fiscal news on real activity under restrictions derived from the theory. Section 7 concludes.

2. A Stylized Model of Signaling Effects

In this section, we present a stylized model to outline the key properties of the theory regarding the signaling effects of economic policies. This model will provide critical insights for designing our empirical analysis of fiscal policy's signaling effects, which we will explore in Sections 4 and 6.[3] The model incorporates asymmetric information between the private sector and the policymaker, who takes policy actions based on beliefs about an economic shock that is not perfectly observed by anyone in the economy. The policy action impacts the state of the economy and is perfectly observed by the private sector, which is aware of the policymaker's reaction function. Note that we do not assume that the policymaker has superior information as this assumption is not essential for signaling effects to arise.

The model has two periods; however, the results can be straightforwardly extended to the multi-period case. In the first period, nature draws an i.i.d. Gaussian shock ε to the state of the economy, X_1. Concomitantly, the private sector observes the signal s^p regarding the state of the economy. In the second period, the policymaker observes its own signal, s^g, regarding the state of the economy in the previous period. This signal is not observed by the private sector and only affects the policymaker's beliefs about the state of the economy, which, in

[3]Appendix A presents a version of our stylized model that allows a policymaker to take simultaneous policy actions, demonstrating that the results discussed in this section remain consistent regardless of the timing of the policy action. The analysis of the signaling effects theory within a general equilibrium model is provided by Melosi (2017).

turn, affect its policy action, a, taken in the second period. Information is asymmetric since the separate signals observed by the private sector (s^p) and the policymaker (s^g) are privately observed. For tractability, we assume that the private sector correctly observes the precision of the signal received by the policymaker (s^g).[4]

The two-period structure of the model allows us to consider lags between changes in the economic outlook and the policy response. This time structure captures the idea that policymakers react to an economic shock – e.g., a recession – with a lag. Lags are particularly relevant for discretionary fiscal stabilization policies, which will be the focus of our empirical analysis. Moreover, this time protocol facilitates the illustration of the key property of the theory of signaling effects.

The first period can be interpreted as a period when an unexpected change in the economic outlook occurs. This change can be a recession, whose severity is unknown to private agents and the policymaker. The private sector relies on the signal, s^p, to form beliefs about the economic outlook X_1 in the first period. Formally,

$$X_1 = \varepsilon, \tag{1}$$

$$s^p = X_1 + \xi, \tag{2}$$

where $\varepsilon \sim \mathcal{N}(0, \sigma_\varepsilon^2)$ denotes the economic shock affecting the outlook in the first period. The second equation describes the noisy signal, s^p, received by the private sector before the policymaker announces its policy action. The random variable $\xi \sim \mathcal{N}(0, \sigma_\xi^2)$ indicates that the noise of the private sector's signal is drawn from a normal distribution.

The policymaker observes a signal regarding the shock that hit the economy in the previous period:

$$s^g = X_1 + \xi^g,$$

where noise $\xi^g \sim \mathcal{N}(0, \sigma_{\xi,g}^2)$. The policymaker's beliefs about the economic outlook in the

[4]Signaling effects arise from asymmetric information between policymakers and the private sector, without requiring policymakers to hold an informational advantage. This is a natural feature of fiscal policy, since policymakers operate at the intersection of the political and legislative process and therefore have access to different, albeit not necessarily more precise, information than the private sector (Vickers, 1986).

first period will shape its action, a. These beliefs – denoted by $E(X_1|s^g)$ – are the solution to a standard signal extraction problem.

The state of the economy and the policy action in the second period are defined as follows:

$$X_2 = X_1 + \gamma a + \lambda E(X_1|s^p, a), \tag{3}$$

$$a = \delta E(X_1|s^g) + \varepsilon_a. \tag{4}$$

Starting from the first equation, the parameter γ captures the effects of policy actions on the economic variable. The policymaker can stimulate the economy in period 2, X_2, by maneuvering its policy tool, a. The larger the parameter γ, the stronger the effect of a policy action, a, on the state of the economy in the second period, X_2. To make the analysis more intuitive and without loss of generality, throughout this section, we assume that γ is strictly positive, as government spending increases output, X_2.

We assume that agents' expectations conditional on observing both the private signal s^p in the first period, and the policy action a in the second period, may have *feedback effects* on the economic variable, X_2. These expectations are denoted by $E(X_1|s^p, a)$ and the parameter λ controls the magnitude of these feedback effects. If $\lambda > 0$, expectations can be regarded as self-reinforcing.[5]

Equation (4) is the policymaker's reaction function. We set $\delta < 0$, implying that the policy action is intended to be *countercyclical*; that is, a falls, cooling down economic activity, X_2, if the government expects period 1's output to have increased. In this case, the government takes action a with the objective of stabilizing the economy represented by the random variable X_2. We assume that policymakers respond to the economic condition observed before their intervention – i.e. X_1. This assumption is made for tractability and to capture delays in fiscal responses.[6] The policy shock is drawn from a mean-zero Gaussian distribution, $\varepsilon_a \sim \mathcal{N}(0, \sigma^2_{\varepsilon,a})$. It is assumed that the private sector knows the reaction

[5]We could assume that feedback effects are not delayed and occur already in the first period. However, this would complicate our analysis without adding anything important to the main point we want to make in this section. A model where feedback effects and learning occur simultaneously with policy actions is described in the appendix.

[6]Appendix A develops a model in which policymakers take simultaneous policy actions. Our main conclusions extend to that environment.

parameter, δ and the quality of the policymaker's signal – i.e., the volatility of the noise $\sigma_{\xi,g}$. However, the private sector does not observe the government signal's noise, ξ^g, and the policy shock, ε_a.

Agents' prior beliefs about state of the economy X_1 ahead of the policy response can be pinned down by solving a straightforward signal extraction problem – equations (1)-(2). Solving this problem yields $E(X_1|s^p) = k_1 \cdot s^p$ where $k_1 \equiv \frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2+\sigma_\xi^2}$ and the uncertainty $VAR(X_1|s^p) = \sigma_\varepsilon^2 \cdot (1-k_1)$.

Similarly, the solution to the signal extraction faced by the government is $E(X_1|s^g) = k_g s^g$, where $k_g \in (0,1)$ is the Kalman gain reflecting how sensitive the policymaker's beliefs are to the signal, s^g. This gain is given by $k_g = \frac{\sigma_\varepsilon^2}{(\sigma_\varepsilon^2+\sigma_{\xi,g}^2)}$. Thus, the policymaker's reaction function can be written as $a = \delta \cdot k_g s^g + \varepsilon_a$. Without loss of generality, we rescale the policy response $\delta \equiv \frac{\alpha}{k_g}$, where the parameter $\alpha < 0$ represents the reaction of the government to the signal it receives, s^g. Thus, the policy reaction function (4) can be equivalently expressed as

$$a = \alpha \left(X_1 + \xi^g\right) + \varepsilon_a. \tag{5}$$

The policy action expected by the private sector at the end of the first period is: $E(a|s^p) = \alpha E(X_1|s^p)$. After observing the policy action, a, the private sector optimally updates its expectations regarding X_t^1 as follows:

$$E(X_1|s^p, a) \;\; = \;\; E(X_1|s^p) + k_2(a - E(a|s^p)), \tag{6}$$

where $k_2 \equiv \frac{\alpha VAR(X_1|s^p)}{VAR(X_1|s^p)\alpha^2+\alpha^2\sigma_{\xi,g}^2+\sigma_{\varepsilon,a}^2}$. Note that this gain is negative because $\alpha < 0$ as the private sector understands policy actions to be countercyclical.

A negative gain k_2 implies that if the magnitude of the policy action, a, exceeds the private sector's ex-ante expectations $E(a|s^p)$, the private sector will revise its expectations about the state of the economy downward, such that $E(X_1|s^p, a) < E(X_1|s^p)$. This adjustment in the private sector's expectations arises from the signaling effects associated with the policy action. Importantly, the revision to expectations in equation (6) depends on the policy surprise captured by $a - E(a|s^p)$.

The time structure of this simple model allows us to precisely pin down the signaling effects of policy actions, a. Formally, signaling effects are defined as the revision to private sector's expectations after the policymaker announces its policy action, a. Formally, $E(X_1|s^p, a) - E(X_1|s^p)$, which can be shown from equation (6) to be as follows:

$$E(X_1|s^p, a) - E(X_1|s^p) \quad = \quad k_2(a - E(a|s^p)). \tag{7}$$

The term $k_2(a - E(a|s^p))$ in equation (7) captures the signaling effects and illustrates the importance of controlling for the private sector's beliefs before observing the policy action when evaluating the signaling effects of policy. The mere policy action being positive or negative in and of itself does not capture the signaling effects. What matters to evaluate signaling effects is whether the size of the policy action surprises the private sector negatively or positively.

As we will show through a numerical exercise later in this section, a negative surprise – a fiscal package smaller than what the private sector had expected based on its assessment of the state of the economy, $a < E(a|s^p)$, – will deliver good news to the private sector. A smaller than expected policy action is interpreted by the private sector as evidence that the policymaker expects the economy to be in a better shape than what the private sector thought before observing the policy action. As a result, the private sector will review its expectations positively.

2.1. Illustrative Numerical Exercises

We will now perform a few numerical exercises to illustrate the fundamental properties of signaling effects theory. First, to accurately assess the presence of signaling effects from an economic policy, it is essential to consider the prior beliefs of economic agents regarding the scale of the policy action. If the fiscal package exceeds expectations, the private sector may interpret this as an indication that the economy is in worse shape than anticipated, potentially leading to negative signaling effects on economic activity. Second, increased uncertainty in the private sector about the state of the economy amplifies signaling effects.

Third, signaling effects do not necessarily reverse the impact of economic policies. Often, signaling effects only dampen the overall impact of a policy intervention, making it more complex to determine their existence than what the literature has typically done – e.g., Campbell et al. (2012). This feature aligns with our approach, which focuses on the differential effects of policy shocks with varying degrees of signaling. Finally, policy actions perceived as unrelated to changes in economic conditions do not produce signaling effects.

We set the policymaker's response to economic condition, $\alpha = -2$. The effect of a unitary change in the policy action, a, on the economic activity in the second period is given by the parameter $\gamma = 0.5$. In the baseline case, the standard deviation of the fundamental shock σ_ε is equal to one. The standard deviation of the noise in the policymaker's signal shock, $\sigma_{\xi,g}$ is set to 0.05 and the standard deviation of the noise in the signal received by the private sector in the first period, σ_ξ, is set to 0.25.

We assume that the realized noise in the private signal is zero; that is, $\xi = 0$. We also shut down the policy shock, $\sigma_{\varepsilon,a} = 0$, in all the exercises where we want to focus on policies with signaling effects. In the last exercise (Section 2.5), we will consider "exogenous" policy actions that do not have signaling effects and so we will consider that shock.

These numbers are not intended to match any moment in the data given the admittedly very abstract nature of the model. These values are chosen to illustrate properties of signaling effects of economic policies that will turn out to be useful to design the empirical exercises of the paper.

2.2. Prior Beliefs and Signaling Effects

We assume that a unitary negative shock ($\varepsilon = -1$) in the first period causes the value of the fundamentals to fall ($X_1 = \varepsilon = -1$). Agents expect this deterioration of the outlook to trigger a response from the government in the second period. Their prior beliefs – called prior because they are formed before the government takes its perfectly observed action a in the second period – are denoted by $E(a|s^p)$. As shown in the previous section, these prior beliefs are based on the knowledge of the policy reaction function – specifically the parameter

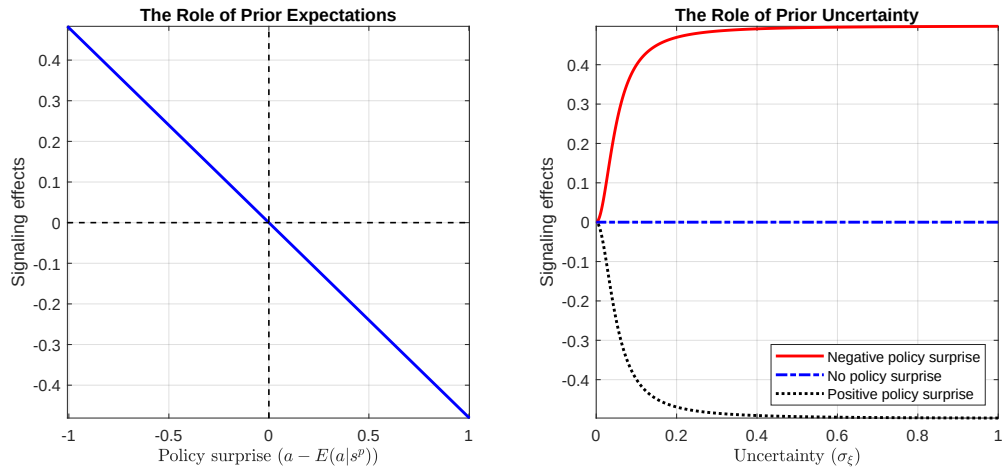


Figure 1: **Signaling Effects of Economic Policy.** The *left chart* shows how signaling effects (i.e., the revision to economic agents' expectations about the state of the economy after observing the policy action – $E(X_1|s^p, a) - E(X_1|s^p)$) as a function of the policy surprise $(a - E(a|s^p))$. The policy surprises are obtained by choosing a set of noise shocks ξ^g to the policymaker's signal for a given fundamental shock $\varepsilon = -1$. The *right chart* shows the signaling effects of policy actions triggering a negative surprise (the red solid line), no surprise (the blue dotted-dashed line), and a positive surprise (the black dotted line) as economic agents' uncertainty varies. Uncertainty varies as a result of changes in the precision of the signal (σ_ξ) observed by the private sector. The three policy surprises are obtained by setting the noise ξ^g in the policymaker's signal equals to 1 (negative policy surprise), 0 (no policy surprise), and -1 (positive policy surprise).

α –, and agents' beliefs about the state of the economy in the first period, $E(X_1|s^p)$.

The left chart of Figure 1 shows the signaling effects $(E(X_1|s^p, a) - E(X_1|s^p))$, as a function of the policy surprise $(a - E(a|s^p))$. To obtain this graph we assume a set of positive and negative noise shocks to policymaker's signal (ξ^g) to generate an array of policy surprises $(a - E(a|s^p))$. These policy surprises are shown in the horizontal axis. The vertical axis reports the signaling effects (i.e. $E(X_1|s^p, a) - E(X_1|s^p)$) associated with these policy surprises. The slope of the solid blue line is the gain k_2, defined in the previous section – see equation (7).

A negative (positive) policy surprise means that, based on its prior beliefs, the private sector expected a larger (smaller) policy action than what is actually taken by the government in period 2. The announcement of a smaller (larger) than expected policy action is good (bad) news about the state of the economy, leading the private sector to review their expectations $(E(X_1|s^p, a) - E(X_1|s^p))$ accordingly.

Importantly, in the left chart of Figure 1, the blue line crosses the point (0,0), suggesting that signaling effects arise only if the private sector is surprised by the size of the policy action. If agents' prior beliefs correctly anticipate the size of a policy package, there is no signaling effects.

To sum up, this exercise underscores the importance of taking into account the revision to private sector's expectations about the size of the policy intervention when assessing signaling effects of policy actions. The size of the policy action, a, in and of itself is not decisive for the sign of the signaling effects.

2.3. Uncertainty and Signaling Effects

We now show that signaling effects become more pronounced when the private sector is more uncertain about the fundamentals. To illustrate this, we vary the level of uncertainty regarding the state of the economy by selecting a range of values for the precision of the private sector's signal noise, denoted by ξ. Specifically, as the standard deviation σ_ξ increases, the precision of the signal decreases, leading to greater uncertainty about the state of the economy X_1. Consequently, as we will show, the signaling effects become larger. We assume that no fundamental shock impacts the economy in the first period ($\varepsilon = 0$).

The right chart of Figure 1 illustrates how the size of the signaling effects (on the vertical axis) – i.e. $E(X_1|s^p, a) - E(X_1|s^p)$ – varies in response to a more uncertain outlook from the perspective of the private sector (on the horizontal axis). Uncertainty and the size of the signaling effects interact. Specifically, signaling effects increase with the private sector's uncertainty about the state of the economy. When (prior) uncertainty is large, the private sector relies more on the policy action to learn about the state of the economy, boosting the signaling effects. This is a theoretical prediction that we will test to prove the existence of signaling effects of fiscal announcements in Japan.

Not surprisingly, as indicated by the analysis in the previous exercise (left chart), the sign of the signaling effects depends on whether the private sector is surprised by the size of the policy action, a, from the downside or the upside. A smaller (larger) than expected policy

action – a negative (positive) policy surprise – leads to an improvement (deterioration) of the private sector's beliefs regarding the state of the economy; that is positive (negative) signaling effects. If the private sector correctly anticipates the policy action, there are no signaling effects. See the dashed-dotted blue line on the right chart of Figure 1. This result is in line with what we showed in the first exercise.

2.4. Signaling Does Not Necessarily Reverse the Impact of Policies

In this third exercise, we assume that no fundamental shock affects the economy in the first subsample ($\varepsilon = 0$). As in the first exercise, a set of positive and negative noise shocks to the policymaker's signal, ξ^g provide us with a range of values for policy action, a, which are shown on the horizontal axis of the two charts in Figure 2.[7]

We examine two factors that could dampen the effects of policy actions. First, we consider different degrees of feedback effects: no feedback ($\lambda = 0.0$), minimal feedback ($\lambda = 0.5$), and substantial feedback ($\lambda = 1.5$). Based on these assumptions regarding feedback effects, we compute the state of the economy in the second period, X_2, which is shown on the vertical axis of the left chart in Figure 2. The state of the economy in the second period reflects both the effects of the policy action on the economy, γa, and the feedback effects from the private sector's beliefs about the economy, $\lambda E(X_1|s^p, a)$.[8] These feedback effects are the channel through which the signaling effects of policy actions influence the state of the economy in the second period, X_2.

The left chart of Figure 2 illustrates the effect of a policy action a on the state of the economy in the second period, X_2 under different levels of feedback to the economy. The black dotted line represents the state of the economy for a given policy surprise under the assumption of no feedback effects (i.e., $\lambda = 0$). When there is no feedback, the effects of the policy action on the economy are the largest because signaling effects do not influence

[7] We could display the policy surprises, $a - E(a|s^p)$, on the x-axis. However, this would not affect our analysis because we assume that no fundamental shock impacts the economy in the first subsample ($\varepsilon = 0$) and that the realization of the noise in the private sector's signal is zero ($\xi = 0$). Consequently, $E(a|s^p) = 0$.

[8] Since we assume that no economic shock affects the economy in the first period ($\varepsilon = 0$), $X_1 = 0$, and therefore, the first term on the right-hand side of equation (3) defining X_2 is zero.

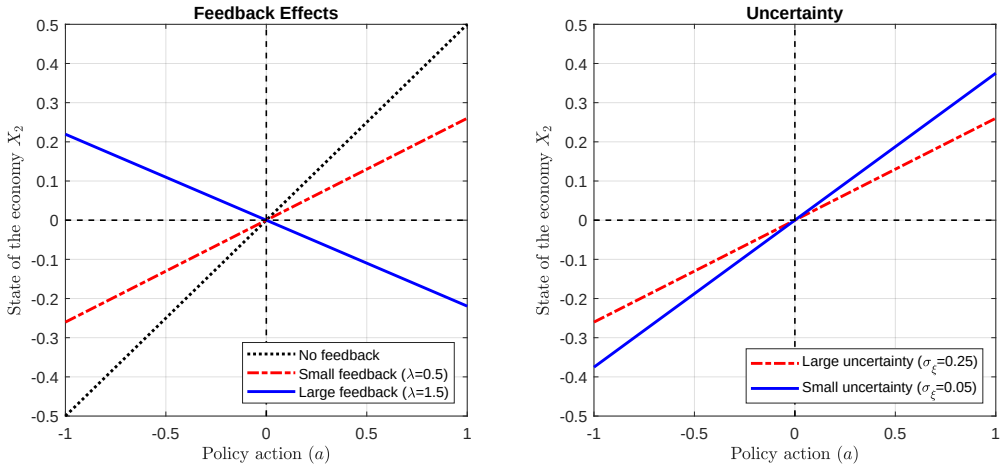


Figure 2: **Effectiveness of Economic Policies with Signaling Effects.** In the *left chart*, economic activity (X_2) is plotted as a function of the policy action, a for three levels of feedback from beliefs to economic activity. The black dotted line denotes the case with no feedback effects ($\lambda = 0.0$). The cases of small feedback effects ($\lambda = 0.5$) and large feedback effects ($\lambda = 1.5$) are denoted by the red dashed dotted line and the solid blue line, respectively. In the *right chart*, economic activity (X_2) is plotted as a function of the policy action, a, for two levels of uncertainty of the private sector. The red dashed-dotted line denotes the case of large uncertainty, in which the noise standard deviation of the private sector's signal is relatively large ($\sigma_\xi = 0.25$). The blue solid line denotes the case of small uncertainty, in which the noise standard deviation of the private sector's signal is relatively small ($\sigma_\xi = 0.05$). In both cases the parameter controlling the feedback, λ is equal to 0.5. In both charts, policy actions on the horizontal axis are obtained by varying the realized noise in the policymaker's signal (ξ^g).

the state of the economy, X_2, through the feedback channel. As feedback effects become stronger, signaling effects play a more significant role in dampening the impact of the policy on output, X_2. This is evident by moving from the black dotted line (no feedback effects, $\lambda = 0$) to the dashed-dotted red line (with feedback effects, $\lambda = 0.5$). Feedback effects can become so pronounced ($\lambda = 1.5$) that signaling effects might even overturn the conventional impact of policy action on the state of the economy ($\gamma > 0$). This is reflected in the blue line sloping downward on the left chart, indicating that stimulative policies may ultimately contract the economy.

The right chart of Figure 2 illustrates how private sector's uncertainty affects the strength of signaling effects and hence the efficacy of policy actions, a, on the economy, X_2 . The red dashed-dotted line represents the high-uncertainty scenario, where the volatility of the noise in the private sector's signal, σ_ξ, is 0.25. The blue solid line denotes the low-uncertainty

scenario, with $\sigma_\xi = 0.05$. The red dashed-dotted line is flatter than the blue solid line, implying that when the private sector faces greater uncertainty about the state of the economy, signaling effects are stronger, resulting in smaller effects of policy actions on the economy, X_2.[9] When the signal observed by the private sector is more imprecise (higher uncertainty), agents rely more on the information conveyed by the policy action, amplifying the signaling effects. It can be shown that, for sufficiently large levels of uncertainty, signaling effects become so strong that they can reverse the effects of policy on output, X_2.

These exercises show that while a contraction in output following an expansionary economic policy may be explained by signaling effects; however, finding an increase in output does not disprove the existence of signaling effects as often assumed in the literature – e.g Campbell et al. (2012). Signaling effects *dampen* the impact of a policy on economic outcomes but they do not necessarily reverse the sign of its impact.

2.5. "Exogenous" Policy Actions

By "exogenous" policy actions, we mean policy actions that are not aimed at stabilizing economic conditions. These actions are captured by our stylized model by setting the policy reaction parameter δ equal to zero and by considering the case in which the policy action is entirely driven by the policy shock ε_a. If the private sector understands that the policy action is not triggered by any changes to the economic conditions, X_1, expected by the policymaker, they will not update their beliefs after observing the policy action a. The signal is exogenous because $\delta = 0$ and, therefore, does not convey any information about the state of the economy, X_1. Hence, it is obvious that $E(X_1|s^p) = E(X_1|s^p, a)$, implying zero signaling effects – defined in equation (7).

To sum up, this simple signal-extraction model highlights the key properties of the theory of signaling effects. First, to correctly assess the existence of signaling effects of an economic

[9] Recall that because of signaling effects, positive (negative) policy surprises cause the private sector to revise downward (upward) their expectations on the state of the economy, X_1 –i.e., $E(X_1|s^p, a) < E(X_1|s^p)$ if policy surprises are positive and vice versa. See the right chart of Figure 1. As shown in equation (3), expectations $E(X_1|s^p, a)$ positively affect the state of the economy in period 2 through the feedback channel.

policy, it is critical to control for economic agents' prior beliefs about the size of the policy. Second, the larger the private sector's prior uncertainty, the more sizable the signaling effects. Third, signaling effects do not necessarily reverse the effect of economic policies. A fiscal expansion can still boost output even though signaling effects are at play. Signaling effects only dampen the expansionary effects of a fiscal stimulus. It is also important to underscore that a critical feature for an economic policy to have signaling effects is that the policy is understood to respond to economic conditions. If an economic policy is fully autonomous ($\delta = 0$), it does not give rise to signaling effects.

3. Data

To study the signaling effects of fiscal policy, we construct a novel dataset that integrates daily stock price data (the Nikkei stock average), narrative accounts of fiscal announcements from Japanese newspaper reports, and professional forecasters' projections of government expenditure. We examine the theory in the context of Japan because its distinctive institutional and legislative frameworks provide an ideal setting for identifying these signaling effects.

3.1. Institutional Framework and Fiscal Announcements

Fiscal announcements exhibit signaling effects if they prompt the private sector to revise its beliefs about the current state of the economy. Identifying such effects in the data requires pinpointing the exact date when the government releases new information about the size of a fiscal intervention. This is often difficult for two reasons. In many countries, the content of a fiscal package is revealed only gradually over the course of the legislative process, and political negotiations can reshape spending measures in unpredictable ways along the way. A central challenge in our analysis, therefore, is to identify the date when the size of the fiscal package becomes public for the first time and is no longer subject to parliamentary bargaining.

Japan's legislative process is orderly and predictable, and the government typically responds to events that threaten the economic outlook by introducing ad hoc fiscal packages, consistent with the evidence that discretionary fiscal policy in advanced economies is countercyclical (Kaminsky et al., 2004; Frankel et al., 2013; Calderón et al., 2016). This makes Japan an ideal setting for testing the signaling effects hypothesis. Over our sample period, from June 2009 to December 2022, the Japanese government announced twenty-one fiscal stimulus packages, most of which were financed through supplementary budgets. The packages are concentrated in periods of adverse shocks: three were announced in 2011 after the Great East Japan Earthquake and five in 2020 during the COVID-19 pandemic, whereas none was announced in 2015, 2017, or 2018. The sample starts in June 2009 because the professional forecast data used in our estimation are available only from that date. Table 1 provides the main details of each package. For each package, the table reports both fiscal spending and the total size; the former excludes items such as loans from government-affiliated financial institutions and tax deferrals, which are included in the latter. The table also reports the dates of the three phases of each announcement, which we describe below.

Overall, the packages show the following salient features. First, they are large relative to the regular budget. The initial general account budget of the Japanese government was around 100 trillion yen per year between 2009 and 2022. Against this benchmark, the packages reported in Table 1 are sizable: fiscal spending (column 5) frequently exceeds 10 trillion yen, and during the COVID-19 pandemic it reached 40 to 73 trillion yen per package. The exceptions are the five packages below 1 trillion yen (those with a dash in column 4), which were financed through the government's contingency reserve funds rather than through supplementary budgets.[10]

Second, the largest component of the fiscal packages pertains to the expenditure side of the budget. None of the packages in our sample includes tax cuts as a major component.[11]

[10] Section 5 shows that our main result is robust to excluding these five packages (footnote 22).

[11] The packages also differ in the composition of spending, for example between public investment and transfers to households and firms. Since the survey measures expectations of total government spending, defined as the sum of government consumption and public investment in the national accounts, our analysis does not distinguish among these components, and compositional heterogeneity could affect the estimated responses.

Table 1: Dates of Fiscal Announcements: 2009–2022

(1) Package	(2) Order	(3) Size	(4) Ratify	(5) Fiscal spending	(6) Total size	(7) Size disclosed at
(a) *Countermeasures against global financial crisis*						
$A_{1,t}$	11/12/2009	12/08/2009	12/15/2009	7.2 trn.	24.4 trn.	Cabinet meeting
$A_{2,t}$	08/20/2010	08/31/2010	–	915 bn.	9.8 trn.	Committee of relevant ministers
$A_{3,t}$	09/28/2010	10/08/2010	10/26/2010	4.9 trn.	20.8 trn.	Cabinet meeting
(b) *Supplementary budgets for recovery from Great East Japan Earthquake*						
$A_{4,t}$	03/29/2011	04/18/2011	04/22/2011	4.0 trn.	n.a.	Ruling parties' agreement
$A_{5,t}$	06/14/2011	06/30/2011	07/05/2011	2.0 trn.	n.a.	Government plan (press report)
$A_{6,t}$	07/12/2011	10/17/2011	10/21/2011	12.1 trn.	n.a.	Cross-party agreement
(c) *Countermeasures against yen appreciation*						
$A_{7,t}$	10/18/2012	10/25/2012	–	400 bn.	750 bn.	Government plan (press report)
$A_{8,t}$	11/16/2012	11/27/2012	–	880 bn.	1.2 trn.	Government plan (press report)
(d) *Abenomics policy*						
$A_{9,t}$	12/27/2012	01/11/2013	01/16/2013	10.3 trn.	20.2 trn.	Press conference by PM
$A_{10,t}$	09/11/2013	12/05/2013	12/13/2013	5.5 trn.	18.6 trn.	Gov.–ruling parties meeting
$A_{11,t}$	11/19/2014	12/29/2014	01/13/2015	3.5 trn.	n.a.	Gov.–ruling parties meeting
$A_{12,t}$	07/13/2016	08/02/2016	08/25/2016	13.5 trn.	28.1 trn.	Gov.–ruling parties meeting
$A_{13,t}$	11/08/2019	12/05/2019	12/16/2019	13.2 trn.	26 trn.	Gov.–ruling parties meeting
(e) *Countermeasures against COVID-19 pandemic*						
$A_{14,t}$	02/07/2020	02/14/2020	–	15.3 bn.	500 bn.	COVID-19 Response HQ
$A_{15,t}$	03/02/2020	03/11/2020	–	430 bn.	1.6 trn.	COVID-19 Response HQ
$A_{16,t}$	03/30/2020	04/07/2020	04/08/2020	39.5 trn.	108.2 trn.	Gov.–ruling parties meeting
$A_{17,t}$	05/15/2020	05/27/2020	05/28/2020	72.7 trn.	117.1 trn.	Gov.–ruling parties meeting
$A_{18,t}$	11/10/2020	12/08/2020	12/16/2020	40.0 trn.	73.6 trn.	Gov.–ruling parties meeting
$A_{19,t}$	10/08/2021	11/19/2021	11/29/2021	55.7 trn.	78.9 trn.	Gov.–ruling parties meeting
(f) *Countermeasures against price increases*						
$A_{20,t}$	03/29/2022	04/27/2022	05/18/2022	6.2 trn.	13.2 trn.	Press conference by PM
$A_{21,t}$	09/30/2022	10/28/2022	11/09/2022	39.0 trn.	71.6 trn.	Gov.–ruling parties meeting

Notes: The table summarizes information about fiscal announcements in Japan from June 2009 to December 2022. Column (1) reports the package identifier. Columns (2)–(4) report the dates of the order, size, and ratification stages, that is, the dates on which the Prime Minister orders the preparation of the package, the final size of the package becomes public, and the Cabinet approves the supplementary budget that finances it. Dates are the trading days on which the corresponding indicator variables equal one: when an event occurs on a non-trading day or after the stock market closes, the date shown is the next trading day. A dash in column (4) indicates that the package was financed through contingency reserve funds and therefore has no ratification stage. Columns (5) and (6) report fiscal spending and the total size of the package, in yen. Fiscal spending is the headline figure released by the government for each package. Depending on the package, it is either national government expenditure or a broader measure that also includes local government expenditure and the Fiscal Investment and Loan Program. The total size additionally includes items such as loans from government-affiliated financial institutions; n.a. indicates that this figure was not released. Column (7) reports the event at which the final size of the package was disclosed.

Earlier packages occasionally included tax cuts—for example, those of February 1994, April 1998, November 1998, and October 2008—but even in these cases, tax cuts accounted for a minority of the overall size of the package.[12] Since the primary component of the fiscal packages is increased government expenditure, our analysis focuses on this aspect of the budget. Moreover, we focus on announcements of fiscal packages rather than the regular budget, as the packages are specifically designed to address adverse events and are more likely to contain new information regarding the state of the economy. In contrast, regular budget measures usually constitute systematic responses to business cycle fluctuations or reflect political priorities, and are therefore less likely to provide further insight into the government's assessment of the economic outlook.

We now turn to the central challenge outlined above: dating the announcement of each package. In Japan, the legislative process for approving a fiscal measure comprises three main orderly phases. In the first phase (order stage), the Prime Minister instructs the Cabinet ministers, or senior members of the ruling parties, to prepare a proposal for the supplementary budget or fiscal package. In the second phase (size stage), a public discussion between the government and the ruling parties reveals the approximate content of the fiscal package but leaves uncertainty about its size. This phase ends when the final size of the package becomes public, typically through an announcement by the Prime Minister or another government official. In the third phase (ratification stage), the Cabinet formally approves the supplementary budget that finances the package. The budget is then submitted to the Diet, which typically passes it without revisions, since the measures have already gained the support of the ruling parties and the Cabinet.[13] Columns (2)–(4) of Table 1 report the dates of the order, size, and ratification stages for each package, and column (7) reports the event at which the final size was disclosed. Packages financed through contingency reserve funds do not require a supplementary budget and therefore have no ratification stage (a dash in column 4). Among these phases, our analysis focuses primarily on the size stage, which

[12]In these four packages, the sizes of the announced tax cuts, with the total size of the package in parentheses, are as follows (in trillions of yen): 5.85 (15.25), 4 (16.65), 6 (23.9), and 2 (26.9), respectively.

[13]The Cabinet Office of Japan confirmed to us that all supplementary budgets during our sample period were approved by the Diet as proposed by the government.

entails the first public disclosure of the size of the fiscal package, to test for signaling effects. The order and ratification stages, at which no new information about the size is released, serve as points of comparison.

Unlike monetary policy decisions, which are released at pre-scheduled meetings, fiscal packages do not follow a fixed calendar: they are announced irregularly, and sometimes outside stock market trading hours. Announcement dates therefore cannot be read off an official schedule. To identify the dates of the three stages, and in particular the date on which the size stage ends, we use the *Nikkei* newspaper—Japan's leading economic and business daily. For each package, we select the news article that first reports the final size of the package, and record the event at which it was disclosed. When an announcement occurs after the stock market closes or on a non-trading day, we assign it to the next trading day.

To study the effect of fiscal announcements on stock prices, we construct indicator variables for the three stages of each announcement. Specifically, $\mathbb{I}\{A_t^{\text{order}}\}$ equals one on the dates on which the Prime Minister orders the preparation of a fiscal package, $\mathbb{I}\{A_t^{\text{size}}\}$ on the dates on which the final size of a package becomes public, and $\mathbb{I}\{A_t^{\text{ratify}}\}$ on the dates on which the Cabinet approves the supplementary budget.[14]

As we will show, the announcements in the size stage, which are informative about the size of the fiscal packages, are the most relevant for evaluating the signaling effects of fiscal policy. By contrast, the information released during the order stage does not seem to be very relevant for the stock market. The ratification stage may convey information regarding the implementation of the announced fiscal intervention. However, at this late stage, the size of the fiscal package is already known and, hence, no signaling effects are expected. As shown in Section 2, signaling effects rest upon the revelation of the actual size of the stimulus, from which the private sector can learn about the government's view on the state of the economy.

[14]We assign each announcement to a trading day according to whether the news becomes public before or after the stock market closes. News that becomes public before the close—including news reported in the morning edition of the *Nikkei* before the market opens—is assigned to the same day; news that becomes public after the close is assigned to the next trading day. We determine the time of each announcement from *Nikkei Quick News* (NQN), a real-time news service for financial market participants that records the release time of each news item to the minute, and from the Prime Minister's daily schedule published in Japanese newspapers, which records the start times of the meetings and press conferences attended by the Prime Minister.

3.2. Revisions to Expectations of Government Spending

We measure revisions in the private sector's expectations about government spending using the *ESP Forecast*, a monthly survey of professional forecasters currently conducted by the Japan Center for Economic Research (JCER). Each month, about forty economists at private financial institutions and research institutes report their projections for a range of macroeconomic variables. Since the June 2009 survey, these include projections of the annual growth rate of government consumption and public investment for the current and the next fiscal year, which determines the start of our sample.[15] We take the mean projection across respondents and combine the two components into the expected growth rate of total government expenditure. We then convert the fiscal-year projections into a twelve-month-ahead projection by weighting the projections for the two fiscal years by the number of months of each that fall within the following twelve months, and define the expectation revision as the change in this projection between two consecutive surveys. Appendix B.1.1 describes the construction in detail.

The survey asks about total government spending rather than about the size of a specific fiscal package. However, we argue that the revision in expected spending between the surveys conducted immediately before and after an announcement serves as a good proxy for the policy surprise contained in the announcement under the four following assumptions. First, the announcement is the main piece of news about government spending that enters the revision. This is plausible because, as documented in Section 3.1, fiscal spending in these packages is large relative to the regular budget, frequently exceeding 10 percent of the initial general account budget; for the five small packages financed through contingency reserve funds it is less so, and Section 5 shows that our results are robust to excluding them. Second, the two surveys bracket the announcement, which our matching by survey collection date ensures (Appendix B.1.2). Third, forecasters incorporate the announced package into their projections by the following survey. Consistent with this, revisions average 0.10 percentage

[15] See columns 8 and 9 of Table I-1 of the survey form. The most recent form available as of September 2026 (in Japanese) can be downloaded from https://www.jcer.or.jp/?p=141346.

points in the months in which a package is announced, against −0.06 in other months (Appendix B.1.2). Fourth, other news affecting expected government spending between the two surveys is not systematically related to uncertainty or to the stock price response on the announcement day. This assumption cannot be verified directly, but Section 5.3 shows that the revisions are essentially unrelated to macroeconomic data surprises and that purging them of such surprises leaves our results unchanged. These are identifying assumptions, whose violations could bias the estimates rather than merely add noise to the policy-surprise proxy.

3.3. Measuring Uncertainty

We use two measures of uncertainty, matched to the frequency of each part of our analysis. In the daily regressions of Section 5, we use the Nikkei Stock Average Volatility Index (Nikkei VI), which measures the volatility of the Nikkei 225 over the following month implied by option prices. It is the only measure of uncertainty available at daily frequency, which allows us to condition the stock market response to each announcement on the level of uncertainty prevailing on the previous day. In the monthly VAR of Section 6, our baseline measure is instead a survey-based measure of household uncertainty. The Nikkei VI captures uncertainty as perceived by financial market participants, whereas the signaling effect in the model of Section 2 depends on the private sector's uncertainty about the state of the economy, a concept to which household expectations are closer. The two measures are nonetheless positively and significantly correlated at monthly frequency (Appendix B.1.3).

We construct the survey-based measure from the *Consumer Confidence Survey*, which has been conducted monthly by the Cabinet Office since 2004.[16] The survey covers 8,400 households selected from over 50 million households nationwide, excluding foreigners, students, and households living in institutions. Respondents report their expectations for the next six months on several items, including overall livelihood, income growth, and the asset prices, on a five-point scale: "improve," "improve slightly," "no change," "worsen slightly,"

[16]The original survey began in 1957, when only urban households were surveyed biannually. The current nationwide monthly survey has been conducted since 2004.

and "worsen." Following the scoring used by the Cabinet Office, we assign the values 1, 0.75, 0.5, 0.25, and 0 to the five responses and measure uncertainty as the cross-sectional standard deviation of these scores, computed from the share of each response. Our baseline measure uses the question on overall livelihood. Appendix B.3 shows that our results are robust to using the questions on income growth and the asset prices, as well as the monthly average of the Nikkei VI. Appendix B.1.3 plots the measures and reports their correlations.

4. Fiscal Announcements and the Stock Market

We first establish how stock prices respond to fiscal news in the absence of signaling effects. To this end, we consider three announcements that implied large increases in government spending but were unrelated to the business cycle.[17] As discussed in Section 2, signaling effects do not arise when a policy action is not taken in response to changes in economic conditions. The stock market response to these announcements therefore provides a point of comparison for the response to the fiscal packages listed in Table 1.

The three fiscal spending episodes unrelated to macroeconomic conditions are:

1. The selection of Japan as the host of the 2019 Rugby World Cup on July 28, 2009, which required public investment in stadiums and related infrastructure.

2. The selection of Tokyo as the host city of the 2020 Olympic and Paralympic Games on September 8, 2013, which entailed large public investment in venues and transport infrastructure.

3. The selection of Osaka as the host city of the 2025 World Exposition on November 24, 2018, which was accompanied by plans for urban regeneration and infrastructure spending.

[17] These host-city and host-country announcements also raised private-sector expectations about tourism and urban regeneration, so the stock market response to them reflects more than the prospect of higher public spending. We therefore use them only as a qualitative point of comparison. What matters for our purposes is that the spending commitments were unrelated to current macroeconomic conditions and hence, according to the theory, free of signaling effects.

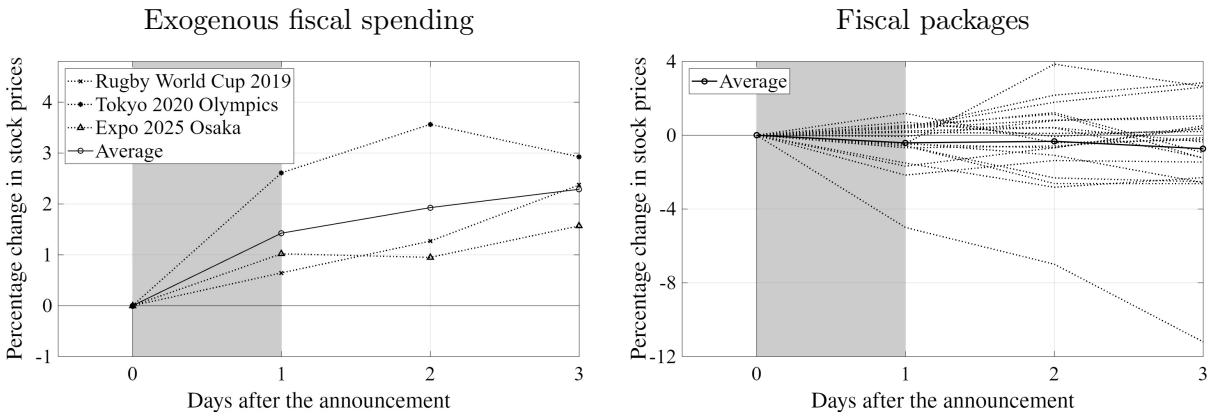


Figure 3: **Effects of fiscal spending news on stock prices.** The figure shows the response of stock prices to the three announcements unrelated to macroeconomic conditions described in the text (left panel) and to the fiscal packages listed in Table 1 (right panel). For the fiscal packages, the announcement date is the date of the size stage. Responses are cumulative sums of the residuals from the regression $\Delta s_t = Z_{t-1}\gamma + e_t$, estimated on daily data from June 2009 to December 2022, where Δs_t is the log difference of the Nikkei 225 index, in percent, and Z_{t-1} contains a constant, the lagged standardized Nikkei VI (VI_{t-1}), the lagged change in stock prices (Δs_{t-1}), the change in the Dow Jones Industrial Average on the preceding US trading day ($\Delta DJIA_{t-1}$), the lagged change in the nominal effective exchange rate of the yen ($\Delta NEER_{t-1}$), the lagged change in the Japanese Government Bond (JGB) Volatility Index (ΔJGB_VIX_{t-1}), and the lagged ten-year JGB yield ($BOND_{t-1}$). Day 1 is the first trading day on which the stock market can react to the announcement, and responses are normalized to zero on day 0, the preceding trading day. The shaded area marks the interval in which the announcement occurs. The solid line with circle markers shows the average response.

The left panel of Figure 3 shows the percentage response of the Nikkei 225 index over the three days following each announcement.[18] Specifically, we plot the cumulative sum of the residuals obtained by regressing the daily percentage change in stock prices on a set of control variables, normalizing the response on the day before the announcement to zero.[19] In the figure, the announcement occurs between day 0 and day 1 (the shaded area), so the change in stock prices on day 1 is the immediate response that is not explained by the control variables. On average, stock prices rise in response to the three announcements (solid line with circle markers). The cumulative response is positive for every announcement on each of the three days, ranging from around 0.6 percent for the Rugby World Cup on

[18]The dates listed above are those on which the hosting decisions were made. Because all three decisions reached Japan after the stock market had closed or on a weekend, we assign each announcement to the first trading day after the news, consistent with the rule used for the fiscal packages in Table 1: July 29, 2009, September 9, 2013, and November 26, 2018.

[19]The control variables are the same as in equation (8) in the next section and are listed in the notes to Figure 3.

day 1 to around 3.6 percent for the Tokyo Olympics on day 2. These responses provide a first point of comparison: the stock market responded positively to announcements of public spending that were unrelated to macroeconomic conditions and, according to the theory, free of signaling effects.

We compare these responses with those to the twenty-one fiscal packages listed in Table 1, dated at the size stage, that is, on the first trading day on which the final size of each package is public. Unlike the three announcements above, these packages respond to macroeconomic conditions, and according to the theory of Section 2, their effects may be dampened or even reversed by signaling effects. The right panel of Figure 3 shows that the stock market response to the packages covers a wide range of positive and negative values, so that the average response is close to zero (solid line with circle markers). On day 1, stock prices rise for 10 of the twenty-one packages and fall for the remaining 11.

This contrast is consistent with signaling effects. The fiscal packages are intended to stabilize the economy in the face of an adverse shock, and their size may therefore signal to the private sector how severe the government believes the downturn to be. Such a signal could offset the positive response of stock prices observed for the three announcements unrelated to macroeconomic conditions. This evidence is only suggestive, however: the comparison rests on three episodes and does not account for what the private sector expected before each announcement or for the level of uncertainty at the time. The next section therefore examines the stock market response formally.

5. Empirical Investigation of Signaling Effects

In this section, we formally examine whether the fiscal packages listed in Table 1 had signaling effects by taking to the data two predictions of the theory in Section 2. First, signaling effects are stronger when the private sector is more uncertain about the state of the economy. Second, signaling effects are proportional to the policy surprise: an announcement that exceeds the private sector's expectations about the size of the intervention leads the private sector to revise down its view of the state of the economy, which weakens, and may even

reverse, the positive response of stock prices. Taken together, the two predictions imply that the response of stock prices to an upward revision in expected government spending should be lower when uncertainty is high, which is the focus of our empirical specification. We test these predictions using daily stock prices, and defer the quantification of signaling effects on economic activity to the VAR analysis in Section 6.

5.1. Evidence of Signaling Effects of Fiscal Policy

To detect potential signaling effects of fiscal policy, we estimate the stock market response to fiscal announcements using the following baseline specification:

$$\begin{aligned}\Delta s_t = \alpha \mathbb{I}\{A_t^i\} + \beta \mathbb{I}\{A_t^i\} \times VI_{t-1} + \delta \mathbb{I}\{A_t^i\} \times \Delta E_t G_{t+1} + \eta \mathbb{I}\{A_t^i\} \times VI_{t-1} \times \Delta E_t G_{t+1} \\ + Z_{t-1}\gamma + e_t,\end{aligned} \tag{8}$$

where Δs_t is the log difference of the Nikkei 225 index, in percent, and $\mathbb{I}\{A_t^i\}$ is the indicator variable for stage $i \in \{\text{order}, \text{size}, \text{ratify}\}$ defined in Section 3.1, which equals one on the dates on which a fiscal package is ordered, its final size becomes public, or the Cabinet approves the supplementary budget, respectively. We estimate equation (8) separately for each stage. VI_{t-1} is the Nikkei VI on the previous trading day, standardized to have zero mean and unit variance over the sample. It measures, in standard deviations, the level of uncertainty prevailing before the announcement. $\Delta E_t G_{t+1}$ is the revision in the private sector's expectations about government spending between the surveys conducted immediately before and after the announcement, constructed from the *ESP Forecast* as described in Section 3.2.[20] For ease of interpretation, we demean the revision across the announcement days, so that α and β measure the stock market response to an announcement associated with an average revision in expectations.[21]

[20] We use the collection dates of each survey to match every announcement with the last survey collected before it and the first survey collected after it, so that the revision reflects the announcement. Because the survey is monthly, the revision may also reflect other macroeconomic news that arrives between the two surveys. Section 5.3 shows that our results are robust to purging the revision of such news.

[21] A specification with a triple interaction would ordinarily include all lower-order terms. In our case, the demeaned revision $\Delta E_t G_{t+1}$ is defined only on announcement days and is set to zero on all other days. As a result, $\Delta E_t G_{t+1}$ and $VI_{t-1} \times \Delta E_t G_{t+1}$ coincide with $\mathbb{I}\{A_t^i\} \times \Delta E_t G_{t+1}$ and with the triple interaction

The vector Z_{t-1} contains the control variables: a constant, the lagged standardized Nikkei VI (VI_{t-1}), the lagged change in stock prices (Δs_{t-1}), the change in the Dow Jones Industrial Average on the preceding US trading day ($\Delta DJIA_{t-1}$), the lagged change in the nominal effective exchange rate of the yen ($\Delta NEER_{t-1}$), where an increase denotes an appreciation of the yen, the lagged change in the Japanese Government Bond (JGB) Volatility Index (ΔJGB_VIX_{t-1}), and the lagged ten-year JGB yield ($BOND_{t-1}$). The lagged change in stock prices accounts for serial correlation in daily returns. The Dow Jones Industrial Average captures spillovers from the US stock market to the Japanese market; Chen and Rogoff (2003) show a strong correlation between movements in the US and Japanese stock prices. The exchange rate is a well-known determinant of share prices in Japan, where a large proportion of listed companies are exporters. The JGB yield and the JGB Volatility Index control for conditions in the government bond market and, more broadly, for financial conditions.

Table 2 reports the estimates of equation (8). Column (1) uses the indicator variable for the order stage, column (2) the indicator for the size stage, and columns (3) and (4) the indicator for the ratification stage.

The coefficients in equation (8) have the following interpretation. Because VI_{t-1} is standardized and the revision in expectations is demeaned, α is the response of stock prices to an announcement associated with an average revision, made when uncertainty is at its sample mean. The theory in Section 2 does not pin down its sign. An expansionary package has a direct positive effect on stock prices, since higher government spending stimulates economic activity, and, to the extent that it exceeds the private sector's expectations, a negative signaling effect, since it leads the private sector to revise down its view of the state of the economy. The coefficient β measures how the response to such an announcement varies with uncertainty. The average revision associated with the size announcements is positive (0.10 percentage points), so the average announcement carries a negative signal. The theory predicts that this signal is amplified by uncertainty, whereas the direct effect does not depend on uncertainty. The theory therefore predicts that β is negative, which corresponds to the

term, respectively, and cannot be included separately. The level of VI_{t-1} is included in Z_{t-1}.

first prediction above.

The coefficient δ is the response of stock prices to a revision that is one percentage point larger than average when uncertainty is at its sample mean. As for α, its sign depends on whether the direct effect or the signaling effect of a larger package dominates. Finally, η measures how the response to the revision varies with uncertainty: $\delta + \eta$ is the response to a revision that is one percentage point larger than average when uncertainty is one standard deviation above its mean. Since only the signaling effect becomes stronger as uncertainty rises, the theory predicts that η is negative. This is our main coefficient of interest. It combines the two features that characterize signaling effects, their dependence on the policy surprise and their amplification by uncertainty, and a negative estimate of η is evidence of signaling effects even if the overall response of stock prices to an announcement remains positive.

We begin with the size stage in column (2). As discussed in Section 3.1, this is the critical stage of the announcement process: it is when the final size of the fiscal package becomes public, and the size typically remains unchanged thereafter. The coefficient α is not statistically significant: an announcement associated with an average revision, made when uncertainty is at its sample mean, has no significant effect on stock prices. The coefficient β is -0.555 and significant at the 1% level. For an announcement associated with an average revision, the response of stock prices is about 0.6 percentage points lower when uncertainty is one standard deviation above its mean. The negative sign is consistent with the first prediction of the theory: signaling effects are stronger when the private sector is more uncertain about the state of the economy. The coefficient δ is -0.840 and significant at the 5% level: when uncertainty is at its sample mean, a revision that is one percentage point larger than average lowers stock prices by about 0.8 percent.

The main coefficient of interest, η, is estimated to be -2.674 and is significant at the 1% level. When uncertainty is one standard deviation above its mean, the response of stock prices to a revision that is one percentage point larger than average is $\delta + \eta = -3.5$ percent, compared with -0.8 percent at an average level of uncertainty. To gauge the magnitude of

these effects, note that the revisions associated with the size announcements have a standard deviation of 0.33 percentage points. A revision that is one standard deviation larger than average lowers stock prices by about 0.3 percent when uncertainty is at its sample mean, and by about 1.1 percent when uncertainty is one standard deviation above its mean. As predicted by the theory, the response of stock prices to an upward revision becomes more negative as uncertainty rises: the private sector reads a larger-than-expected package as a signal that the government views the economic outlook as worse than previously thought, and the more so the more uncertain it is about the state of the economy.

Columns (1), (3), and (4) report the results for the order and ratification stages. At the order stage, none of the coefficients of interest is statistically significant, consistent with the fact that no information about the size of the package is released at this stage. At the ratification stage, when all ratification dates are used (column 3), β and η are positive and significant, the opposite of the pattern at the size stage. This result is driven by the first two COVID-19 packages of 2020, for which the ratification date (April 8 and May 28, 2020) is the trading day immediately after the size date, so that the response at the ratification stage cannot be separated from the adjustment of stock prices following the size announcement. When these two dates are excluded (column 4), neither coefficient is statistically significant. The coefficient δ is negative in both columns, but only marginally significant once the two dates are excluded. Overall, the negative response to an upward revision under high uncertainty, which is the signature of signaling effects, appears only at the size stage, when the final size of the package becomes public.[22]

[22]The five packages financed through contingency reserve funds are small, and the revision in expected total government spending may not capture the surprise they contain. Excluding them and re-estimating equation (8) for the size stage on the remaining 16 packages yields $\eta = -2.117$ (s.e. 0.961), significant at the 5% level, while $\beta = -0.201$ (0.126) and $\delta = -0.403$ (0.408) retain their signs but are no longer significant. The loss of precision reflects the smaller number of announcements made under high uncertainty, in particular the package of March 11, 2020.

5.2. Risk of Government's Default and Stock Price Indexes

We have interpreted the negative response of stock prices to fiscal announcements under high uncertainty as evidence of signaling effects. One might argue instead that this response reflects concerns about the sustainability of public finances in Japan, whose ratio of public debt to GDP is the highest among advanced economies: market participants may fear that a debt-financed fiscal stimulus raises the perceived risk of sovereign default. To address this concern, we re-estimate equation (8) with the change in the Japanese government bond volatility index, which captures perceived risk in the government bond market, as the dependent variable in place of the change in stock prices.

The results, reported in Table B.3 in Appendix B.2, do not support this alternative explanation. At the size stage, the index falls on announcement days, significantly at the 10% level, which is the opposite of what one would expect if news of a new fiscal package raised sovereign risk. Moreover, the index does not respond significantly to any of the interactions between the announcement indicator, uncertainty, and the revision in expectations. Fiscal announcements therefore do not raise perceived risk in the government bond market, and the negative response of stock prices to an upward revision under high uncertainty cannot be attributed to concerns about sovereign solvency.

One might also be concerned that our results depend on the choice of stock market index. The Nikkei 225 is a price-weighted average of 225 stocks, and its movements can be dominated by a small number of high-priced stocks. To address this concern, we re-estimate equation (8) with the TOPIX, a market-capitalization-weighted index of all stocks listed on the main market of the Tokyo Stock Exchange, in place of the Nikkei 225.[23] The results, reported in Table B.4 in Appendix B.2, closely mirror those in Table 2: at the size stage, the coefficient on the triple interaction, η, remains negative and significant at the 1% level. Our evidence of signaling effects is therefore robust to how we measure the response of stock prices.

[23]The main market of the Tokyo Stock Exchange was the First Section until April 2022 and has been the Prime Market since then.

5.3. Controlling for Macroeconomic News

The revision in expected government spending is measured between two monthly surveys. It may therefore reflect not only the announcement but also macroeconomic news that arrives between the two surveys. This raises a concern analogous to the one raised by Bauer and Swanson (2023) for monetary policy: if the government announces a larger package in response to bad economic news, and the same news depresses stock prices, expected spending would rise and stock prices would fall even in the absence of signaling effects. The matching of announcements to surveys by collection date (Section 3.2) ensures that the two surveys bracket the announcement, but it does not rule out that other news arrives in the same window.

To address this concern, we purge the revision of macroeconomic news. We measure such news with the Citi Economic Surprise Index for Japan, which summarizes the surprises in Japanese macroeconomic data releases relative to consensus forecasts, weighting recent releases more heavily. For each survey, we compute the change in the index between the deadline of the previous survey and the deadline of the current one, so that it captures the data surprises that arrived between the two surveys. We then regress the monthly revision in expected government spending on this change over the full sample and use the residual in place of the revision. The slope of this regression is indistinguishable from zero (0.000, s.e. 0.001, in percentage points per index point) and its R^2 is below 0.01: a change in the index of 50 points, a large move by historical standards, is associated with a revision of less than 0.01 percentage points. Revisions in expected government spending are thus essentially unrelated to macroeconomic data surprises, which by itself suggests that the revisions are driven by the fiscal announcements rather than by macro news.

Table B.5 in Appendix B.2 reports the estimates of equation (8) with the purged revision for all three stages. The results are virtually identical to those in Table 2: at the size stage, η is -2.678 and significant at the 1% level, compared with -2.674 in the baseline, and the coefficients at the order and ratification stages follow the same pattern as in the baseline. We conclude that the negative response of stock prices to an upward revision under high

uncertainty is not due to macroeconomic news arriving around the announcement.

6. Quantifying Signaling Effects on Economic Activity

Section 5 shows that fiscal announcements have signaling effects: under high uncertainty, stock prices respond negatively to a larger-than-expected package. Stock prices, however, are only a summary of how the private sector revises its expectations on the announcement day. The question that matters for policy is whether these signaling effects weaken the stabilizing effect of fiscal policy on economic activity, as the theory in Section 2 predicts. Answering it requires tracing the response of output over the months following an announcement, which the daily regressions cannot do. In this section, we therefore quantify the signaling effects of fiscal news on economic activity by estimating a threshold VAR model at monthly frequency. The threshold VAR allows us to study how the impact of fiscal news on economic activity depends on the strength of signaling effects and on the level of uncertainty, using identifying restrictions motivated by the theory.

Three features of the VAR deserve attention. First, since the theory predicts that signaling effects are stronger when uncertainty is high and can even reverse the effect of an expansionary announcement, we estimate a threshold VAR that allows the dynamics to differ between periods of high and low uncertainty. A linear VAR would average responses that may differ in size and sign across these periods, concealing the state dependence predicted by the theory. We use the survey-based measure of household uncertainty described in Section 3.3 as the threshold variable.[24] Second, besides the revision in expected government spending and the change in stock prices on announcement days, the VAR includes government expenditure, to verify that the news is followed by an actual increase in spending, real GDP, our main outcome of interest, and tax revenue, whose response is left unrestricted to check whether the response of output reflects the anticipation of higher future taxes rather than signaling effects. Third, following the theory, we identify fiscal news shocks from the

[24] Our baseline measure is the dispersion of responses to the question on livelihood. Appendix B.3 shows that our results are robust to using the questions on income growth and asset prices, as well as the monthly average of the Nikkei VI.

co-movement between the revision in expected government spending and stock prices on announcement days, rather than from the size of the stimulus alone.

Guided by the theory in Section 2, we identify two types of fiscal news shocks that differ in the strength of their signaling effects, using sign restrictions on the co-movement between the revision in expected government spending and the change in stock prices on announcement days (Uhlig, 2005; Mumtaz and Zanetti, 2012, 2015; Bai et al., 2024). We define *fiscal news with significant signaling effects* as news on which the revision in expected government spending and the change in stock prices move in opposite directions, that is, an upward revision in expected spending is accompanied by a fall in stock prices, or a downward revision by a rise. Conversely, we define *fiscal news with minor signaling effects* as announcements on which the two variables move in the same direction. This distinction follows from the theory, which predicts that signaling effects dampen the positive effect of an announced stimulus on stock prices and, when they are strong enough, reverse it.[25] As in Section 5, we measure the revision in expected spending as the change between the surveys conducted immediately before and after the announcement, and the change in stock prices on the trading day of the announcement, and we focus on the size stage, at which signaling effects emerge.

Table 3 summarizes our identifying restrictions. The two fiscal news shocks are distinguished by the sign of the co-movement between the revision in expected government spending and the change in stock prices on announcement days, negative for news with significant signaling effects and positive for news with minor signaling effects. Because both shocks are news about future spending rather than changes in spending itself, we restrict the response of actual government spending to be approximately zero on impact: at the size stage, the package has been announced but not yet implemented. We then require that government spending rise between four and twelve months after the announcement, when the supplementary budget is executed, so that both shocks are expansionary fiscal news. Finally, we assume that no other shock affects the revision in expected spending or stock

[25] Appendix B.3.2 provides an interpretation of our identifying restrictions using the stylized model in Section 2.

prices on announcement days, so that the two variables in f_t are driven only by the two fiscal news shocks. The responses of output and tax revenues are left unrestricted for both shocks.

We estimate a threshold VAR in which uncertainty in the previous month, u_{t-1}, is the threshold variable. The lagged value ensures that the regime is determined by the uncertainty prevailing before the announcement, as in the daily regressions of Section 5. The model is

$$\begin{pmatrix} f_t \\ y_t \end{pmatrix} = \begin{pmatrix} 0 \\ c_{r,Y} \end{pmatrix} + \sum_{p=1}^{P} \begin{pmatrix} 0 & 0 \\ B^p_{r,YF} & B^p_{r,YY} \end{pmatrix} \begin{pmatrix} f_{t-p} \\ y_{t-p} \end{pmatrix} + \begin{pmatrix} \epsilon^f_{r,t} \\ \epsilon^y_{r,t} \end{pmatrix}, \qquad \begin{pmatrix} \epsilon^f_{r,t} \\ \epsilon^y_{r,t} \end{pmatrix} \sim \mathcal{N}(0, \Sigma_r), \quad (9)$$

where $r = l$ if $u_{t-1} < \overline{u}$ and $r = h$ if $u_{t-1} \geq \overline{u}$, and the threshold $\bar{u}$ is set to the sample mean of u_t over June 2009 to December 2022 rather than estimated (Figure B.2 in Appendix B.1.3 plots u_t together with $\bar{u}$).[26] The vector f_t contains the revision in expected government spending, $\Delta E_t G_{t+1}$, and the change in stock prices, ΔSP_t, associated with the size announcements. Both variables are defined as in Section 5: the revision is the change between the surveys conducted immediately before and after the announcement, and the change in stock prices is measured on the trading day of the announcement. Following Jarocinski and Karadi (2020), we assign both variables to the month of the announcement and set them to zero in months without an announcement. The zero restrictions in the first row of equation (9) imply that f_t does not depend on its own lags or on those of y_t, so that its innovations, $\epsilon^f_{r,t}$, are driven only by the two fiscal news shocks; this is the exclusion restriction in the last column of Table 3. The vector y_t contains monthly real government expenditure (G_t), real GDP (Y_t), and real tax revenue (T_t), all in logs, and Σ_l and Σ_h are the variance–covariance matrices of the innovations in the two regimes.[27] We estimate the model on monthly data from June 2009 to December 2022 with $P = 6$ lags. Following Uhlig (2005), we use a diffuse

[26] This specification is deliberately simple. Uncertainty is treated as exogenous to the variables in the VAR. Fiscal news and the resulting movements in output may themselves affect uncertainty and hence the regime, a feedback that our specification does not capture. The specification is also linear within each regime, so that the effects of upward and downward revisions in expected spending are assumed to be symmetric, as in the model of Section 2. We adopt this specification because our sample is short, covering 163 months and twenty-one announcements. The responses should therefore be interpreted as conditional on the prevailing level of uncertainty.

[27] Government expenditure and real GDP are taken from the *JCER Monthly GDP Estimate*, and tax revenue from the *Ministry of Finance Statistics Monthly*. Appendix B.1.2 provides details.

normal–inverse Wishart prior and draw the reduced-form parameters from their posterior in each regime. For each draw, we draw a rotation matrix and retain it if the implied impulse responses satisfy the restrictions in Table 3, repeating the procedure until 5,000 draws are retained. The reported impulse responses are the median and the 68 and 90 percent bands across the retained draws.

Figure 4 shows the impulse responses to fiscal news with minor signaling effects (panel a) and to fiscal news with significant signaling effects (panel b). Within each panel, the left column reports the responses under high uncertainty and the right column those under low uncertainty. The size of each shock is normalized so that the median impact response of the revision in expected government spending, $\Delta E_t G_{t+1}$, is 10 basis points, so that the responses of the other variables can be compared across the two types of news.

Our main interest is the response of output, which is left unrestricted in the identification. Under high uncertainty (left column of each panel), output rises in response to fiscal news with minor signaling effects (panel a) and falls in response to fiscal news with significant signaling effects (panel b). The contraction in panel (b) is concentrated in the months immediately following the announcement, when output declines by about 0.5 percent at the trough, and output returns to its pre-announcement level within about six months. Under low uncertainty (right column of each panel), output does not fall in response to either type of news; in particular, it does not respond negatively to fiscal news with significant signaling effects. The response of government spending is positive and persistent in all four cases: it rises after the announcement and remains above zero well beyond the twelve-month horizon over which the restriction is imposed. The fall in output under high uncertainty (panel b) therefore cannot be attributed to a failure to implement the announced spending. Rather, output falls even though government spending rises in the months following the announcement, which is consistent with the signaling effect outweighing the direct effect of the spending increase.

These results are in line with the predictions of the theory in Section 2. First, output falls in response to fiscal news with significant signaling effects: the private sector reads the

announcement as a signal that the government views the economic outlook as worse than previously thought, and this revision in beliefs outweighs the direct effect of higher spending. Second, this contraction arises only under high uncertainty. When uncertainty is low, the private sector relies less on the announcement to learn about the state of the economy, the signaling channel is weak, and the expansionary effect of the news is not reversed.

These results rest on the identification in Table 3, and one might ask whether the restrictions isolate signaling effects or merely capture bad macroeconomic news that arrives around the announcement (Bauer and Swanson, 2023), or the anticipation of higher future taxes. Section 5.3 addresses the first concern for the daily regressions: the change in stock prices in f_t is measured on the announcement day, the revision in expected spending is essentially unrelated to macroeconomic data surprises, and purging it of such surprises leaves the results unchanged. The same holds for the VAR: Figure B.3 in Appendix B.3.3 shows that the impulse responses are virtually identical when the purged revision enters f_t. Two further considerations, specific to the VAR, argue against both interpretations. First, neither type of fiscal news generates a sustained increase in tax revenues, whose response is left unrestricted, in either regime (bottom row of Figure 4). Together with the evidence in Section 5.2 that the government bond volatility index does not rise on announcement days, this indicates that the fall in stock prices does not reflect concerns about future tax burdens or debt sustainability. Second, the contraction in output following news with significant signaling effects appears only under high uncertainty. Bad macroeconomic news would depress output regardless of the level of uncertainty, whereas this state dependence is what the theory predicts for signaling effects.

Appendix B.3 also shows that our results are robust to alternative measures of uncertainty, including responses to different questions from the *Consumer Confidence Survey* and the Nikkei VI. It also shows that the regimes do not merely capture the state of the business cycle: our measure of uncertainty is essentially uncorrelated with the cyclical component of the unemployment rate, and when the regimes are defined by this component instead, the state dependence of the output response documented in Figure 4 does not appear.

Table 2: Impact effects of fiscal announcements on stock prices: 2009–2022

	Dependent variable: Δs_t			
	Order	Size	Ratify	
			All	Excl. 2 dates
	(1)	(2)	(3)	(4)
$\mathbb{I}\{A_t^i\}$	0.150	−0.243	0.086	−0.172
	(0.211)	(0.168)	(0.185)	(0.157)
$\mathbb{I}\{A_t^i\} \times VI_{t-1}$	−0.168	−0.555***	1.212***	0.490
	(0.156)	(0.204)	(0.186)	(0.377)
$\mathbb{I}\{A_t^i\} \times \Delta E_t G_{t+1}$	0.211	−0.840**	−1.084**	−1.046*
	(0.503)	(0.398)	(0.519)	(0.564)
$\mathbb{I}\{A_t^i\} \times VI_{t-1} \times \Delta E_t G_{t+1}$	−0.082	−2.674***	5.843***	3.516
	(0.243)	(0.758)	(1.912)	(2.445)
VI_{t-1}	0.042	0.048	0.034	0.039
	(0.040)	(0.038)	(0.040)	(0.040)
Δs_{t-1}	−0.144***	−0.143***	−0.145***	−0.144***
	(0.026)	(0.026)	(0.026)	(0.026)
$\Delta DJIA_{t-1}$	0.567***	0.569***	0.573***	0.566***
	(0.038)	(0.038)	(0.037)	(0.038)
$\Delta NEER_{t-1}$	−0.452***	−0.465***	−0.450***	−0.453***
	(0.071)	(0.067)	(0.071)	(0.071)
ΔJGB_VIX_{t-1}	−0.001	−0.001	−0.001	−0.001
	(0.003)	(0.003)	(0.003)	(0.003)
$BOND_{t-1}$	−0.069	−0.075	−0.063	−0.067
	(0.052)	(0.050)	(0.052)	(0.052)
Constant	0.045	0.050	0.042	0.046
	(0.033)	(0.031)	(0.032)	(0.032)
Announcements	21	21	16	14
Observations	3324	3324	3324	3324
Adj. R-squared	0.238	0.243	0.242	0.239

Notes: The table reports estimates of equation (8) on daily data from June 2009 to December 2022. Each column uses the indicator variable for the stage shown in the column header, $i \in \{\text{order}, \text{size}, \text{ratify}\}$. Column (4) excludes the ratification dates of April 8 and May 28, 2020, which are the trading days immediately after the corresponding size dates. VI_{t-1} is the lagged standardized Nikkei VI, and $\Delta E_t G_{t+1}$ is the revision in expected government spending between the surveys conducted immediately before and after the announcement, demeaned across the announcement days. The control variables are the lagged change in stock prices (Δs_{t-1}), the change in the Dow Jones Industrial Average on the preceding US trading day ($\Delta DJIA_{t-1}$), the lagged change in the nominal effective exchange rate of the yen ($\Delta NEER_{t-1}$), the lagged change in the Japanese Government Bond (JGB) Volatility Index (ΔJGB_VIX_{t-1}), and the lagged ten-year JGB yield ($BOND_{t-1}$). Newey–West standard errors are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively, based on two-sided tests.

Table 3: Identifying restrictions

	Shock		
Variables	Fiscal news with minor signaling	Fiscal news with significant signaling	Other shocks
Co-movement of $\Delta E_t G_{t+1}$ and ΔSP_t	$+$	$-$	0
Government spending	≈ 0 on impact > 0 for 4–12 mos.	≈ 0 on impact > 0 for 4–12 mos.	Unrestricted
Output	Unrestricted	Unrestricted	Unrestricted
Tax revenues	Unrestricted	Unrestricted	Unrestricted

Notes: $\Delta E_t G_{t+1}$ is the revision in expected government spending between the surveys conducted immediately before and after the announcement, and ΔSP_t is the change in stock prices on the trading day of the announcement. Both are nonzero only in months with a size announcement. The first row restricts the sign of the product of the contemporaneous responses of $\Delta E_t G_{t+1}$ and ΔSP_t to each shock; the sign of each shock is normalized so that $\Delta E_t G_{t+1}$ rises. $+$ and $-$ denote positive and negative restrictions on the sign of this co-movement, and 0 denotes that both $\Delta E_t G_{t+1}$ and ΔSP_t are restricted to zero. The response of government spending is restricted to be approximately zero on impact and positive at each horizon from four to twelve months after the shock. The responses of output and tax revenues are left unrestricted.

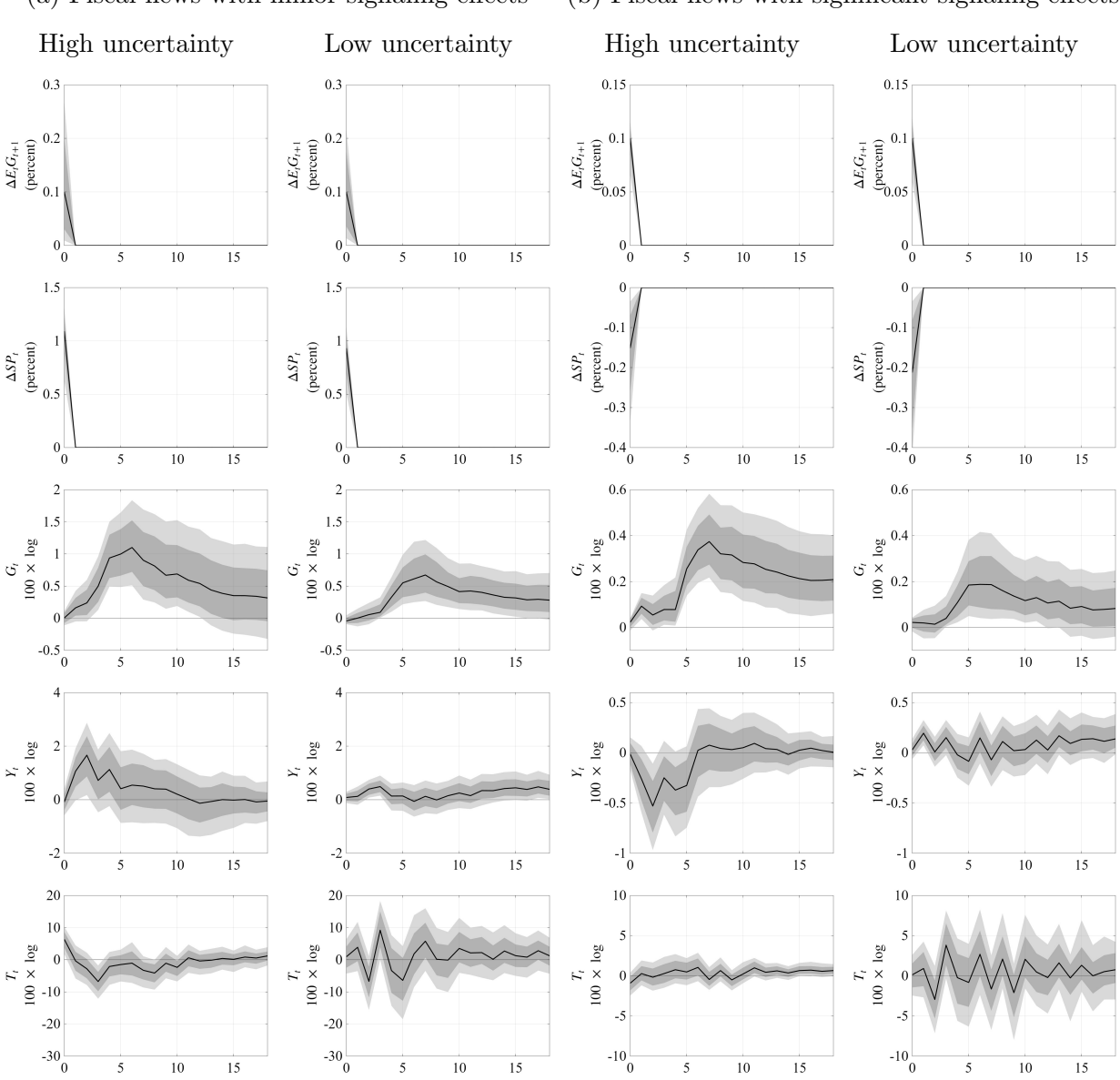


Figure 4: **Impulse response functions.** *Notes*: The figure shows the responses to fiscal news with minor signaling effects (panel a) and significant signaling effects (panel b), under high uncertainty (left column of each panel) and low uncertainty (right column). The solid line is the median impulse response, and the dark- and light-shaded areas are the 68 and 90 percent credible bands, respectively. The size of each shock is normalized so that the median impact response of the revision in expected government spending is 10 basis points. The horizontal axis is in months. Uncertainty is measured as the cross-sectional standard deviation of household expectations about livelihood over the next six months in the *Consumer Confidence Survey*; a month is classified as high (low) uncertainty if this measure in the previous month is above (below) its sample mean. $\Delta E_t G_{t+1}$ is the revision in expected government spending, in percentage points, and ΔSP_t is the change in stock prices at the size stage, in percent; G_t, Y_t, and T_t are real government expenditure, real GDP, and real tax revenue, in 100 times logs.

7. Conclusion

This paper has studied the signaling effects of fiscal announcements. In a stylized model, the announcement of a fiscal package reveals to the private sector the government's assessment of the state of the economy, so that a larger-than-expected package is read as bad news. The theory delivers two testable predictions: signaling effects depend on the policy surprise, that is, on the revision in the private sector's expectations about the size of the intervention, and they are stronger when the private sector is more uncertain about the state of the economy. It also shows that signaling effects need not reverse the impact of fiscal policy: they dampen it, and reverse it only when they are strong enough.

We have tested these predictions with a new dataset that combines daily stock prices, narrative records of twenty-one fiscal packages announced in Japan between 2009 and 2022, and professional forecasters' projections of government spending. Japan's legislative process allows us to identify the date on which the size of each package first becomes public. On that date, an upward revision in expected government spending lowers stock prices, and the more so the higher the uncertainty prevailing before the announcement; this pattern appears only at the stage at which the size is disclosed, and not when the package is ordered or when the supplementary budget is approved. It is not driven by sovereign risk, by macroeconomic news arriving around the announcement, or by the anticipation of higher taxes. A threshold VAR identified with restrictions derived from the theory shows that, under high uncertainty, output rises after fiscal news with minor signaling effects but falls after fiscal news with significant signaling effects, whereas under low uncertainty output does not fall after either type of news. To our knowledge, this is the first quantitative assessment of the signaling effects of fiscal policy on real activity.

The policy implications depend on the strength of the signaling channel. When signaling effects only dampen the impact of a fiscal package, a larger package is needed to achieve a given stabilizing effect. When uncertainty is high enough for signaling effects to reverse the impact of the package, a larger package may deepen the contraction it is meant to counter.

Since uncertainty is typically high precisely when stabilization is most needed, this tension is a first-order consideration for the design of discretionary fiscal policy.

Several extensions are left for future research. One is to ask whether fiscal authorities can manage signaling effects through communication, for example by disclosing the assessment of the economy that motivates a package, without compromising credibility. Another is to extend the analysis to other fiscal instruments, such as tax announcements or debt issuance, whose signaling content may differ from that of spending packages. A third is to incorporate the level of public debt, which introduces a further trade-off between the stabilizing potential of a package and the risks associated with elevated debt.

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Online Appendices

The Signaling Effects of Fiscal Announcements

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A. Extension to the Simple Model of Signaling Effects

This section presents an alternative version of the simple model described in Section 2, where policymakers respond with no lag to the realization of the economic shock. The key properties of the model introduced in Section 2 are retained also under this alternative assumption.

A.1. The model

As in the baseline model of Section 2, the behavior of the economy is summarized by a univariate process driving a scalar, X_t, which we call the economic variable, economic conditions, or the economy. We assume that agents do not observe this variable and have to track it using two sources of information: (i) a non-policy source of information, captured by the signal s_t about X_t, which is perfectly observed by every agent and (ii) the policy actions taken by the government or policymaker in response to the economic variable X_t. Differently from the baseline model, though, the government aims at contemporaneously stabilizing its dynamics by taking contemporaneous action a. The action is perfectly observed by every agent of the economy. Agents know the model structure (i.e., the equation and the parameter values), which is formalized below.

We assume that agents' expectations, $X_{t|t}$, have feedback effects on the economic variable, X_t. The policymaker can stimulate the economic variable, X_t, by increasing its policy tool a. The economic variable is also affected by an i.i.d. Gaussian shock, ε_t. More formally,[1]

$$X_t = \gamma a_t + \lambda X_{t|t} + \varepsilon_t, \quad \gamma > 0 \text{ and } \lambda \neq 0, \tag{A.1}$$

where $\varepsilon_t \sim \mathcal{N}(0, \sigma_\varepsilon^2)$. The parameter $\gamma > 0$ encapsulates the positive effects of policy on the economic variable. The parameter λ controls the feedback effect of agents' beliefs. If $\lambda > 0$, expectations can be regarded to some extent as self-fulfilling. We make this assumption throughout this section.

The government takes action a in every period t with the objective of stabilizing the dynamics of the economic variable X_t.

$$a_t = \alpha E_t^g X_t + \tau_t, \quad \alpha \leq 0, \tag{A.2}$$

where $\tau_t \sim \mathcal{N}(0, \sigma_\tau^2)$ is an exogenous policy shock and $E_t^g(\cdot)$ denotes the expectations of the government, which are defined as follows:

$$E_t^g(X_t) = X_t + \mu_t, \tag{A.3}$$

where $\mu_t \sim \mathcal{N}\left(0, \sigma_\mu^2\right)$ is a measurement error.

[1] Since all the shocks in the model are i.i.d. and, for simplicity, there is no inertia in the model equation (A.1), agents' expectations about future realizations of the economic variable $X_{t+h|t}$ are always equal to zero and thereby do not affect the dynamics of the economic variable, X_t.

The non-policy signal is defined as follows:

$$s_t = X_t + \xi_t, \tag{A.4}$$

where $\xi_t \sim \mathcal{N}(0, \sigma_\xi^2)$ is the noise.

Private agents receive the same information and perfectly know the structure of the model. Their beliefs, $X_{t|t}$, and signals are common knowledge, so that their information set is $I_t^p = \{a_t, s_t, X_{t|t}\}$.[2] The government, instead, bases its policy action on its own independent assessment of the economy, observing X_t with a measurement error (as in equation (A.3)). Therefore, the expectations of the government differ from those of the private agents, i.e., $E_t^g(X_t) \neq X_{t|t}$. The difference in the information acquired by the private agents and the government is critical to allow the government's actions to transfer non-redundant information to private agents for the emergence of signaling effects.[3] The system can be written as follows:

$$\begin{aligned} X_t &= \gamma a_t + \lambda X_{t|t} + \varepsilon_t, && \text{(A.5)} \\ a_t &= \alpha X_t + u_t, && \text{(A.6)} \\ s_t &= X_t + \xi_t, && \text{(A.7)} \end{aligned}$$

where $u_t \equiv \tau_t + \alpha\mu_t$. Note that if $\alpha = 0$ (i.e., the policy action is unrelated to the government's expectations on the state of the economy), the shock u_t is simply the exogenous policy shock (i.e., $u_t = \tau_t$). If $\alpha < 0$ such that the policy action is related to the government's expectations and is countercyclical, the shock u_t is also affected by autonomous changes in beliefs of the government driven by the measurement error (μ_t).

A.2. Signal Extraction Problem

Notice that agents know their expectations (i.e., $X_{t|t} \in I_t^p$.) Hence, after plugging the policy function into the law of motion of the economic variable, we obtain the following state-space model for the signal extraction problem:[4]

$$\begin{aligned} \tilde{X}_t &= \frac{\gamma}{1-\alpha\gamma} u_t + \frac{1}{1-\alpha\gamma} \varepsilon_t, && \text{(A.8)} \\ \tilde{a}_t &= \alpha \tilde{X}_t + u_t, && \text{(A.9)} \\ \tilde{s}_t &= \tilde{X}_t + \xi_t, && \text{(A.10)} \end{aligned}$$

[2] See Melosi (2017) for a case in which agents acquire different information about the economy and optimally respond to their forecasts of the forecasts of other agents. Our results are robust to this assumption.

[3] As we shall see, the other important feature for signaling effects to arise is that government actions respond to the economic variable (i.e., $\alpha \neq 0$).

[4] Unlike Nimark (2008) and Melosi (2017), agents do not have private information and, thereby, have the same expectations about the economic variable, X_t.

where $\tilde{X}_t \equiv X_t - \lambda/(1-\alpha\gamma)X_{t|t}$, $\tilde{a}_t \equiv a_t - \alpha\lambda/(1-\alpha\gamma)X_{t|t}$, and $\tilde{s}_t \equiv s_t - \lambda/(1-\alpha\gamma)X_{t|t}$. Notice that $\{\tilde{a}_t, \tilde{s}_t\} \in I_t^p$.

This can be written in matrix form as follows:

$$\tilde{X}_t = \mathbf{R}\mathbf{z}_t, \tag{A.11}$$

$$\mathbf{y}_t = \mathbf{D}\tilde{X}_t + \mathbf{e}_t, \tag{A.12}$$

where $\mathbf{z}_t = [u_t \quad \varepsilon_t]'$, $\mathbf{e}_t = [u_t \quad \xi_t]'$, $\mathbf{y}_t = [\tilde{a}_t \quad \tilde{s}_t]'$, $\mathbf{D} = [\alpha \quad 1]'$,

$$\mathbf{R} = \left[\frac{\gamma}{(1-\alpha\gamma)} \quad \frac{1}{(1-\alpha\gamma)}\right]. \tag{A.13}$$

The Kalman gain vector, $\mathbf{K}$, can be shown to be given by

$$\mathbf{K} = \left(\mathbf{R}\Sigma_z\mathbf{R}'\mathbf{D}' + \mathbf{R}\mathbf{V}\right)\mathbf{F}^{-1}, \tag{A.14}$$

where

$$\Sigma_z = \begin{bmatrix} \sigma_u^2 & 0 \\ 0 & \sigma_\varepsilon^2 \end{bmatrix}, \tag{A.15}$$

$$\mathbf{V} = E\left(\mathbf{z}_t\mathbf{e}_t'\right) = \begin{bmatrix} \sigma_u^2 & 0 \\ 0 & 0 \end{bmatrix}, \tag{A.16}$$

$$\mathbf{F} = E\left(y_t y_t'\right) = \mathbf{D}\left(\mathbf{R}\Sigma_z\mathbf{R}'\right)\mathbf{D}' + \Sigma_e + \mathbf{D}\mathbf{R}\mathbf{V} + \left(\mathbf{D}\mathbf{R}\mathbf{V}\right)', \tag{A.17}$$

$$\Sigma_e = \begin{bmatrix} \sigma_u^2 & 0 \\ 0 & \sigma_\xi^2 \end{bmatrix}, \tag{A.18}$$

and the law of motion of the private sector's expectations, $X_{t|t} \equiv E\left(X_t|I_t^p\right)$, can be, thereby, expressed as follows:

$$\tilde{X}_{t|t} = \mathbf{K}\begin{bmatrix} \tilde{a}_t \\ \tilde{s}_t \end{bmatrix} = \mathbf{K}\begin{bmatrix} \left[\frac{\alpha\gamma}{1-\alpha\gamma} + 1\right]u_t + \frac{\alpha}{1-\alpha\gamma}\varepsilon_t \\ \frac{\gamma}{1-\alpha\gamma}u_t + \frac{1}{1-\alpha\gamma}\varepsilon_t + \xi_t \end{bmatrix}. \tag{A.19}$$

From the definition of $\tilde{X}_{t|t}$, we obtain

$$X_t = \tilde{X}_t + \frac{\lambda}{1-\alpha\gamma}X_{t|t} \tag{A.20}$$

Applying the expectation operator on both sides of the equation yields

$$X_{t|t} = \tilde{X}_{t|t} + \frac{\lambda}{1-\alpha\gamma}X_{t|t} \tag{A.21}$$

and after re-arranging

$$X_{t|t} = \frac{1-\alpha\gamma}{1-\alpha\gamma-\lambda}\tilde{X}_{t|t} \tag{A.22}$$

By plugging equation (A.22) into equation (A.20) we obtain

$$X_t = \tilde{X}_t + \frac{\lambda}{1-\alpha\gamma-\lambda}\tilde{X}_{t|t} \tag{A.23}$$

The system of equations (A.11), (A.19), (A.22), and (A.23) is the solution to the model and can be written more compactly as:

$$X_{t|t} = \left(\frac{1-\alpha\gamma}{1-\alpha\gamma-\lambda}\right) \cdot \mathbf{K} \begin{bmatrix} \left[\frac{\alpha\gamma}{1-\alpha\gamma}+1\right] u_t + \frac{\alpha}{1-\alpha\gamma}\varepsilon_t \\ \frac{\gamma}{1-\alpha\gamma}u_t + \frac{1}{1-\alpha\gamma}\varepsilon_t + \xi_t \end{bmatrix}. \tag{A.24}$$

A.3. Signaling Effects and Private Sector's Uncertainty

In this section, we conduct numerical exercises to show the basic properties of the theory of signaling effects. Specifically, we show that the magnitude of signaling effects varies with the government's degree of responsiveness to economic conditions (α). In the case of no response ($\alpha = 0$), there is no signaling effects because the government does not respond to the economy, X_t, and, consequently, its action, a_t, is driven by the exogenous policy shock τ_t and does not convey any information about the economy. When the government responds to the economy ($\alpha < 0$), signaling effects kick in and affect agents' beliefs about the economy ($X_{t|t}$) and – provided that there is feedback from agents' beliefs to the economic variable ($\lambda \neq 0$) – economic outcomes as well. In particular, we want to focus on how the private agents' uncertainty about the non-policy signal on the state of the economy (represented by σ_ξ) prior to observing the policy signal influences the size of signaling effects.

Parameter Values

	No Response	**Weak Response**	**Strong Response**
α	0.00	-1.00	-2.00
γ	0.50	0.50	0.50
λ	0.75	0.75	0.75
σ_ε	1.00	1.00	1.00
σ_u	0.10	0.10	0.10

Table A.4: **Parameter values.** Each column shows the parameter values used in three numerical exercises. The three cases only differ in how strongly the government responds to the economic variable (α).

Table A.4 reports the parameter values used in the numerical exercises.

Figure A.5 shows the response of the economy (X_t, dashed-dotted red line) and the private agents expectations ($X_{t|t}$, solid-blue line) to an autonomous unitary change in the policy actions driven by u_t for different values of the private agents' prior uncertainty (σ_ξ). We consider three policy actions: no government response to the economy ($\alpha = 0$, left panel), a weak government's response to the economy ($\alpha = -1$, middle panel), and a strong government's response to the economy ($\alpha = -2$, right panel). The signaling effects are defined as the deviation of the economic variable from the value it would have assumed if agents were perfectly informed by receiving a perfectly accurate signal such that their prior uncertainty is zero ($\sigma_\xi = 0$).

We first examine the case in which the government does not respond to the economic variable ($\alpha = 0$), and so signaling effects is absent by construction. The left panel in Figure A.5 shows the private agents expectations ($X_{t|t}$) in solid-blue line, and the state of the economy (X_t) in dashed-dotted red line. The two lines perfectly overlap for different values of the uncertainty prior to observing the economic signal (σ_ξ). Absent other disturbances, agents' beliefs perfectly reflect the state of the economy when the action of the government does not respond to the economic variable. In the case of no response of fiscal policy to the economic condition, the change in the policy action is uniquely driven by the independent policy shock (τ_t) whose magnitude is perfectly observed by agents. In the literature on fiscal multipliers, these shocks are the closest counterpart of discretionary changes in government spending, which are exogenous to the state of the economy and therefore do not give rise to signaling effects. The private agents recover the exact state of the economy from the signal in the policy action. Since the action of the government (a_t) is unrelated to the economic condition (X_t), private beliefs ($X_{t|t}$) perfectly track the economic condition for any given level of noise in the common signal received by agents (σ_ξ). In this case, neither beliefs nor the economic conditions are affected by variations in private sector's prior uncertainty, as evinced by the perfect overlapping of the two lines in the figure.

As a second and third exercise, we consider the government that maneuvers its policy action (a_t) to respond to *perceived* changes in the economic variable $E_t^g(X_t)$, encapsulated by the parameter α in equation (A.2). We assume that these changes in the government's beliefs also reflect some noise/error (μ_t), as defined in equation (A.3). Since the parameter $\alpha \neq 0$, agents do not know if the observed changes in the policy action are driven by a policy shock (τ_t), or noise (μ_t), or a change in the unobserved economic condition (X_t). Since the private sector cannot rule out the possibility that the policy action is driven by the unobserved economic condition, the policy action transfers non-redundant information about the economy to agents.

To establish whether signaling effects increase if the government is more proactive in stabilizing the economy, we consider two subcases: one case of a weak policy response ($\alpha = -1$) and one of a strong policy response ($\alpha = -2$). The middle panel in Figure A.5 shows the case of the government action (a_t) that weakly responds to changes in the economic environment ($\alpha = -1$). In this case, both agents' beliefs about the economy and the economy are affected by signaling effects. This can be seen by observing how beliefs ($X_{t|t}$, the blue solid line) and economic conditions (X_t, the red dashed-dotted line) fall as the private sector's

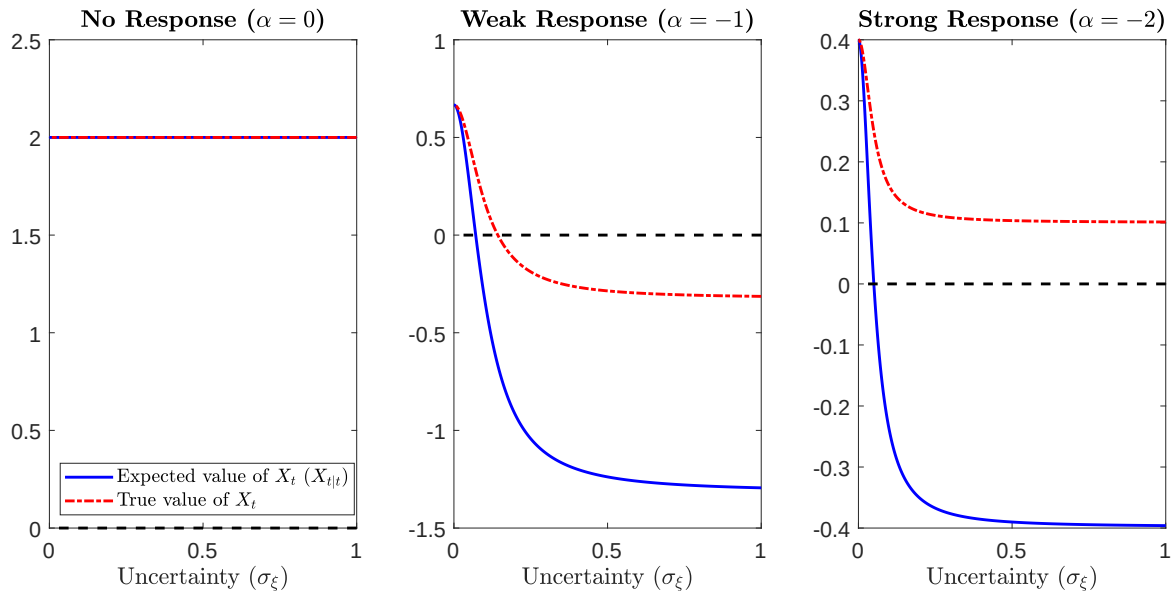


Figure A.5: **Signaling Effects of Economic Policy.** The response of agents' expectations, $X_{t|t}$, (blue solid line) and the economy, X_t, (red dotted-dashed line) to an autonomous unitary increase in the policy action ($u_t > 0$) as the private sector's prior uncertainty, σ_ξ, varies on the horizontal axis. On the left, the case of weaker policy response ($\alpha = -1$). On the right, the case of stronger policy response ($\alpha = -2$)

prior uncertainty rises. For positive values of the prior uncertainty ($\sigma_\xi > 0$) both variables ($X_{t|t}$ and X_t) are lower than their perfect information values with no prior uncertainty ($\sigma_\xi = 0$). But why do signaling effects lower beliefs and harm the economy? Because in the presence of uncertainty, the policy actions have the dual nature of economic policy and signal about the economy. The duality implies that if the government raises its instrument a_t, rational agents that face uncertainty on the state of the economy perceive that the policy action may have been executed in response to deteriorating economic conditions ($X_t < 0$).

Furthermore, and critical for the empirical analysis that follows, as agents' prior uncertainty (σ_ξ) increases, agents' expectations about the economic variable ($X_{t|t}$) are more responsive to policy signaling and consequently signaling effects become stronger, as exemplified by the solid-blue line in the middle and the right panels. Signaling effects grow with the private sector's prior uncertainty because as the private signal becomes more inaccurate, agents rely more on the public signal to learn about the economic condition X_t. Since rational agents know that the government increases its policy action a_t when the economic condition deteriorates, agents will lower their expectations of the economic conditions. Since the private sector's expectations simultaneously feed into economic conditions, X_t, the economy deteriorates as a result of signaling effects.

With the increase in uncertainty in the signal received on the state of the economy, the private agents increase the importance of the policy action to signal the state of the economy. With sufficiently high uncertainty, signaling effects are so strong that agents' beliefs *worsen* ($X_{t|t} < 0$, the blue solid line) in response to an *expansionary* policy action, ($a_t > 0$). Since

agents' beliefs feed back to the economic conditions, X_t, large signaling effects can even imply a perverse *negative* response of the economy (X_t, the red dashed-dotted line) to the *expansionary* policy action ($a_t > 0$).

The right panel in Figure A.5 shows the case of the government action that strongly responds to changes in the economic environment ($\alpha = -2$). Comparing the middle and right panels in the figure, there is yet another prediction of our theory of signaling effects of fiscal policy. As the government becomes more proactive in using its policy tools (a_t) to stabilize the economy (X_t), signaling effects become smaller. The degree of the government's pro-activity is controlled by the parameter α. You can see that when this parameter is twice as big (right panel), the economy does not contract in the aftermath of an expansionary policy shock regardless of the level of prior uncertainty, σ_ξ. The stronger stabilization effort by the government reduces the volatility of the economic variable X_t and, hence, for a given level of prior uncertainty, agents' expectations, $X_{t|t}$, are less sensitive to signaling effects. As agents' expectations fall less, the economy, X_t, does not shrink following the fiscal intervention.

B. Data and Robustness for the Empirical Analysis

This appendix provides supplementary material for the empirical analysis. Section B.1 describes the data: the construction of the expectation revisions (B.1.1), the matching of announcements to surveys and the sources of the daily and monthly series (B.1.2), and the measures of uncertainty (B.1.3). Section B.2 reports robustness checks for the daily regressions of Section 5, using the government bond volatility index and the TOPIX as dependent variables and a revision in expected spending purged of macroeconomic news. Section B.3 provides estimation details for the threshold VAR of Section 6 (B.3.1), an interpretation of the identifying restrictions through the stylized model (B.3.2), and robustness checks with alternative measures of uncertainty (B.3.3).

B.1. Data

B.1.1. Construction of the Expectation Revisions

This appendix describes how we construct the series of revisions in expected government spending. We use the *ESP Forecast*, a monthly survey of professional forecasters currently conducted by the Japan Center for Economic Research (JCER). Since the June 2009 survey, respondents have reported projections of the annual growth rates of real government consumption and public investment by fiscal year. The Japanese fiscal year (FY) runs from April to March. From June to December, the survey covers the current and the next fiscal year; from January to May, it additionally covers the following fiscal year. For example, the surveys from January to May 2010 cover FY2009, FY2010, and FY2011, and the surveys from June 2010 cover FY2010 and FY2011. For each survey, we take the mean projection across respondents and combine the two components into the expected growth rate of total government expenditure, weighting the projected growth rates of government consumption

and public investment by their shares in total government expenditure in the most recently completed fiscal year as of the preceding June survey. The surveys from June 2009 to May 2010, for instance, use the FY2008 shares, and those from June 2010 use the FY2009 shares.

Because the projections refer to fiscal years, their horizon, measured in months, varies across surveys. To obtain a series with a constant horizon, we follow the standard approach in the literature (e.g., Dovern et al., 2012) and construct a twelve-month-ahead projection as a weighted average of the projections for the two fiscal years spanned by the following twelve months. Let FY_t denote the fiscal year that contains month $t+1$, and let m_t denote the number of months from $t+1$ to $t+12$ that fall in FY_t. The twelve-month-ahead projection is

$$E_t\left[\hat{G}_{t,t+12}\right] = \frac{m_t}{12} E_t\left[G_{FY_t}\right] + \frac{12-m_t}{12} E_t\left[G_{FY_t+1}\right],$$

where $E_t\left[G_{FY_t}\right]$ and $E_t\left[G_{FY_t+1}\right]$ denote the projections, made in month t, of the annual growth rate of government expenditure in fiscal years FY_t and FY_t+1. For the June 2009 survey, for instance, the following twelve months comprise nine months of FY2009 and three months of FY2010, so $m_t = 9$ and the weights are $9/12$ and $3/12$. The expectation revision is the change in this projection between two consecutive surveys:

$$\Delta E_t\left[\hat{G}_{t,t+12}\right] = E_t\left[\hat{G}_{t,t+12}\right] - E_{t-1}\left[\hat{G}_{t-1,t+11}\right].$$

Appendix B.1.2 describes how each announcement is matched with the two surveys that bracket it.

B.1.2. Data Sources and the Timing of Expectation Revision

B.1.2.1. Matching announcements to surveys.

Survey responses to the *ESP Forecast* are typically collected around the beginning of each month, although the exact collection period varies from survey to survey. Using the deadline for responses to each survey, we match each announcement with the revision between the last survey whose deadline precedes the announcement and the first survey whose deadline follows it. Consider, for example, the first package in Table 1, whose size was announced on December 8, 2009. Responses to the December 2009 survey were collected from November 24 to December 1, 2009, and responses to the January 2010 survey from December 25, 2009, to January 7, 2010. The December survey therefore predates the announcement and the January survey follows it, so we match this announcement with the change in projections between the December and January surveys. We apply the same rule to the order and ratification dates of each package, each of which is matched with the two surveys that bracket it. We use the matched revisions both in the daily regressions of Section 5 and in the vector f_t of the VAR of Section 6. In the VAR, we assign the revision to the month of the announcement. The revision is observed only after the announcement, but it measures the information contained in the announcement itself, which is why we date it at the announcement rather than at the survey. Figure B.1 plots the revisions matched to the size announcements, and

Table B.1 reports descriptive statistics of the matched revisions, together with those of the announcement-day change in stock prices for each stage. The matched revisions average 0.10 percentage points across the 21 size announcements, compared with −0.06 in the remaining months (excluding April 2011, when the revision following the Great East Japan Earthquake was 3.2 percentage points), which indicates that forecasters revise their projections in response to the announcements.

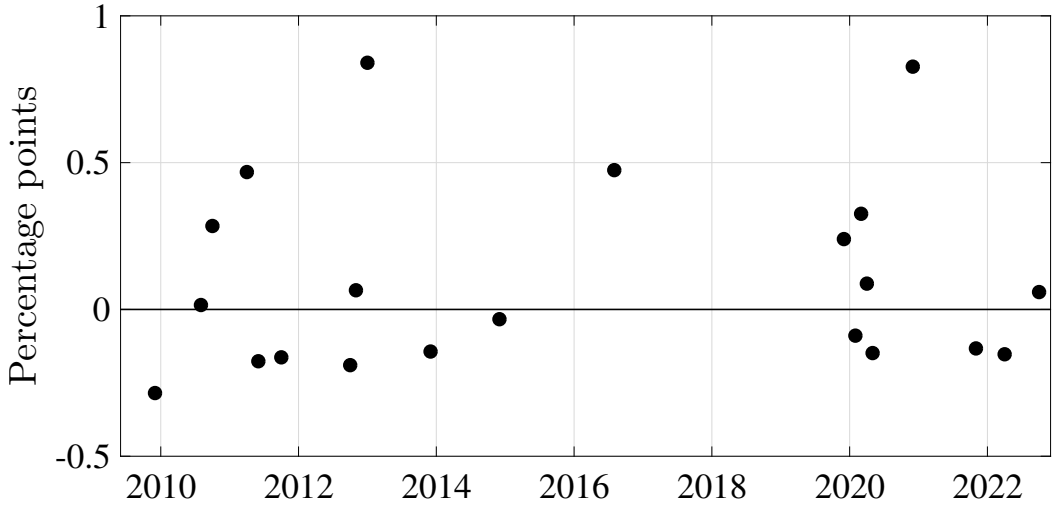


Figure B.1: **Revision to private sector's expectations about government expenditure around the announcement date.** This figure shows the JCER ESP revisions to expectations about next year government expenditure $\Delta E_t \left[\hat{G}_{t,t+12}\right]$.

Table B.1: Descriptive statistics of the announcement-day variables

	Obs.	Mean	Std. dev.	Min	Max	Positive
Revision in expected government spending, $\Delta E_t G_{t+1}$ (percentage points)						
Order stage	21	0.18	0.76	-0.77	3.19	12
Size stage	21	0.10	0.33	-0.28	0.84	11
Ratification stage	16	0.05	0.31	-0.36	0.84	9
Change in stock prices on the announcement day, Δs_t (percent)						
Order stage	21	0.10	1.21	-1.98	2.18	12
Size stage	21	-0.26	1.35	-3.62	1.99	9
Ratification stage	16	-0.03	1.15	-2.59	2.29	8

Notes: The table reports descriptive statistics of the variables entering the interaction terms in equation (8), computed across the announcement days of each stage. The revision in expected government spending is the change between the surveys conducted immediately before and after the announcement, before demeaning. The last column reports the number of announcements for which the variable is positive.

B.1.2.2. Mechanical component of the revision.

Because $E_t[\hat{G}_{t,t+12}]$ tracks a rolling twelve-month horizon, the change in this series between two surveys reflects not only the revision in the projections for each fiscal year but also the shift in the weights $m_t/12$ and $(12 - m_t)/12$ as the calendar advances. The latter component is known before the announcement and equals one twelfth of the difference between the projections for the two fiscal years in the earlier survey. It is typically negative, since projected growth for the next fiscal year is usually below that for the current one, and it varies little from month to month relative to the revision itself, so that the baseline revision and a revision that holds the weights fixed at their values in the earlier survey are highly correlated. We retain the rolling horizon in the baseline because a constant twelve-month horizon is the relevant one for the pricing of assets, and because the mechanical component is absorbed by demeaning in the daily regressions.

B.1.2.3. Daily data.

All daily series are taken from *Nikkei NEEDS FinancialQUEST*: the closing values of the Nikkei 225 and the TOPIX, the Nikkei VI, the Dow Jones Industrial Average, the nominal effective exchange rate of the yen compiled by the Bank of Japan, the Japanese government bond futures volatility index, and the yield on ten-year Japanese government bonds. Stock prices, the exchange rate, and the bond volatility index enter in log differences multiplied by 100; the Nikkei VI is standardized to have zero mean and unit variance over the sample; the bond yield enters in levels.

B.1.2.4. Monthly data.

The VAR uses real government expenditure and real GDP from the *JCER Monthly GDP Estimate*, which, unlike the official national accounts released at quarterly frequency, is available at monthly frequency. Tax revenue is taken from the *Ministry of Finance Statistics Monthly*, deflated by the monthly GDP deflator from the same JCER estimate, and seasonally adjusted using X-13ARIMA-SEATS with level-shift outliers in April 2014 and October 2019, when the consumption tax rate was raised from 5 to 8 percent and from 8 to 10 percent, respectively. All three series enter in logs.

B.1.3. Measures of Uncertainty

This section describes the two measures of uncertainty used in the main text and documents their co-movement. The market-based measure is the Nikkei Stock Average Volatility Index (Nikkei VI), which is computed from the prices of options on the Nikkei 225 and measures the expected volatility of the index over the following month. It is available at daily frequency and is used in the daily regressions of Section 5.

The survey-based measure is constructed from the *Consumer Confidence Survey* described in Section 3.3. For each of the questions on overall livelihood, income growth, and

asset prices over the next six months, the survey reports the share of households choosing each of the five responses. Following the scoring used by the Cabinet Office, we assign the values $v = 1, 0.75, 0.5, 0.25$, and 0 to "improve," "improve slightly," "no change," "worsen slightly," and "worsen," respectively. Let $w_{j,t}$ denote the share of response j in month t. The mean score is $\bar{v}_t = \sum_j w_{j,t} v_j$, and our measure of uncertainty is the cross-sectional standard deviation of the scores,

$$u_t = \Big(\sum_j w_{j,t} (v_j - \bar{v}_t)^2 \Big)^{1/2}.$$

Figure B.2 plots the three survey-based measures (panels a to c), together with their sample means, and the monthly average of the Nikkei VI (panel d).

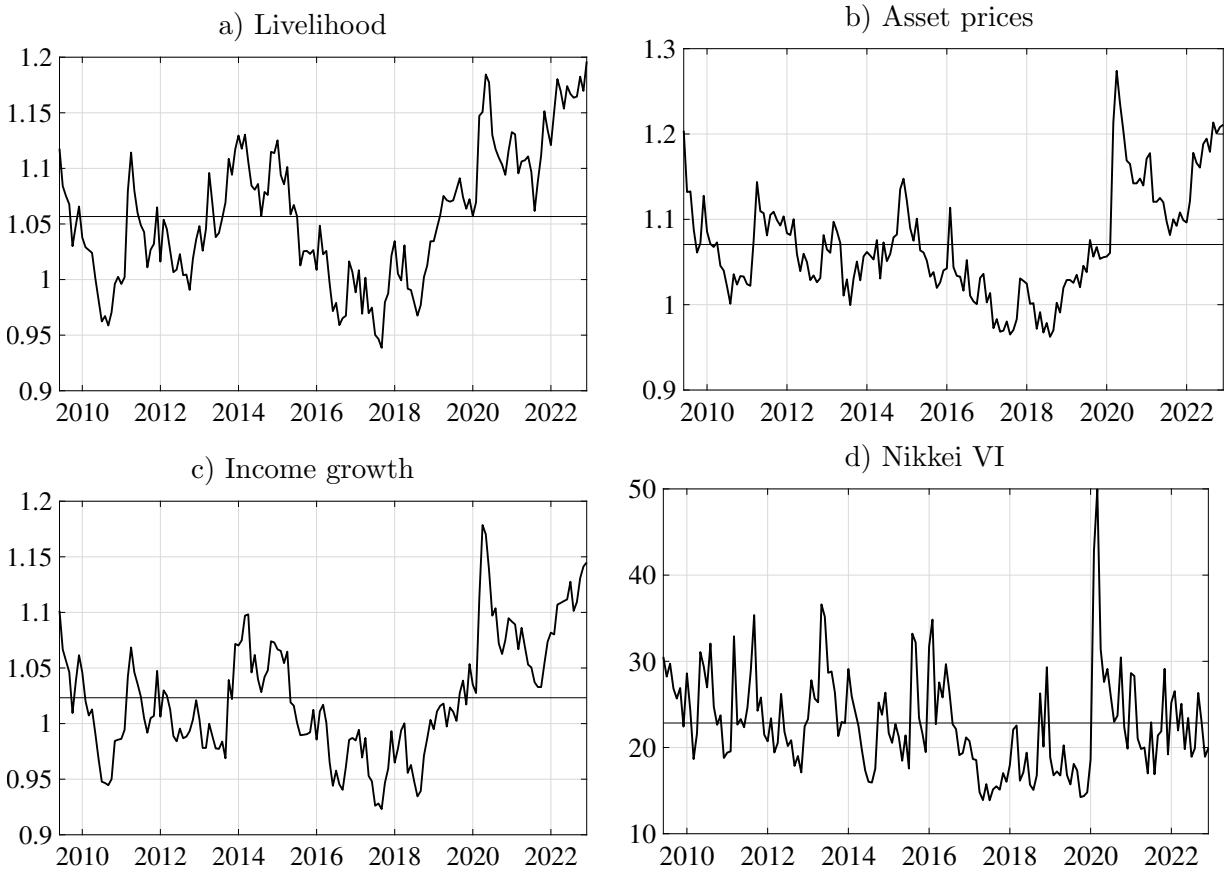


Figure B.2: **Measures of uncertainty.** Panels (a) to (c) show the cross-sectional standard deviation of household expectations in the *Consumer Confidence Survey* for the questions on overall livelihood, asset prices, and income growth over the next six months, computed as described in Appendix B.1.3. The horizontal line in each panel is the sample mean, which is the threshold used in the threshold VAR. Panel (d) shows the monthly average of the Nikkei VI. The sample is June 2009 to December 2022.

Table B.2 reports the correlations between the three survey-based measures and the monthly average of the Nikkei VI over the estimation sample, June 2009 to December 2022, with p-values for the null of zero correlation in parentheses. The three survey-based measures

are highly correlated with one another, with correlations 0.84 or higher. Each is positively and significantly correlated with the Nikkei VI, although the correlations are moderate, between 0.19 and 0.34. The market- and survey-based measures thus capture related but distinct aspects of uncertainty. This is consistent with the discussion in Section 3.3, and Appendix B.3.3 shows that our VAR results do not depend on which measure is used to define the regimes.

Table B.2: Correlations among the Consumer Confidence Survey measures and the Nikkei VI

	Consumer confidence survey			Nikkei VI
	Overall livelihood	Asset prices	Income growth	
Overall livelihood	1			
Asset prices	0.84 (0.00)	1		
Income growth	0.94 (0.00)	0.89 (0.00)	1	
Nikkei VI	0.19 (0.02)	0.34 (0.00)	0.19 (0.02)	1

Notes: The entries show the correlation coefficients between the standard deviations for the *Consumer Confidence Survey* (Figure B.2) related to the questions about livelihood, asset prices and income growth, and the monthly Nikkei VI for June 2009–December 2022. The values in parentheses indicate the p-value for the hypothesis that the null of zero correlation.

B.2. Impact Effects of Fiscal Announcements: Robustness Checks

This section reports three robustness checks for the daily regressions in Section 5.1: we replace the dependent variable with the change in the government bond volatility index, replace the Nikkei 225 with the TOPIX, and replace the revision in expected government spending with a revision purged of macroeconomic news.

Table B.3 reports estimates of equation (8) with the change in the Japanese government bond volatility index, which captures perceived risk in the government bond market, as the dependent variable in place of the change in stock prices. At the size stage (column 2), the index falls on announcement days, significantly at the 10% level, and none of the interaction terms is statistically significant. Fiscal announcements therefore do not raise perceived risk in the government bond market, and the negative response of stock prices to an upward revision under high uncertainty documented in Section 5.1 cannot be attributed to concerns about sovereign risk. At the order and ratification stages, a few coefficients are significant at the 5% or 10% level, namely δ and η at the order stage and β in column (4). Since no new information about the size of the package is released at these stages, they do not bear on the interpretation of the results at the size stage.

Table B.4 reports estimates of equation (8) with the log difference of the TOPIX as the dependent variable in place of the Nikkei 225 index. The two indices differ in construction: the Nikkei 225 is a price-weighted average of 225 stocks selected from the Tokyo Stock Exchange, whereas the TOPIX is a market-capitalization-weighted index of all stocks listed on the exchange's main market (the First Section until April 2022 and the Prime Market thereafter). The results closely mirror those in Table 2. At the size stage, β, δ, and η are are negative and significant at the 1% level. At the ratification stage, the positive and significant coefficients in column (3) disappear once the two ratification dates of 2020 are excluded (column 4). Our results are therefore robust to the choice of stock market index.

Table B.5 reports estimates of equation (8) with the revision in expected government spending replaced by the revision purged of macroeconomic news, as described in Section 5.3. The estimates are virtually identical to those in Table 2. At the size stage, β, δ, and η are -0.558, -0.842, and -2.678, significant at the 1%, 5%, and 1% levels, respectively, compared with -0.555, -0.840, and -2.674 in the baseline, and the coefficients at the order and ratification stages follow the same pattern as in the baseline.

Table B.3: Impact effects of fiscal announcements on JGB volatility index

	Dependent variable: ΔJGB_VIX_t			
	Order	Size	Ratify	
			All	Excl. 2 dates
	(1)	(2)	(3)	(4)
$\mathbb{I}\{A_t^i\}$	1.596	−4.268*	1.579	3.373
	(3.110)	(2.323)	(2.976)	(3.745)
$\mathbb{I}\{A_t^i\} \times VI_{t-1}$	0.031	−0.609	−0.451	7.396*
	(1.425)	(1.350)	(1.585)	(4.228)
$\mathbb{I}\{A_t^i\} \times \Delta E_t G_{t+1}$	−7.441*	1.787	−6.764	−5.439
	(3.853)	(5.938)	(6.314)	(6.889)
$\mathbb{I}\{A_t^i\} \times VI_{t-1} \times \Delta E_t G_{t+1}$	3.322**	−0.019	10.687	47.687
	(1.574)	(8.202)	(19.344)	(36.515)
VI_{t-1}	−0.177	−0.153	−0.168	−0.169
	(0.147)	(0.143)	(0.139)	(0.139)
Δs_{t-1}	−0.431***	−0.416***	−0.426***	−0.424***
	(0.129)	(0.127)	(0.126)	(0.126)
$\Delta DJIA_{t-1}$	−0.790***	−0.778***	−0.791***	−0.792***
	(0.204)	(0.205)	(0.205)	(0.203)
$\Delta NEER_{t-1}$	−1.106**	−1.097**	−1.106**	−1.110**
	(0.469)	(0.475)	(0.470)	(0.469)
ΔJGB_VIX_{t-1}	−0.167**	−0.166**	−0.166**	−0.166**
	(0.070)	(0.070)	(0.070)	(0.070)
$BOND_{t-1}$	−0.139	−0.127	−0.124	−0.134
	(0.235)	(0.233)	(0.230)	(0.230)
Constant	0.081	0.118	0.084	0.088
	(0.185)	(0.182)	(0.182)	(0.181)
Announcements	21	21	16	14
Observations	3324	3324	3324	3324
Adj. R-squared	0.037	0.038	0.036	0.037

Notes: The table replicates Table 2 with the change in the Japanese Government Bond (JGB) volatility index (ΔJGB_VIX_t), in percent, as the dependent variable in place of the change in stock prices. See the notes to Table 2 for the definition of the columns and of the variables. Newey–West standard errors are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively, based on two-sided tests.

Table B.4: Impact effects of fiscal announcements on stock prices: TOPIX

	Dependent variable: Δs_t			
	Order	Size	Ratify	
			All	Excl. 2 dates
	(1)	(2)	(3)	(4)
$\mathbb{I}\{A_t^i\}$	0.200	−0.121	0.028	−0.179
	(0.193)	(0.141)	(0.150)	(0.140)
$\mathbb{I}\{A_t^i\} \times VI_{t-1}$	−0.168	−0.434***	0.958***	0.377
	(0.133)	(0.155)	(0.147)	(0.296)
$\mathbb{I}\{A_t^i\} \times \Delta E_t G_{t+1}$	0.472	−1.010***	−0.761*	−0.731*
	(0.430)	(0.333)	(0.388)	(0.436)
$\mathbb{I}\{A_t^i\} \times VI_{t-1} \times \Delta E_t G_{t+1}$	−0.305	−2.451***	4.957***	3.079
	(0.213)	(0.576)	(1.505)	(1.949)
VI_{t-1}	0.049	0.054	0.043	0.047
	(0.036)	(0.034)	(0.035)	(0.035)
Δs_{t-1}	−0.095***	−0.095***	−0.097***	−0.096***
	(0.025)	(0.025)	(0.025)	(0.025)
$\Delta DJIA_{t-1}$	0.498***	0.500***	0.503***	0.498***
	(0.035)	(0.034)	(0.034)	(0.035)
$\Delta NEER_{t-1}$	−0.412***	−0.425***	−0.412***	−0.414***
	(0.063)	(0.060)	(0.063)	(0.063)
ΔJGB_VIX_{t-1}	−0.001	−0.001	−0.001	−0.001
	(0.003)	(0.003)	(0.003)	(0.003)
$BOND_{t-1}$	−0.071	−0.077*	−0.067	−0.070
	(0.048)	(0.046)	(0.047)	(0.047)
Constant	0.038	0.042	0.036	0.039
	(0.029)	(0.028)	(0.028)	(0.028)
Announcements	21	21	16	14
Observations	3324	3324	3324	3324
Adj. R-squared	0.225	0.229	0.227	0.225

Notes: The table replicates Table 2 with the log difference of the TOPIX, in percent, as the dependent variable and as the lagged change in stock prices (Δs_{t-1}), in place of the Nikkei 225. See the notes to Table 2 for the definition of the columns and of the variables. Newey–West standard errors are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively, based on two-sided tests.

Table B.5: Impact effects of fiscal announcements on stock prices: revisions purged of macroeconomic news

	Dependent variable: Δs_t			
	Order	Size	Ratify	
			All	Excl. 2 dates
	(1)	(2)	(3)	(4)
$\mathbb{I}\{A_t^i\}$	0.149	−0.242	0.086	−0.173
	(0.211)	(0.168)	(0.186)	(0.157)
$\mathbb{I}\{A_t^i\} \times VI_{t-1}$	−0.168	−0.558***	1.214***	0.486
	(0.155)	(0.204)	(0.187)	(0.378)
$\mathbb{I}\{A_t^i\} \times \Delta E_t G_{t+1}$	0.210	−0.842**	−1.079**	−1.044*
	(0.503)	(0.400)	(0.519)	(0.565)
$\mathbb{I}\{A_t^i\} \times VI_{t-1} \times \Delta E_t G_{t+1}$	−0.082	−2.678***	5.856***	3.495
	(0.243)	(0.767)	(1.916)	(2.454)
VI_{t-1}	0.042	0.048	0.034	0.039
	(0.040)	(0.038)	(0.040)	(0.040)
Δs_{t-1}	−0.144***	−0.143***	−0.145***	−0.144***
	(0.026)	(0.026)	(0.026)	(0.026)
$\Delta DJIA_{t-1}$	0.567***	0.569***	0.573***	0.566***
	(0.038)	(0.038)	(0.037)	(0.038)
$\Delta NEER_{t-1}$	−0.452***	−0.465***	−0.450***	−0.453***
	(0.071)	(0.067)	(0.071)	(0.071)
ΔJGB_VIX_{t-1}	−0.001	−0.001	−0.001	−0.001
	(0.003)	(0.003)	(0.003)	(0.003)
$BOND_{t-1}$	−0.069	−0.075	−0.063	−0.067
	(0.052)	(0.050)	(0.052)	(0.052)
Constant	0.045	0.050	0.042	0.046
	(0.033)	(0.031)	(0.032)	(0.032)
Announcements	21	21	16	14
Observations	3324	3324	3324	3324
Adj. R-squared	0.238	0.243	0.242	0.239

Notes: The table replicates Table 2 with $\Delta E_t G_{t+1}$ replaced by the revision purged of macroeconomic news, as described in Section 5.3, demeaned across the announcement days. See the notes to Table 2 for the definition of the columns and of the variables. Newey–West standard errors are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively, based on two-sided tests.

B.3. Details on the VAR analysis

B.3.1. Estimation

We estimate the threshold VAR in equation (9) separately for the two regimes. A month belongs to the high-uncertainty regime if the survey-based measure of uncertainty in the previous month, u_{t-1}, is above its sample mean, and to the low-uncertainty regime otherwise. The VAR includes $P = 6$ lags, and the zero restrictions on the equations for f_t are imposed in estimation, so that these equations contain neither a constant nor lags.

Following Uhlig (2005), we use a diffuse prior, under which the posterior of the reduced-form parameters is normal–inverse Wishart centered on the OLS estimates. We draw the covariance matrix from its inverse Wishart posterior and, conditional on it, the coefficients from their normal posterior, discarding draws for which the companion matrix has an eigenvalue larger than one in modulus. For each draw of the reduced-form parameters, we compute the Cholesky factor of the covariance matrix with f_t ordered first, so that shocks other than the two fiscal news shocks have no contemporaneous effect on f_t, and rotate the 2×2 block corresponding to f_t by an orthogonal matrix obtained from the QR decomposition of a matrix of standard normal draws (Rubio-Ramírez et al., 2010). We draw 300 rotations per parameter draw and retain a rotation if the implied impulse responses satisfy the restrictions in Table 3: the impact responses of $\Delta E_t G_{t+1}$ and ΔSP_t have the required signs, the impact response of government expenditure lies within ± 0.05 percent, and the response of government expenditure is positive at each horizon from four to twelve months after the shock. Both shocks must satisfy their restrictions in the same rotation. We repeat the procedure until 5,000 rotations are retained. The reported impulse responses are the pointwise median and the 68 and 90 percent bands of the retained draws, and each shock is normalized so that the median impact response of $\Delta E_t G_{t+1}$ equals 10 basis points.

B.3.2. Interpretation of the VAR identifying restrictions in the stylized model

This section interprets the two types of fiscal news identified in the VAR through the lens of the stylized model in Section 2. In the model, private agents do not observe distinct primitive disturbances but respond to the composite policy surprise, $a - E(a \mid s^p)$. The VAR partitions announcements according to the observed strength of the resulting signaling effect, as measured by the co-movement between the revision in expected spending and the change in stock prices. The model accounts for this heterogeneity in two ways: higher noise in the private sector's signal (σ_ξ) strengthens the signaling effect and thus distinguishes the high- and low-uncertainty regimes, while differences in the composition of the policy surprise generate variation within a regime.

B.3.3. Robustness

We first check that the results are not driven by macroeconomic news arriving between the two surveys. Figure B.3 replaces the revision in f_t with the revision purged of macroeconomic news, as described in Section 5.3. The responses are virtually identical to those in Figure 4.

We then check that the results do not depend on the measure of uncertainty used to define the regimes. The baseline uses the dispersion of household expectations about overall livelihood, the broadest of the three questions in the *Consumer Confidence Survey* and therefore the closest to the private sector's uncertainty about the state of the economy in the theory. Figures B.4 and B.5 replace it with the dispersion of expectations about asset prices and income growth, respectively, and Figure B.6 with the monthly average of the Nikkei VI, the measure used in the daily regressions of Section 5. In all cases, the regimes are defined by comparing the lagged measure with its sample mean. The three survey-based measures are highly correlated with one another (Table B.2), so that the first two exercises change the regime classification only marginally; the Nikkei VI, which is only moderately correlated with the survey-based measures, provides the more demanding check. The key result of the baseline holds in all three cases: under high uncertainty, output falls in the months immediately following fiscal news with significant signaling effects, whereas it does not fall under low uncertainty. The responses are less precisely estimated than in the baseline, and in some cases output recovers more quickly, but the sign of the initial response and its dependence on the uncertainty regime are unchanged.

We also check that the regimes do not merely capture the state of the business cycle. The survey-based measure of uncertainty is essentially uncorrelated with the cyclical component of the unemployment rate, obtained by applying the Hodrick–Prescott filter ($\lambda = 14{,}400$) to the monthly unemployment rate from 1953 to 2026 (correlation 0.01 over our sample). Figure B.7 re-estimates the threshold VAR with the regimes defined by whether the cyclical component of the unemployment rate in the previous month is positive, that is, whether unemployment is above its trend. The state dependence of the baseline does not appear: following fiscal news with significant signaling effects, output declines by a similar small amount under both high and low unemployment, and the decline under high unemployment is much smaller than under high uncertainty in the baseline. The state dependence documented in Figure 4 therefore reflects the level of uncertainty rather than the state of the business cycle.

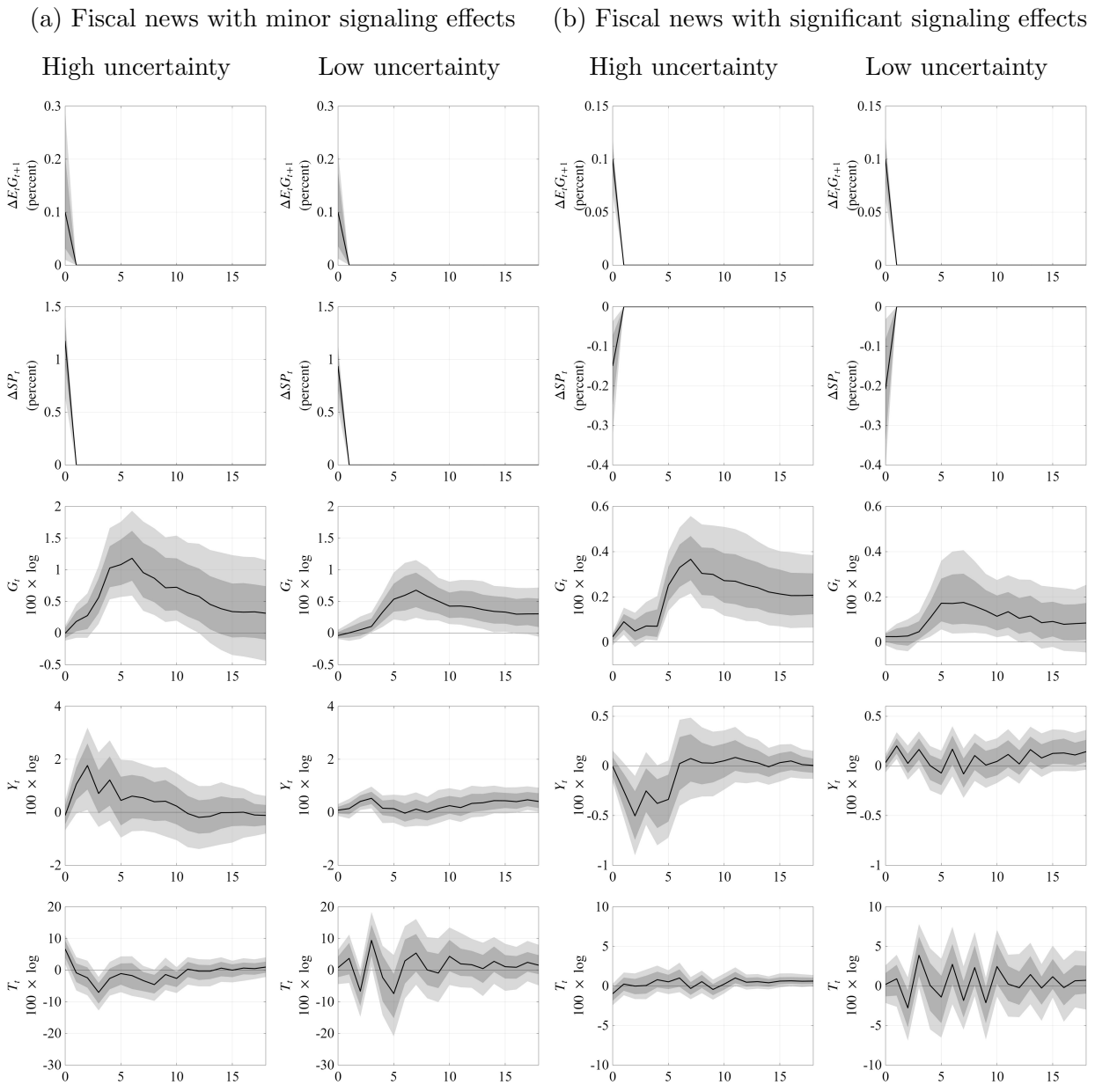


Figure B.3: **Impulse response functions (revisions purged of macroeconomic news).** *Notes*: The figure replicates Figure 4 with the revision in expected government spending in f_t replaced by the residual from a regression of the revision on the change in the Citi Economic Surprise Index for Japan between the two survey deadlines (Section 5.3). Each shock is normalized so that the median impact response of the purged revision is 10 basis points. Uncertainty is measured by the dispersion of household expectations about livelihood, as in Figure 4; see the notes to that figure for the definition of the regimes and of the variables.

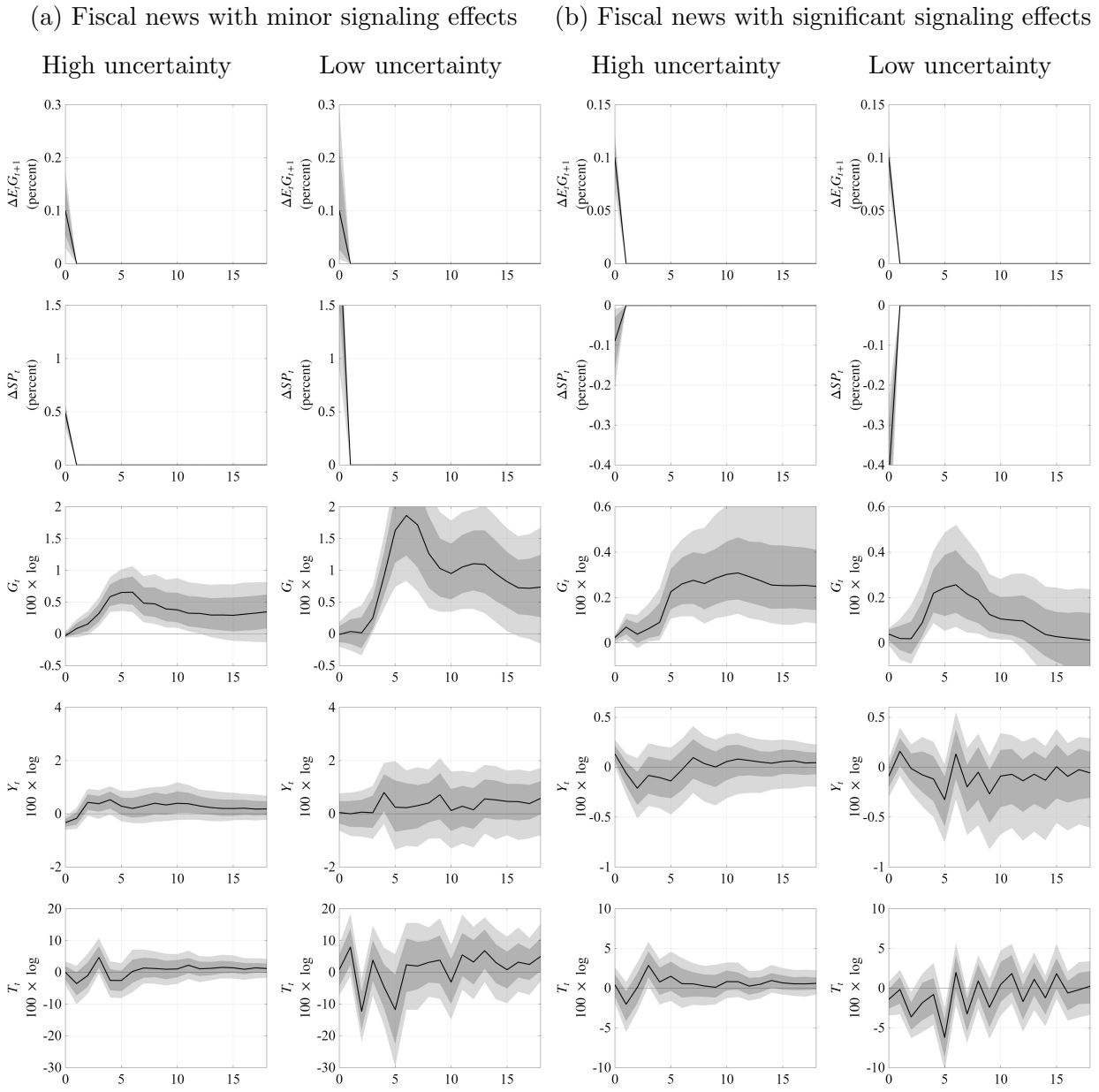


Figure B.4: **Impulse response functions (asset prices).** *Notes*: The figure replicates Figure 4 with the regimes defined by the cross-sectional standard deviation of household expectations about asset prices over the next six months in the *Consumer Confidence Survey*, in place of the question on livelihood; a month is classified as high (low) uncertainty if this measure in the previous month is above (below) its sample mean. See the notes to Figure 4 for the definition of the variables and the normalization of the shocks.

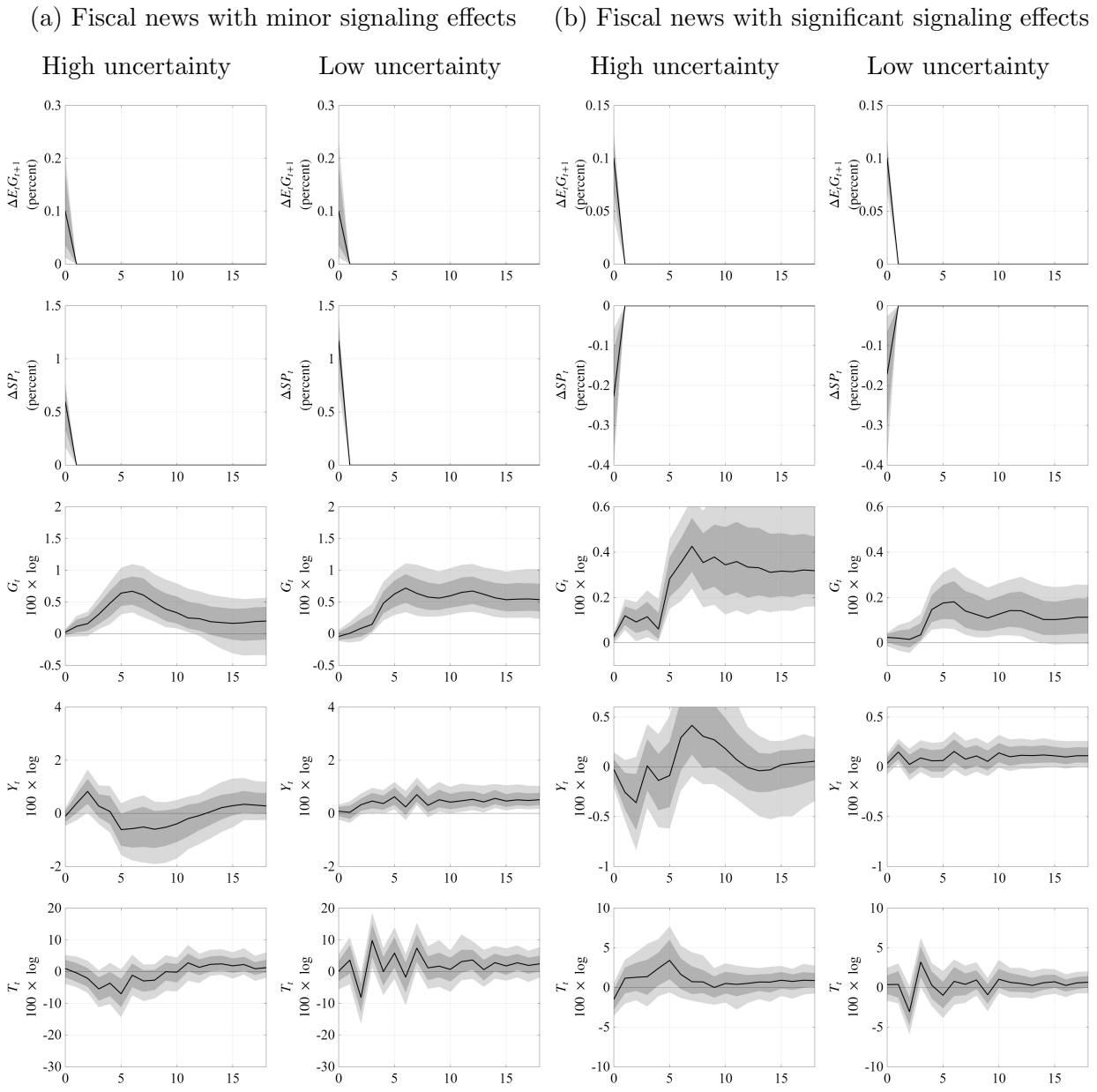


Figure B.5: **Impulse response functions (income growth).** *Notes*: The figure replicates Figure 4 with the regimes defined by the cross-sectional standard deviation of household expectations about income growth over the next six months in the *Consumer Confidence Survey*, in place of the question on livelihood; a month is classified as high (low) uncertainty if this measure in the previous month is above (below) its sample mean. See the notes to Figure 4 for the definition of the variables and the normalization of the shocks.

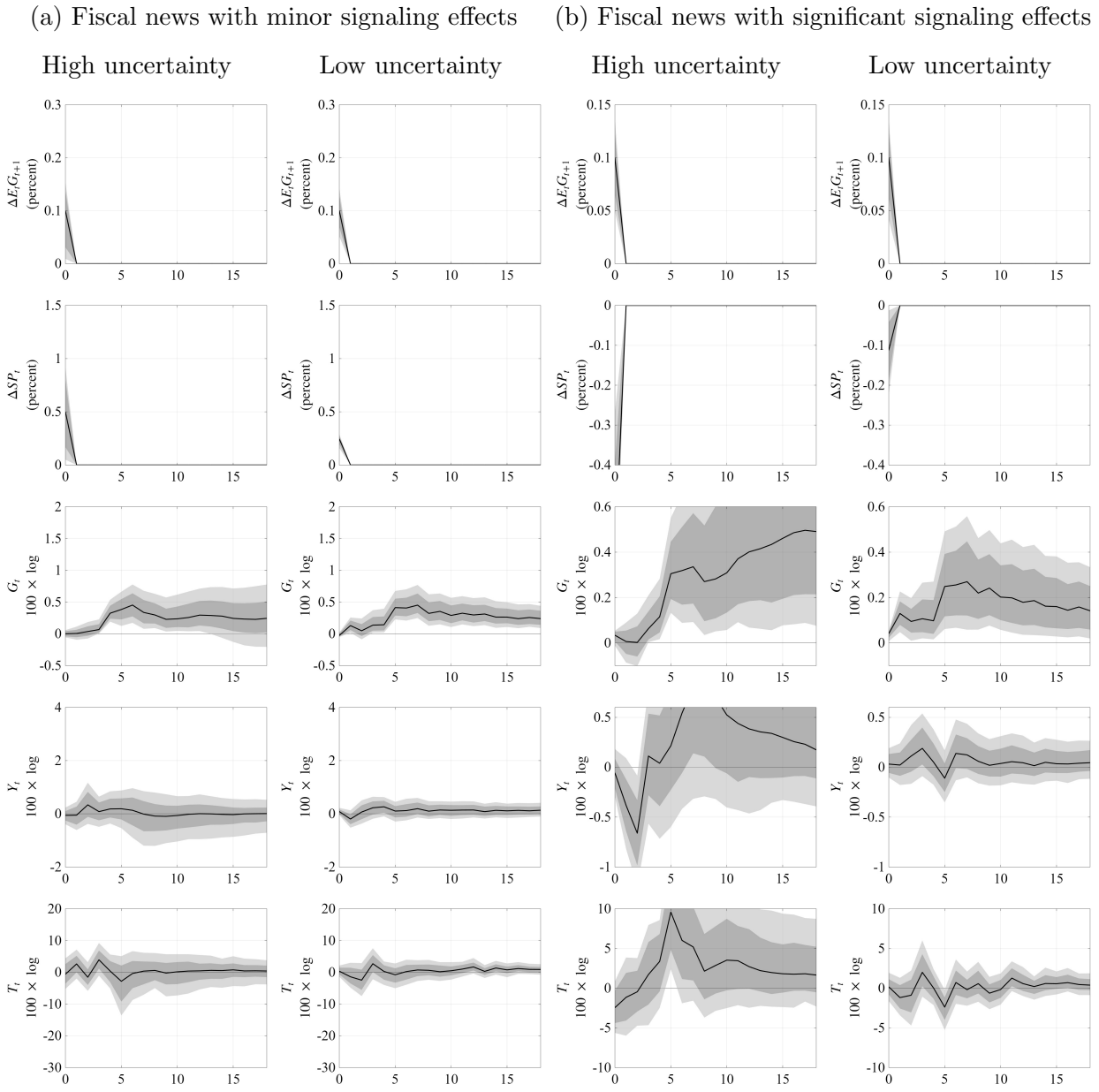


Figure B.6: **Impulse response functions (Nikkei VI).** *Notes*: The figure replicates Figure 4 with the regimes defined by the monthly average of the Nikkei VI, in place of the dispersion of household expectations about livelihood; a month is classified as high (low) uncertainty if the Nikkei VI in the previous month is above (below) its sample mean. See the notes to Figure 4 for the definition of the variables and the normalization of the shocks.

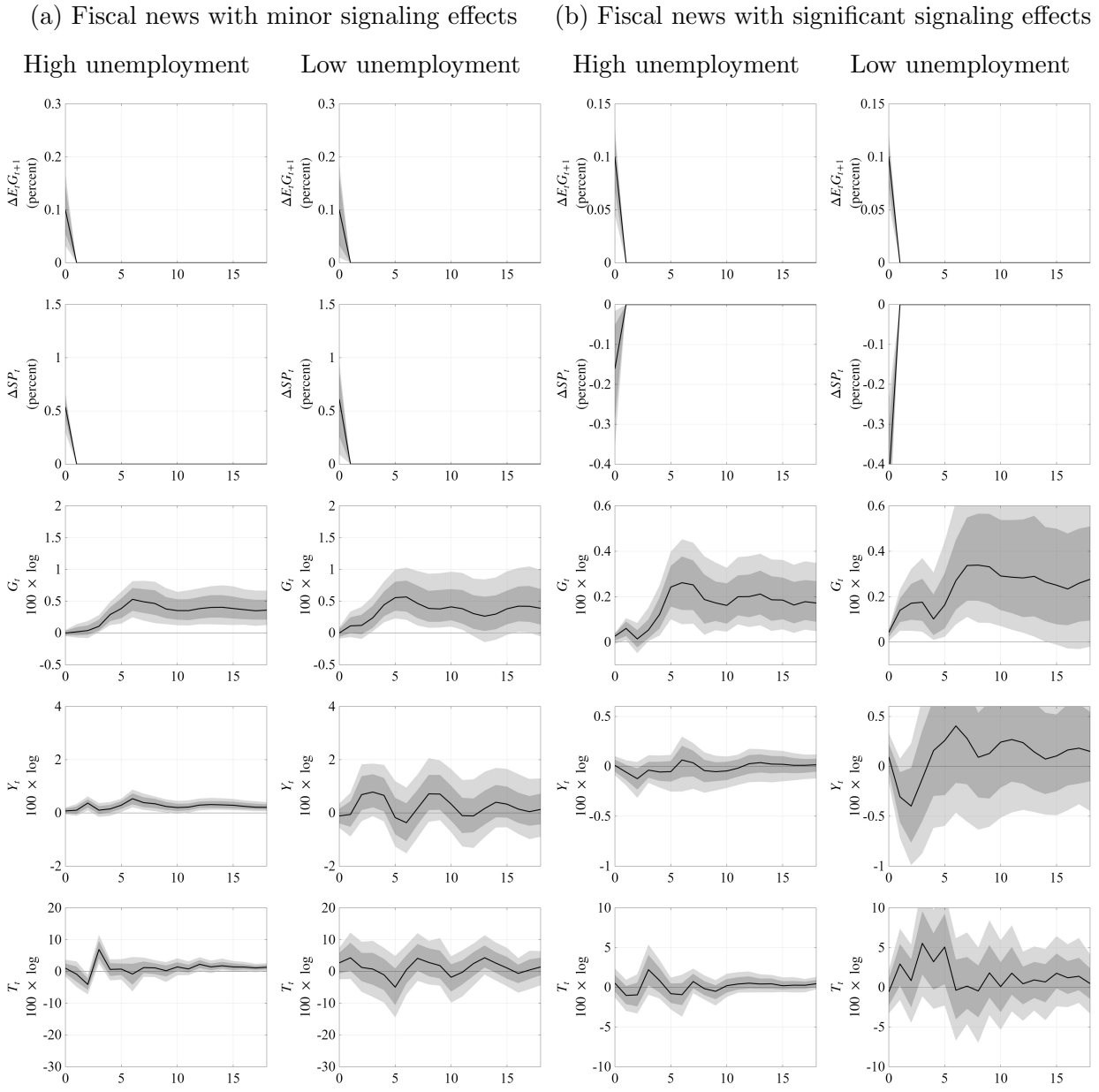


Figure B.7: **Impulse response functions (Unemployment rate).** *Notes*: The figure replicates Figure 4 with the regimes defined by the cyclical component of the unemployment rate, obtained with the Hodrick–Prescott filter, in place of the dispersion of household expectations about livelihood; a month is classified as high (low) unemployment if this component in the previous month is positive (negative), that is, if the unemployment rate is above (below) its trend. See the notes to Figure 4 for the definition of the variables and the normalization of the shocks.