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The signaling effects of fiscal announcements

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Abstract

Announcing a large fiscal stimulus may signal the government's pessimism about the severity of a recession to the private sector, impairing the stabilizing effects of the policy. 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 effects and find that such effects weaken or, in extreme cases, even completely undermine the stabilizing impact of the announcements.

Keywords: Fiscal policy, macroeconomic stabilization, uncertainty, imperfect information.

JEL classification: E62, E32, D83.

Non-technical Summary

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 stock index with narrative records from press releases about thirty-four supplementary fiscal packages announced by the Japanese government from 1992 to 2022. This fiscal news was 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 of the *Nikkei newspaper* – the major, real-time, economic and business outlet in Japan – to identify the timing of public announcements for each fiscal package.

We focus on Japan because of its orderly and predictable legislative process for spending bills, offering a unique setting to empirically assess the significance of signaling effects. A key

institutional feature is that the size of a spending bill is disclosed at a specific stage in the legislative process and is not renegotiated thereafter. This characteristic enables us to precisely identify the moment when the size of fiscal packages is first made public. Establishing the exact timing of fiscal stimulus announcements allows us to assess whether the private sector revises its expectations about government spending in response to the news. This is essential for understanding whether the announcement comes as a surprise and is interpreted as a signal about the broader economic outlook. To this end, we examine changes in stock prices on the day the size of the fiscal package is revealed and control for revisions in the private sector's expectations.

An important preliminary step is to establish how stock prices respond to fiscal news, absent signaling effects. We show that the stock market generally reacts positively to fiscal news in Japan. Bullish responses to fiscal news are not obvious, as such news might lead to expectations of future tax increases – such as taxes on dividends or capital gains – or heightened sovereign default risk. We find that the stock market reacts positively to announcements of large fiscal spending, which are arguably unrelated to the business cycle and thus cannot convey any signal about the government's view of the economic outlook.

The positive response of stock prices to fiscal news, in the absence of signaling effects, implies that these effects might have a negative impact on the stock market. According to our stylized model, signaling effects tend to reduce the effectiveness of fiscal policy in stabilizing the business cycle, particularly when the private sector is more uncertain about the economic outlook. We find evidence supporting these predictions by analyzing changes in stock prices on days when news about the size of supplementary fiscal packages is released. Our results show that when uncertainty – captured by stock market volatility in the Nikkei 225 – is elevated, news about a larger than expected fiscal stimulus package depresses stock prices.

Consistently with our theory, which shows how uncertainty plays an important role in determining the strength of signaling, we estimate a threshold vector autoregression model where we use uncertainty as our threshold variable. Under high uncertainty, output increases in response to fiscal news with minor signaling effects – characterized by positive co-movement between revisions in expectations and stock prices – and decreases in response to news with significant signaling effects, where this co-movement is negative.

These results support the idea that signaling effects from fiscal policies considerably weaken policymakers' ability to stabilize the economy in highly uncertain environments and, in extreme cases, can offset and even reverse the expansionary impact of an announced fiscal stimulus.

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 stock index with narrative records from press releases about thirty-four supplementary fiscal packages announced by the Japanese government from 1992 to 2022. This fiscal news was 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 of the *Nikkei newspaper* – the major, real-time, economic and business outlet in Japan – to identify the timing of public announcements for each fiscal package.

We focus on Japan because of its orderly and predictable legislative process for spending bills, offering a unique setting to empirically assess the significance of signaling effects. A key institutional feature is that the size of a spending bill is disclosed at a specific stage in the legislative process and is not renegotiated thereafter. This characteristic enables us to precisely identify the moment when the size of fiscal packages is first made public. Establishing the exact timing of fiscal stimulus announcements allows us to assess whether the private sector revises its expectations about government spending in response to the news. This is essential for understanding whether the announcement comes as a surprise and is interpreted as a signal about the broader economic outlook.[1] To this end, we examine changes in stock prices on the day the size of the fiscal package is revealed and control for revisions in the private sector's expectations.

An important preliminary step is to establish how stock prices respond to fiscal news, absent signaling effects. We show that the stock market generally reacts positively to fiscal news in Japan. Bullish responses to fiscal news are not obvious, as such news might lead to expectations of future tax increases – such as taxes on dividends or capital gains – or heightened sovereign default risk. We find that the stock market reacts positively to announcements of large fiscal spending, which are arguably unrelated to the business cycle and thus cannot convey any signal about the government's view of the economic outlook.[2]

The positive response of stock prices to fiscal news, in the absence of signaling effects, implies that these effects might have a negative impact on the stock market. According to our stylized model, signaling effects tend to reduce the effectiveness of fiscal policy in stabilizing the business cycle, particularly when the private sector is more uncertain about the economic outlook. We find evidence supporting these predictions by analyzing changes in stock prices on days when news about the size of supplementary fiscal packages is released. Our results show that when uncertainty – captured by stock market volatility in the Nikkei 225 – is elevated, news about a larger than expected fiscal stimulus packages depresses stock prices. This pattern is consistent with the theory of signaling effects.

The Japanese government bond futures volatility index – a measure of sovereign default risk – does not significantly respond to the fiscal news considered in this study. Hence, the negative response of stock prices to the fiscal news in periods of high uncertainty cannot be explained

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

[2] We focus on the following large exogenous fiscal shocks: the announcement that Tokyo was selected to host the 2020 Olympic Games, the choice of Osaka as the host city for the 2025 Universal Exposition, which was accompanied by significant urban regeneration plans and infrastructure spending, and the victory of the Liberal Democratic Party led by Shinzo Abe in the general election, marking the beginning of a pro-government spending economic policy ("Abenomics" policies).

by a change in the perceived risk of sovereign default. Moreover, the positive response of stock prices to news about the ratification of a spending bill makes it hard to argue that these bearish stock market responses to news regarding the size of fiscal stimuli are driven by expectations of higher taxes.

We then turn to the quantification of fiscal policy's signaling effects on economic activity by estimating a threshold vector autoregression (VAR) model. We develop a novel methodology to identify the strength of signaling effects conveyed by fiscal news. The methodology rests on the co-movement between stock prices and *revisions* to the private sector's forecast about government spending on the day when the Prime Minister's Office announces the size of the fiscal packages to the public. In line with the predictions of the stylized model, we impose that signaling effects are strong when we observe *negative* co-movement between the response of stock prices and the revisions to the private sector's forecast. Conversely, fiscal news that generates *positive* co-movement between stock prices and the revisions to the private sector's forecast arguably give rise to signaling effects of smaller magnitude.

Consistently with our theory, which shows how uncertainty plays an important role in determining the strength of signaling, we estimate a threshold VAR model where we use uncertainty as our threshold variable. We estimate two sets of parameters, one in which uncertainty is above average and the other in which uncertainty is below average. We measure uncertainty using households' survey data from the Consumer Confidence Survey, a monthly survey run by the Cabinet Office. Under high uncertainty, output increases in response to fiscal news with minor signaling effects – characterized by positive co-movement between revisions in expectations and stock prices – and decreases in response to news with significant signaling effects, where this co-movement is negative. Fiscal news leading to a 10 basis-point upward revision to the private sector's forecast of the annual growth rate of government expenditure lowers real GDP growth by 50 basis points at the peak. In contrast, under low uncertainty, output does not exhibit a statistically significant response to either type of fiscal news.

These results support the idea that signaling effects from fiscal policies considerably weaken policymakers' ability to stabilize the economy in highly uncertain environments and, in extreme cases, can offset and even reverse the expansionary impact of an announced fiscal stimulus.

It is important to emphasize that the proposed identification strategy aims to distinguish the magnitude of signaling effects associated with fiscal news. By doing so, we can compare the macroeconomic impacts of fiscal news arising from these varying degrees of signaling effects. This differential approach addresses a key limitation in the existing literature on signaling effects

– e.g., Campbell et al., 2012, 2017; Nakamura and Steinsson, 2018; Bauer and Swanson, 2023 – which has sought to identify these effects by examining whether private sector expectations react with the "wrong sign," meaning a sign not explained by standard economic models. However, as shown in the stylized model, this definition of signaling effects is overly restrictive because these effects may just moderate, rather than reverse, the impact of economic 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 effect of announcements about monetary policy, studying the role of incomplete information (Vickers, 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 of monetary announcements (Cieslak and Schrimpf, 2019; Gáti, 2023; Gáti and Handlan, 2024). Bauer and Swanson (2023) challenge the relevance of signaling effects in monetary policy, suggesting that what is often labeled as "Fed information effects" might actually be the result of simultaneous responses from both the Fed and the markets to macroeconomic news. Their critique does not directly apply to our methodology, as we measure signaling effects by analyzing high-frequency changes in stock prices rather than month-over-month shifts in private sector expectations about real activity. Additionally, our approach involves identifying various degrees of signaling effects conveyed by fiscal news and evaluating the implications of these different degrees for the impact of fiscal news on output – an approach that we call differential identification of signaling effects. Melosi (2017) develops and estimates a structural model in which monetary policy can have signaling effects.

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 (2024) 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 veteran's 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. All these papers focus on exogenous changes in fiscal policy, which do not give rise to signaling effects.

Our analysis is related to Ricco et al. (2016), who argue that the government's ability to clearly communicate the future path of fiscal spending to market participants critically affects the efficacy of certain fiscal policies. They propose a new measure of the coordination effects of fiscal communication using the *Survey of Professional Forecasters* and show that with elevated disagreement the output response is muted. Nevertheless, this study does not consider the signaling effects of fiscal policy, which is the main object of the present analysis. De Fiore et al. (2024) study the role of households' expectations in shaping the macroeconomic effects of a fiscal stimulus.

We finally relate to the large literature that studies the role of imperfect information in the formation of expectations 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), and several other studies show that imperfect information is critical to the formation of expectations about inflation and the conduct of monetary policy. Different from the aforementioned studies, we study one of the implications of imperfect information for the effects of fiscal policy.

The remainder of the paper is organized as follows. In Section 2 we develop a stylized model from which we derive a few key predictions of the theory of signaling effects from economic policy. In Section 3, we introduce the dataset of supplementary fiscal announcements compiled from narrative records of press releases of the Japanese government. In Section 4, we show the differential response of stock prices between the fiscal announcements geared towards economic stabilization and those that are *exogenous* to economic conditions. In Section 5, we show formally that stock prices react differently to fiscal news depending on the signaling effects associated with each announcement. Consistent with our theory, we document a significant interplay between the private sector's prior economic uncertainty and signaling effects of fiscal announcements. In Section 6 we estimate a threshold VAR model that identifies the impact of signaling effects on real activity using the restrictions consistent with the theory developed in

Section 2. In Section 7, we conclude.

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 5.[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 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).

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 policy-makers 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 may occur. This change can be a recession, whose severity is unknown to private agents

[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).

and the policymaker. The private sector relies on the signal, s^p, to form their 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 $\varepsilon \sim \mathcal{N}\left(0, \sigma_\varepsilon^2\right)$ 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 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.[4]

[4]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

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.[5] 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 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 $k_1 \equiv \frac{\sigma^2_\varepsilon}{\sigma^2_\varepsilon + \sigma^2_\xi}$ and the uncertainty $VAR(X_1|s^p) = \sigma^2_\varepsilon \cdot (1 - k_1)$.

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 $k_g = \frac{\sigma^2_\varepsilon}{(\sigma^2_\varepsilon + \sigma^2_{\xi,g})}$. 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

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

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^1_t as follows:

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

where $k_2 \equiv \frac{\alpha VAR(X_1|s^p)}{VAR(X_1|s^p)\alpha^2 + \alpha^2\sigma^2_{\xi,g} + \sigma^2_{\varepsilon,a}}$. 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

the appendix.

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

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 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 $(E(X_1|s^p, a) - E(X_t|s^p))$, 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_g, defined in the previous section – see equation (7).

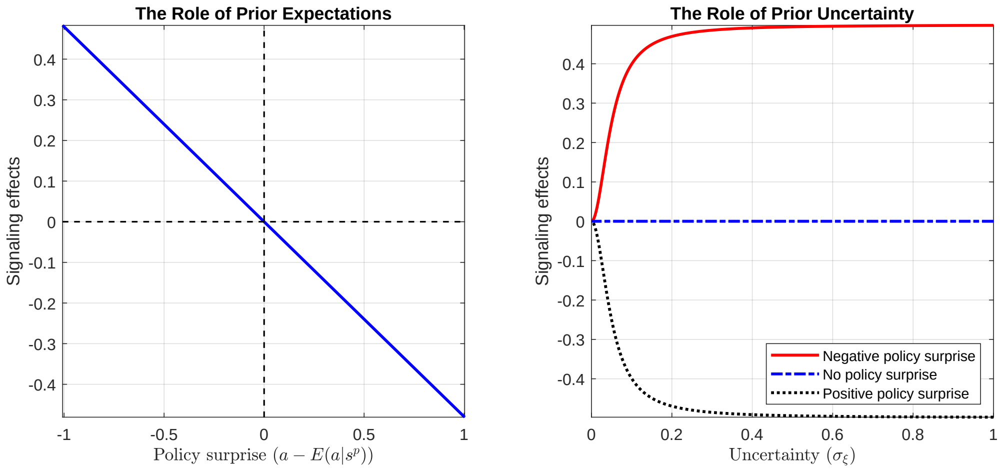


Figure 1: **Signaling Effects of Economic Policy.** The *left chart* shows how signaling effects (i.e., the revision to economic agents' expectations about the state of the economy after observing the policy action – $E(X_1|s^p, a) - E(X_1|s^p)$) as a function of the policy surprise $(a - E(a|s^p))$. 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).

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 $(E(X_1|s^p, a) - E(X_t|s^p))$ 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.[6]

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

[6] 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, $E(a|s^p) = 0$.

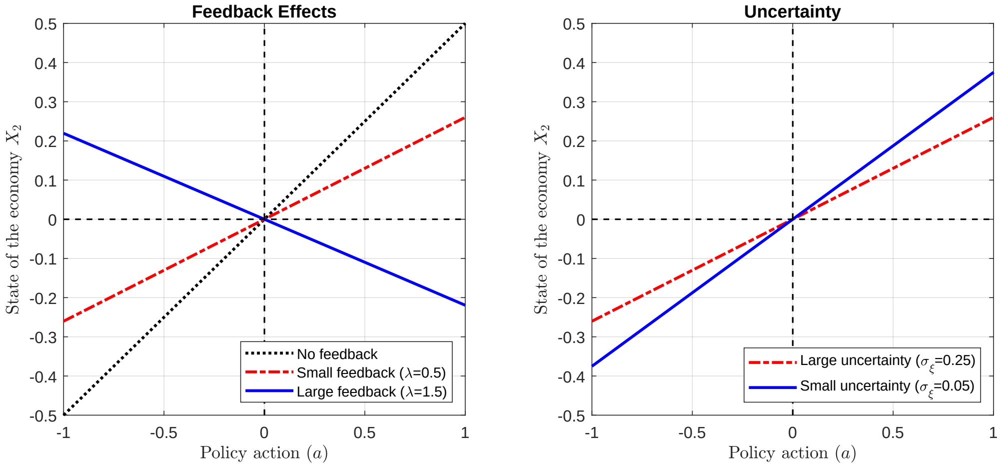


Figure 2: **Effectiveness of Economic Policies with Signaling Effects.** In the *left chart*, economic activity (X_2) is plotted as a function of the policy action, a for three levels of feedback from beliefs to economic activity. The black dotted line denotes the case with no feedback effects ($\lambda = 0.0$). 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).

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, $\lambda E(X_1|s^p, a)$.[7] 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 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

[7] 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.

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.[8] 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).

[8]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.

Table 1: Dates of Fiscal Announcements: 2009–2022

(1) Dates	(2) Indicators	(3) Fiscal spending	(4) Total size	(5) Disclosure event
(c) *Countermeasures against global financial crisis*				
04/09/2009	$\mathbb{I}\{A_{13,t}\}$	15.4 trn.	56.8 trn.	LDP approval
12/08/2009	$\mathbb{I}\{A_{14,t}\}$	7.2 trn.	24.4 trn.	Cabinet decision
08/31/2010	$\mathbb{I}\{A_{15,t}\}$	915 bn.	9.8 trn.	Committee of relevant ministers
10/08/2010	$\mathbb{I}\{A_{16,t}\}$	4.9 trn.	20.8 trn.	Government and ruling parties' agreement
(d) *Supplementary budgets for recovery from Great East Japan Earthquake*				
04/18/2011	$\mathbb{I}\{A_{17,t}\}$	4 trn.	n.a.	Ruling parties' agreement
06/30/2011	$\mathbb{I}\{A_{18,t}\}$	2 trn.	n.a.	Government final plan
10/15/2011	$\mathbb{I}\{A_{19,t}\}$	12 trn.	n.a.	Ruling and opposition parties' agreement
(e) *Countermeasures against yen appreciation*				
10/25/2012	$\mathbb{I}\{A_{20,t}\}$	400 bn.	750 bn.	Government final plan
11/27/2012	$\mathbb{I}\{A_{21,t}\}$	880 bn.	1.2 trn.	Government final plan
(f) *Abenomics policy*				
01/11/2013	$\mathbb{I}\{A_{22,t}\}$	10.3 trn.	20.2 trn.	Press conference by PM
12/05/2013	$\mathbb{I}\{A_{23,t}\}$	5.5 trn.	18.6 trn.	Meeting of Government and ruling parties
12/29/2014	$\mathbb{I}\{A_{24,t}\}$	3.5 trn.	n.a.	Meeting of government and ruling parties
08/02/2016	$\mathbb{I}\{A_{25,t}\}$	13.5 trn.	28.1 trn.	Meeting of government and ruling parties
12/05/2019	$\mathbb{I}\{A_{26,t}\}$	13.2 trn.	26.0 trn.	Meeting of government and ruling parties
(g) *Countermeasures against COVID-19 pandemic*				
02/14/2020	$\mathbb{I}\{A_{27,t}\}$	15.3 bn.	500 bn.	Novel Coronavirus Response Headquarters
03/11/2020	$\mathbb{I}\{A_{28,t}\}$	430 bn.	1.6 trn.	Novel Coronavirus Response Headquarters
04/07/2020	$\mathbb{I}\{A_{29,t}\}$	39.5 trn.	108.2 trn.	Meeting of government and ruling parties
05/27/2020	$\mathbb{I}\{A_{30,t}\}$	72.7 trn.	117.1 trn.	Meeting of government and ruling parties
12/08/2020	$\mathbb{I}\{A_{31,t}\}$	40.7 trn.	73.6 trn.	Meeting of government and ruling parties
11/19/2021	$\mathbb{I}\{A_{32,t}\}$	55.7 trn.	78.9 trn.	Meeting of government and ruling parties
(h) *Countermeasures against price increases*				
04/27/2022	$\mathbb{I}\{A_{33,t}\}$	6.2 trn.	13.2 trn.	Press conference by PM
10/28/2022	$\mathbb{I}\{A_{34,t}\}$	39 trn.	71.6 trn.	Meeting of government and ruling parties

Notes: The table summarizes information about fiscal announcements in Japan for the period 2009-2022. It provides the date (column 1), the indicator variables (column 2), the amount of fiscal spending (column 3) the total size of fiscal packages (column 4), and the event where the final scale of the package was disclosed (column 5). The timing of each announcement is identified from the *Nikkei* newspaper. Fiscal spending consists of national and local government actual spending and fiscal investment and loans. The total size comprises loans from government financial institutions in addition to fiscal spending.

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 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 225 average stock price index), narrative accounts of fiscal announcements from Japanese press releases, and forecast data on government expenditure by professional forecasters. We examine the theory in the context of Japan since its distinctive institutional and legislative frameworks offer a unique setting to empirically study the significance of signaling effects.

3.1. Institutional Framework and Fiscal Announcements

Fiscal announcements exhibit signaling effects if they prompt the private sector to revise its expectations about the current state of the economy. Identifying such effects in the data requires pinpointing the exact moment when the government releases non-redundant information about the scale of a fiscal intervention. This is often difficult because fiscal policy announcements in many countries reflect information that is gradually revealed during the legislative process or because political negotiations can unpredictably shape spending measures during the process. A central challenge in our analysis, therefore, is to identify the moment when information about the size of the fiscal package becomes public and is no longer subject to parliamentary bargaining.

Japan's legislative process is orderly and predictable, and it features the enactment of ad hoc fiscal packages introduced in response to events that threaten the economic outlook. This makes Japan an ideal setting for testing the signaling effects hypothesis. Looking at the institutional details more closely, the Prime Minister's Office of Japan announced twenty-two stimulus packages of supplementary budgets from April 09, 2009, to October 28, 2022. Table 1 provides the main details of each of these packages.[9]

Overall, the packages show the following salient features. First, the scale of the announced fiscal packages is sizable. On average, the Japanese government's general account budget ranged from approximately 90 to 100 trillion yen annually between 2009 and 2022. The values of the fiscal spending and the total size of the fiscal package reported in columns (3) and (4) of Table 1, respectively, show that the magnitude of the extra fiscal stimulus measures is substantial.

Second, the largest component of the fiscal packages pertains to the expenditure side of the

[9] Table 1 shows fiscal announcements starting from 2009. The full set of fiscal announcements starting from 1992 is reported in Appendix B.1. Fiscal spending excludes the loans from government-affiliated financial institutions and tax deferrals from the total size of the fiscal package.

budget. Tax cuts were included in only four instances and before 2009 – February 1994, April 1998, November 1998, and October 2008. In addition, they were relatively modest in scale compared to the overall size of the announced fiscal packages.[10] 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 supplementary budgets, as they are specifically designed to address adverse events and are more likely to contain non-redundant information regarding the state of the economy. In contrast, regular budget measures usually constitute systematic responses to business cycle fluctuations or stem from political decisions, and are therefore less likely to provide further insight into the government's evaluation of expected economic conditions.

Supplementary fiscal packages are issued irregularly, sometimes outside the opening hours of the stock market, with a posthumous formal ratification. To identify the moment of the public announcement of each fiscal package, we use the *Nikkei* newspaper – the major, real-time, economic and business outlet in Japan. Since we are interested in fiscal announcements, we select news releases that report the statement of the Prime Minister and the size of the government intervention.

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 to prepare a proposal for the supplementary budget or fiscal package. In the second phase (announcement stage), a public discussion between the government and the ruling parties reveals the approximate content of the fiscal package but leaves uncertainty around the scale. This second phase ends with a public announcement by the Prime Minister (or government official) on the most likely scale of the fiscal package, which is endorsed by the official approval by the Cabinet. In the third phase (ratification stage), the fiscal package is formally ratified by the Diet, typically without revisions since the measures have already gained support from the ruling parties and the Cabinet.[11] Our analysis, therefore, will mostly focus on the second phase, which entails the first official announcement regarding the scale of the fiscal packages, to assess the existence of signaling effects.

To study the effect of fiscal announcements on stock prices, we create a set of indicator variables that account for the days of information release in each of the three phases of the

[10] The size of the announced tax cuts with the total scale of the package in parentheses is as follows: 5.85trn.(15.25), 4trn.(16.65), 6trn. (23.9), and 2trn. (26.9) in turn.

[11] In fact, we have been confirmed by the Cabinet Office of Japan that all budgets during our sample period were approved by the Diet as proposed by the government.

announcement – see the second column of Table 1.[12] Consequently, we denote with the indicator variable $\mathbb{I}\{A_t^{\text{order}}\}$ the dates when the PM orders the preparation of a proposal for the fiscal package, with the indicator variable $\mathbb{I}\{A_t^{\text{size}}\}$ the dates of the announcements on the size of the final fiscal packages, and with the indicator variable $\mathbb{I}\{A_t^{\text{ratify}}\}$ the dates of ratification by the Diet. Table B.2 in Appendix B.1 reports the dates for the three distinct phases associated with each fiscal announcement for the full sample period 1992-2022.

As we will show, the announcements in the second phase, which are informative about the size of the fiscal packages, are the most relevant to evaluate the signaling effects of fiscal policy. On the contrary, the information released during the first phase does not seem to be very relevant for the stock market. The ratification stage (third phase) seems to convey information regarding the timing of the implementation of the announced fiscal intervention. However, at this late stage, no changes in the size of the fiscal package are announced by government officials and, hence, no signaling effects can be detected at this time. 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.

3.2. Revisions to Expectations of Government Spending

We measure the private sector's revisions to expectations about government spending using forecast data from the *JCER ESP Forecasts*. Published by the *Japan Center for Economic Research*, this dataset compiles forecasts from professional economists for various macroeconomic variables. Respondents provide projections for both government consumption and investment.[13] Although these forecasts pertain to total government spending rather than to the size of a specific fiscal package, revisions in expectations of total government spending serve as a reliable proxy during months in which extraordinary fiscal packages are announced. This is because such packages typically constitute a substantial share of total spending (often exceeding 10%). The construction of the expectation revisions is detailed in Appendix B.4.

[12] We set the indicator variable equal to one on the day in which the news is published either in the evening edition or in the morning edition. The news can in fact be released as flash news in the evening edition before the stock market closure. When the important news of finalizing the scale of fiscal packages is announced in the afternoon of a given day, the news is first released in the evening edition of that day, and then in the morning edition of the following day with detailed information. In such cases, we assign one to the indicator variable for the date when the news appeared in the evening edition, as freshness is more important than the details of the news. As a robustness check on the exact time of the announcements, we also use the *Nikkei Quick News* (NQN) section from *Nikkei* newspaper, which provides the title and content of each news with the timing of the release in one-minute increments. We find that the results remain robust across specifications.

[13] See columns 8 and 9 of Table I-1 in the form available at https://www.jcer.or.jp.

3.3. Measuring Uncertainty

In our analysis, we use both market- and survey-based measures of uncertainty. Our market-based measure of uncertainty is the Nikkei 225 Volatility Index, which reflects the volatility of the Nikkei 225 stock market index. The advantage of using this measure is that it is available at daily frequency, which is crucial for capturing the immediate stock market response to fiscal announcements. A potential drawback of using the Nikkei 225 Volatility Index is that it captures uncertainty specific to financial markets. Therefore, in our VAR analysis, we also use a survey-based measure of uncertainty that better reflects households' perceptions.

We collect household expectations from the *Consumer Confidence Survey*, which has been administered monthly by the Cabinet Office since 2004.[14] The survey samples 8,400 households selected from over 50 million households nationwide, excluding foreigners, students, and households living in institutions. It collects consumer perceptions on a broad range of issues, including overall livelihood, asset prices, and economic growth. Respondents answer each question on a five-point scale: "improve", "improve slightly", "no change", "worsen slightly", and "worsen." We focus on responses related to expectations for overall livelihood, asset prices, and income growth over the next six months. We measure uncertainty as the cross-sectional standard deviation of household expectations concerning these topics.[15]

4. Fiscal Announcements and the Stock Market

We first construct a benchmark to evaluate the role of signaling effects of fiscal measures. To this end, we consider three announcements of large increases in government spending that do not give rise to signaling effects since they are "exogenous" with respect to the business cycle. As discussed in Section 2, if the policy action is not taken in response to a change in the economic conditions, signaling effects do not arise.

The three large "exogenous" fiscal spending episodes are:

1. The victory of the Liberal Democratic Party led by Shinzo Abe in the general election, marking the beginning of a pro-government spending agenda ("Abenomics" policies) on December 16, 2012.[16]

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

[15] Appendix B.2 provides graphical representations of the previously discussed measures of uncertainty.

[16] Prime Minister Shinzo Abe's agenda was aimed at revitalizing long-term economic growth, regardless of the prevailing business cycle conditions. The fiscal spending can thus be considered exogenous to the specific economic context at the time of the election.

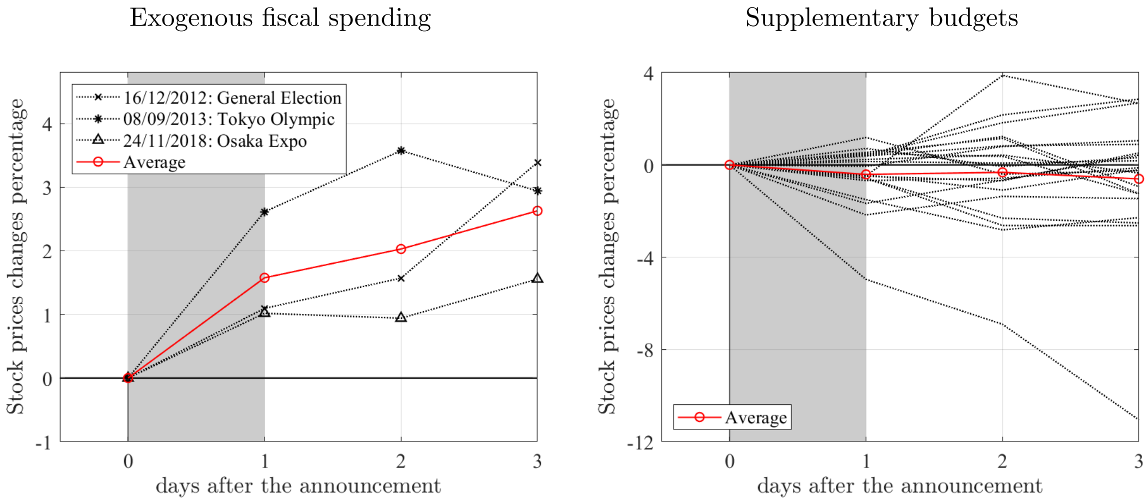


Figure 3: **Effects of fiscal spending news on stock prices.** The figure shows the responses of stock prices to fiscal announcements of three large exogenous fiscal stimuli described in the text (left panel) and the supplementary fiscal packages listed in Table 1 (right panel). The timing of fiscal announcements corresponds to Phase 2. Responses are the cumulative sum of residuals from the regression $\sum_{j=0}^{h} \Delta s_{t+j} = Z_{t-1}\gamma_h' + e_{t+h}$. Z_{t-1} is a vector of variables, including: a constant, the lagged change in the standardized volatility index (ΔVI_{t-1}), the lagged change in stock prices (Δs_{t-1}), the lagged Dow Jones Industrial Average for the US Stock Market at trading closure in the preceding day ($\Delta DJIA_{t-1}$), the lagged change in the yen–dollar exchange rate ($\Delta EXCH_{t-1}$), the lagged change in the Japanese Government Bond (JGB) Volatility Index (ΔJGB_VIX_{t-1}), and the ten-year JGB yields ($BOND_{t-1}$).We normalize the response to zero on the day before the announcement. The shaded areas highlight the time of the announcement. The red-solid line with a circle marker shows the average value of responses.

2. The successful bid to host the 2020 Olympics with the announcement of large public investment projects on September 8, 2013.

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

The left chart of Figure 3 shows the percentage responses of the Nikkei 225 index for the three subsequent days to the fiscal announcements. Specifically, we plot the cumulative sum of the residuals obtained by regressing the percentage change in stock prices on several control variables, normalizing the response on the day before the announcement to zero.[17] In our exercise the fiscal announcement occurs between time zero and one (the shaded area in the figure), and the change in stock prices at time one represents the immediate response of stock prices that cannot be explained by changes in the control variables. The effect of the three expansionary fiscal announcements is positive on stock prices on average (red-solid line with circle markers),

[17] The data and the estimated equations are described in the next section, equation (8). Note that we here estimate equation (8) by varying the daily horizon of the regressand from 0 to 3 days in order to obtain the dynamic responses.

and differences in the responses of stock prices to the separate announcements are sizable, ranging from around 3.5% in response to the winning bid of the 2020 Olympics to around 1% in the case of the Universal Exposition. These responses represent a preliminary benchmark, showing that stock markets responded positively to the announcements of "exogenous" fiscal packages, which are arguably free of signaling effects according to theory.

We compare these three benchmark responses of stock prices against those of the thirty-four supplementary fiscal policy measures that the Prime Minister's Office announced outside the regular budget cycles over the period 2009 – 2022 aimed at counteracting economic difficulties. A list of these measures has been provided in Table 1. We consider the days when the Prime Minister's office announces the size of the package (the second phase). These fiscal packages are not "exogenous" and their effects on the economy may be dampened or reversed by signaling effects according to the theory highlighted in Section 2.

The right chart of Figure 3 shows that the percentage change in stock prices to the supplementary fiscal announcements covers a wide range of values, comprising positive and negative responses, and resulting in an average change of stock prices close to zero, as can be seen by looking at the red-solid line with circle markers. On the first day after the announcement of the size of the packages, the response of stock prices is equally split between negative responses and positive responses. A similar finding emerges if one looks at the responses of stock prices on the days of the fiscal announcements.

Unlike the three large "exogenous" fiscal announcements, these supplementary budget measures are intended to stabilize the economy in the face of a looming recession, potentially signaling the government's expectations regarding the severity of the economic outlook to the private sector. Consequently, the impact of these fiscal measures could potentially offset the positive response of stock prices that is observed with the three large "exogenous" fiscal news.

While these findings only suggest the possibility of signaling effects, this preliminary analysis is helpful for identifying whether any evidence of such effects might be present in the data. The varying responses between the two charts indicate that a more formal investigation could provide clearer insights into the existence and quantitative significance of these effects.

5. Empirical Investigation of Signaling Effects

In this section, we formally examine whether the supplementary stimulus packages announced by the Prime Minister's Office from 2009 to 2022 (Table 1) had signaling effects. These fiscal measures were intended to address adverse and uncertain economic conditions. As discussed in Section 2, the countercyclical nature of these packages could theoretically generate signaling effects. We also investigate whether these effects are more pronounced during periods of increased uncertainty. The quantification of the signaling effects of fiscal shocks on economic activity is deferred 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 benchmark specification:

$$\Delta s_t = \alpha \mathbb{I}\{A_t^{\text{phase}}\} + \beta \mathbb{I}\{A_t^{\text{phase}}\} \times VI_{t-1} + \eta \mathbb{I}\{A_t^{\text{phase}}\} \times VI_{t-1} \times \Delta E_t G_{t+1} + Z_{t-1}\gamma' + \delta + e_t, \tag{8}$$

where Δs_t is the log difference of the Nikkei 225 Index. $\mathbb{I}\{A_t^{\text{phase}}\}$ is an indicator variable taking the value of one when a supplementary fiscal package is either ordered, announced, or ratified, that is phase $\in$ {order, size, ratify}, and zero otherwise. VI_t denotes the Nikkei 225 Volatility Index, normalized to have zero mean and unit variance. This normalization allows us to account for the level of uncertainty prevailing prior to the fiscal package announcement. $\Delta E_t G_{t+1}$ captures the revision in the private sector's expectations about government spending between the month before and the month after the announcement. Expectations are measured using the *JCER ESP Forecasts*, as described in Section 3.2. The variable Z_{t-1} denotes the vector of control variables, which include: the revision of expectations about government spending ($\Delta E_t G_{t+1}$), the lagged volatility index (Δs_{t-1}), the lagged change in stock prices, the Dow Jones Industrial Average for the US Stock Market at trading closure in the preceding day ($\Delta DJIA_{t-1}$), the change in the yen—dollar exchange rate ($\Delta EXCH_{t-1}$), and the ten-year Japanese Government Bond (JGB) yields ($BOND_{t-1}$). These control variables account for possible serial correlation in the errors, changes in domestic stock prices originated by movements in the US stock market, and more broadly the credit supply and financial conditions. Chen and Rogoff (2003) show a strong correlation between movements in the US and Japanese stock prices. The exchange rate is a well-known factor affecting share prices in Japan, where a large proportion of companies are exporters. The coefficient δ is a constant.

Our main coefficient of interest is the parameter η in equation (8), which captures the interaction between the fiscal announcement indicator, the volatility index, and the revision in expectations of government spending. This parameter reflects the stock market response at the time of the announcement when pre-announcement uncertainty is one standard deviation above average and expectations of government spending are revised upward by one percentage point.

As discussed in Section 2, the theory of signaling effects predicts that this interaction term should be positive. According to the theory, the direction of the signaling effect depends on whether the size of the fiscal intervention is revised upward or downward following the announcement. Moreover, the theory implies that signaling effects are stronger when uncertainty is high. To capture this amplification mechanism, we interact the announcement indicator with the volatility index.

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

VARIABLES	Δs_t (1)	(2)	(3)
$\mathbb{I}\{A_t^{\text{size}}\}$	-0.168		
	(0.184)		
$\mathbb{I}\{A_t^{\text{size}}\} \times VI_{t-1}$	-0.372^{**}		
	(0.190)		
$\mathbb{I}\{A_t^{\text{size}}\} \times VI_{t-1} \times \Delta E_t G_{t+1}$	-2.586^{***}		
	(0.601)		
$\mathbb{I}\{A_t^{\text{order}}\}$		0.118	
		(0.242)	
$\mathbb{I}\{A_t^{\text{order}}\} \times VI_{t-1}$		-0.237	
		(0.193)	
$\mathbb{I}\{A_t^{\text{order}}\} \times VI_{t-1} \times \Delta E_t G_{t+1}$		0.632	
		(0.548)	
$\mathbb{I}\left\{A_t^{\text{ratify}}\right\}$			-0.198
			(0.155)
$\mathbb{I}\left\{A_t^{\text{ratify}}\right\} \times VI_{t-1}$			1.221^{***}
			(0.387)
$\mathbb{I}\left\{A_t^{\text{ratify}}\right\} \times VI_{t-1} \times \Delta E_t G_{t+1}$			-1.737
			(1.885)
$\Delta E_t G_{t+1}$	-0.832^{**}	0.110	-0.516
	(0.400)	(0.470)	(0.942)
VI_{t-1}	0.043	0.037	0.029
	(0.040)	(0.042)	(0.041)
Δs_{t-1}	-0.141^{***}	-0.141^{***}	-0.142^{***}
	(0.027)	(0.027)	(0.027)
$\Delta DJIA_{t-1}$	0.576^{***}	0.574^{***}	0.579^{***}
	(0.039)	(0.040)	(0.038)
$\Delta EXCH_{t-1}$	-0.454^{***}	-0.440^{***}	-0.438^{***}
	(0.068)	(0.072)	(0.072)
ΔJGB_VIX_{t-1}	-0.001	-0.001	-0.001
	(0.003)	(0.003)	(0.003)
$BOND_{t-1}$	-0.072^{*}	-0.067	-0.062
	(0.052)	(0.054)	(0.053)
Constant	0.048^{*}	0.043	0.040
	(0.032)	(0.034)	(0.033)
Observations	3324	3324	3324
Adj. R-squared	0.267	0.262	0.265

Notes: This table shows the estimates of regressing the change in stock prices on the indicator variables and control variables for the sample period from 2009 to 2022. We show the results by changing the timings of indicator variables, i.e., $\mathbb{I}\{A_t^{\text{size}}\}$, $\mathbb{I}\{A_t^{\text{order}}\}$, and $\mathbb{I}\left\{A_t^{\text{ratify}}\right\}$. The control variables include the revision of expectations about government spending $\Delta E_t G_{t+1}$, the lagged change in the volatility index (ΔVI_{t-1}), the Dow Jones Industrial Average for the US Stock Market at trading closure in the preceding day ($\Delta DJIA_{t-1}$), the yen–dollar nominal exchange rate ($\Delta EXCH_{t-1}$), the change in the Japanese Government Bond (JGB) Volatility Index (ΔJGB_VIX_{t-1}), and the ten-year JGB yields ($BOND_{t-1}$), and one lag in the change in stock prices (Δs_{t-1}). Newey-West HAC standard errors are in parentheses. The 1%, 5% and 10% significant levels are denoted by $***$, $**$ and $*$, respectively.

Column (1) of Table 2 reports the estimated coefficients from our benchmark specification in equation (8), using the indicator variable for the second phase of the fiscal announcement – $\mathbb{I}\left\{A_t^{\text{size}}\right\}$ – which discloses the final size of the fiscal package to the public. As discussed earlier, this is the critical phase in which the size of the package is revealed and typically remains unchanged thereafter.

The coefficient α on the indicator variable for the announcement is not statistically significant. When the announcement dummy is interacted with the pre-existing level of uncertainty, the effect on the stock market – captured by the coefficient β – is significant and equal to -0.372. The negative sign is consistent with the theory of signaling effects, which predicts that if the announcement occurs during a period of above-average uncertainty, the stock market responds negatively.

Our main coefficient of interest is the one in which the indicator variable for the announcement is interacted not only with uncertainty but also with the revision of expectations. This coefficient (η) is statistically significant at the 1% level and equal to -2.586. It should be interpreted as follows: when the private sector revises its expectations of government spending upward by one percentage point between the month before and after the announcement, and uncertainty is one standard deviation above average on the day before the announcement, the stock market index drops by approximately 2.6% following the announcement. This negative response – despite the upward revision in expected spending – suggests that signaling effects are at play: when uncertainty is high and the announcement surprises the private sector on the upside, markets interpret the news as a signal of a deteriorating economic outlook.

Columns (2) and (3) report regression results using indicator variables for phase 1 and phase 3 of the fiscal announcement process, respectively. In both cases, the coefficient on the triple interaction term is not statistically significant. This suggests that we do not detect meaningful signaling effects during phase 1 or phase 3. These findings are consistent with the interpretation that signaling effects materialize when the size of the fiscal package is publicly disclosed by the Prime Minister – that is, during phase 2. In contrast, phase 1 involves the Prime Minister instructing the Cabinet to prepare a proposal for the supplementary package, and phase 3 corresponds to the package's ratification by the Diet. In both of these stages, there is typically little or no new information revealed about the final size of the package.

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

We have interpreted the negative response of financial markets to fiscal announcements as evidence of signaling effects from fiscal policy. However, one might argue that this negative response reflects concerns about the government's financial solvency in a country where the public debt-to-GDP ratio is very high. In particular, market participants may fear that a debt-financed fiscal stimulus could raise the perceived risk of default.

To address this concern, we re-estimate our baseline regression using a measure of the riskiness of Japanese government bonds as the dependent variable. Specifically, we use changes in the Japanese government bond futures volatility index as our measure of sovereign risk.

As shown in Appendix B.3, this index declines at the 10% significance level in response to a phase 2 fiscal announcement, moving in the opposite direction of what would be expected if news regarding a new fiscal package increased sovereign risk. Moreover, the index does not respond significantly to any interaction involving the announcement indicator, stock market uncertainty, or revisions in expectations about government spending.

These findings suggest that the supplementary fiscal packages considered in our analysis do not lead to a meaningful increase in Japan's perceived default risk. Therefore, the observed negative stock market response to news about the size of these packages does not seem to be driven by concerns over sovereign solvency.

One might also be concerned that our findings may depend on the specific stock market index that we used, which might overweight firms in some specific industries. Appendix B.3 shows that our results supporting the existence of signaling effects are robust to using alternative indexes of stock market prices. In particular, we replace Nikkei 225 with TOPIX (Tokyo Stock Price Index)[18] and show that the significant and negative coefficient on the interaction term, η, is robust to changes in how we measure the response of stock prices, corroborating the key result of this section.

6. Quantifying Signaling Effects on Economic Activity

In this section, we quantify the signaling effect on economic activity by estimating a threshold VAR model at monthly frequency, thereby complementing and extending the results from our regression analysis in Section 5. The threshold VAR approach allows us to study the state-

[18] Nikkei 225 is an average stock price index of 225 stocks selected from the first section of the Tokyo Stock Exchange (TSE), while TOPIX is an alternative index of stock prices obtained from averaging the price index of all stocks listed in the first section of TSE.

dependent impact of the signaling effect on economic activity by imposing identifying restrictions motivated by our theoretical framework.

Three central issues deserve particular attention. First, we account for private sector revisions to expectations about government spending in response to fiscal news. As shown in the stylized model in Section 2, the mere size of a fiscal stimulus is not sufficient to determine how signaling effects influence the efficacy of fiscal policy. Incorporating revisions in expectations about the size of the stimulus is crucial for making quantitative predictions about the signaling effects of economic policy.

Second, we include tax revenues in our VAR model. If agents are forward-looking, the negative correlation between government spending and stock prices, which is central to our identification strategy, as well as any decline in output following expansionary fiscal news, could reflect the anticipation of higher future taxes rather than the signaling channel. Controlling for tax revenues is therefore critical to identify signaling effects.

Third, theory suggests that uncertainty plays a key role in shaping the strength of the signaling channel. To account for potential state-dependence, we partition the sample into periods of high and low uncertainty and estimate a threshold VAR, using uncertainty as the threshold variable. Since our VAR is estimated at monthly frequency, we can exploit survey-based measures of uncertainty from the *Consumer Confidence Survey*, as discussed in Section 3.3.[19]

Consistently with our theory in Section 2 predicting that signaling effects can be either strong or mild – i.e., either reversing or dampening the expansionary impact of an announced fiscal stimulus – we define *fiscal news with significant signaling effects* those in which private sector expectations about public spending and stock prices move in opposite directions. Conversely, we identify *fiscal news with minor signaling effects* those in which private sector expectations about public spending and stock prices move in the same direction. In line with the empirical results in Section 5, we study these co-movements when the Prime Minister's Office announces the size of the fiscal package (second stage).[20] As shown in the previous section, this is the phase during which signaling effects emerge.

To ensure that the identifying restrictions are consistent with the conventional effects of fiscal policy expansions, we impose that the response of government spending is zero on impact – reflecting the implementation lag between the phase 2 announcement and the actual rollout

[19]For our baseline results, we use the dispersion of responses to the question on livelihood. In Appendix B.6, we show that our findings are robust to using alternative measures based on the dispersion of responses to questions on asset prices and income growth.

[20]Appendix B.5 provides the interpretation of our identifying restrictions using the stylized model in Section 2.

Table 3: Identifying restrictions

Variables	Shock: Fiscal news with minor signaling	Fiscal news with significant signaling	Other shocks
Change in expectations of fiscal spending $\Delta E_t G_{t+1}$	+	+	0
Daily change in stock prices 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: The marks, +, −, and 0 denote positive, negative and zero restrictions on contemporaneous responses of variables to each shock, respectively. In addition, sign restrictions over a number of months are imposed on the responses of actual government spending.

of the policy – and becomes positive within four to twelve months following the announcement. Additionally, we assume that disturbances other than the significant and minor signaling fiscal shocks do not affect revisions to expected government spending ($\Delta E_t G_{t+1}$) or stock prices on the days (ΔSP_t) when the Japanese government announces the size of supplementary fiscal packages. Table 3 summarizes the sign restrictions used in our identification strategy.

Since our theoretical framework highlights the importance of uncertainty in shaping the strength of the signaling effect, we estimate a threshold VAR model where uncertainty in period $t-1$ (u_{t-1}) is used as the threshold variable, and the threshold is set at its mean value ($\overline{u}$).

We specify the threshold VAR model as follows:

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

if $u_{t-1} < \overline{u}$, and

$$\begin{pmatrix} f_t \\ y_t \end{pmatrix} = \begin{pmatrix} 0 \\ c_{h,Y} \end{pmatrix} + \sum_{p=1}^{P} \begin{pmatrix} 0 & 0 \\ B^p_{h,YF} & B^p_{h,YY} \end{pmatrix} \begin{pmatrix} f_{t-p} \\ y_{t-p} \end{pmatrix} + \begin{pmatrix} \epsilon^f_{h,t} \\ \epsilon^y_{h,t} \end{pmatrix}, \text{ and } \begin{pmatrix} \epsilon^f_{h,t} \\ \epsilon^y_{h,t} \end{pmatrix} \sim \mathcal{N}(0, \Sigma_h), \tag{10}$$

if $u_{t-1} \geq \overline{u}$.

Vector f_t comprises revisions to government expenditure ($\Delta E_t G_{t+1}$) and changes in stock prices (ΔSP_t) on the days when the fiscal announcements are made (second phase), and Σ_l and Σ_h are the variance-covariance matrices of innovations. In the months without fiscal announcements, we set the variables in f_t to zero, and normalize them to have zero mean and no lags. The vector y_t includes a set of monthly macroeconomic variables: government expenditure (G_t), real GDP (Y_t), and tax revenue (T_t).[21] We estimate the model on monthly data covering

[21] The monthly series of government spending and real GDP is obtained from the *JCER Monthly GDP Estimate*, and tax revenue is collected from the *Ministry of Finance Statistics Monthly*. Appendix B.4 outlines the construction of our series.

the period June 2009-December 2022.[22] Figure 4 shows the IRFs to fiscal news with minor signaling effects (Panel a) and fiscal news with significant signaling effects (Panel b), under high uncertainty (Figure I) and low uncertainty (Figure II). The responses are normalized so that the median revision to private sector's expectations about future government spending, $\Delta E_t G_{t+1}$, at period 0 is 10 basis points.

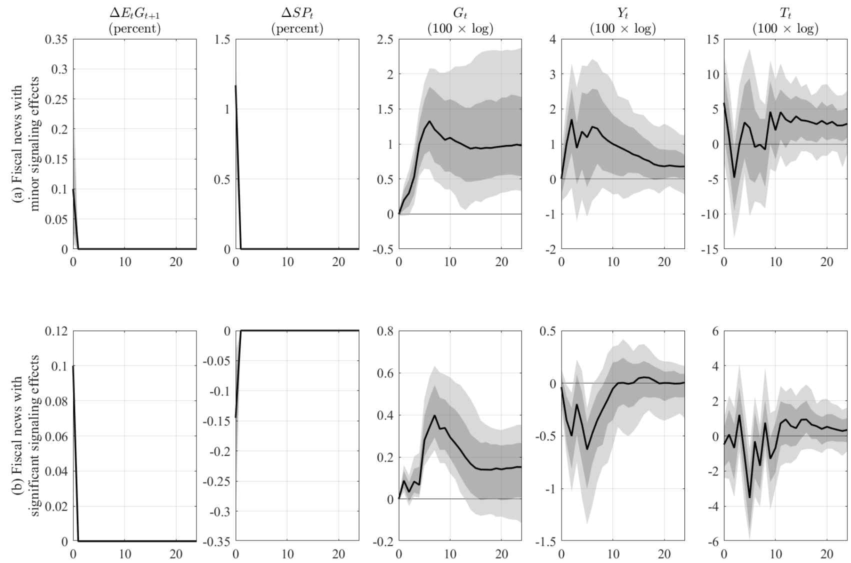
Our primary focus is the response of output, which is left unconstrained in the identification. When uncertainty is high (Figure I), output increases in response to fiscal news with minor signaling effects, characterized by a positive co-movement between revisions in the private sector's expectations and changes in stock prices (Panel a), and declines in response to fiscal news with significant signaling effects, where this co-movement is negative (Panel b). By contrast, when uncertainty is low (Figure II), output does not exhibit a statistically significant response to either type of fiscal news. In particular, the response to minor signaling effects (Panel a) is muted, and the negative response to significant signaling effects (Panel b) is absent.

These results align with the key predictions of the signaling theory outlined in our stylized model in Section 2. First, output responds negatively to fiscal announcements when signaling effects are strong. Second, this negative response arises only under high uncertainty. When uncertainty is low, the signaling channel weakens, and the output response is not reversed.

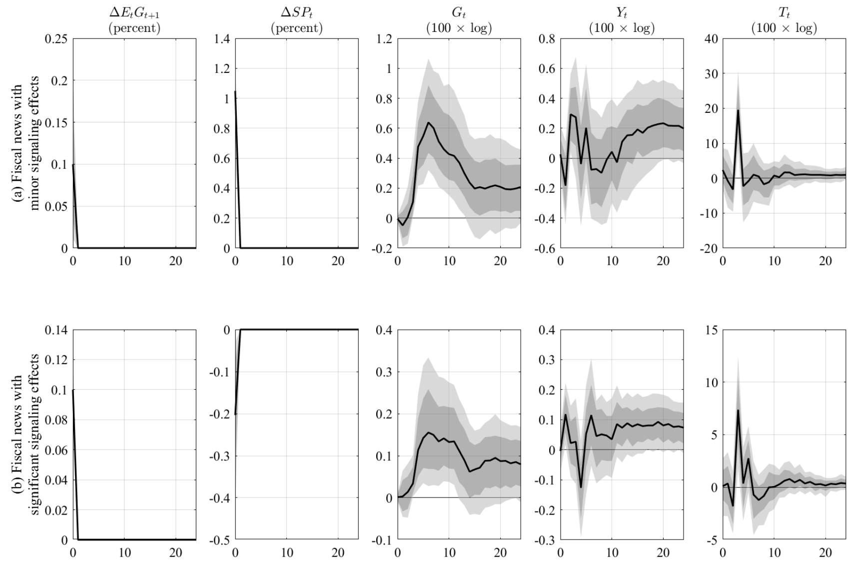
We include tax revenues in our VAR model. If agents are forward-looking, one might argue that the contraction in output following expansionary fiscal news with significant signaling effects could reflect expectations of higher future taxes associated with the increase in government spending. However, tax revenue responds similarly across both types of fiscal shocks. To the extent that markets are able to anticipate the tax response to the fiscal stimuli considered in this analysis, we can rule out the possibility that the negative output response is driven by concerns about how the fiscal expansion is financed.

Appendix B.6 shows that our results are robust to alternative measures of uncertainty, including responses to different questions from the *Consumer Confidence Survey* and the Nikkei 225 Volatility Index.

[22] Our estimation approach is based on sign restrictions as in Uhlig (2005) leaving some series unconstrained, thus imposing minimal structure, as in Mumtaz and Zanetti (2012, 2015) and Bai et al. (2024).



(I) High uncertainty



(II) Low uncertainty

Figure 4: **Impulse response functions.** The black line shows the median impulse response. The dark- and light-shaded areas correspond to 68% and 90% confidence bands, respectively. The magnitude of the shock is normalized to yield a median impact of 10 basis points on the revision of expectations about future government spending. The x-axis shows months. Uncertainty is measured as the cross-sectional standard deviation in the responses of household expectations from the Consumer Confidence Survey, related to the question about livelihood over the next six months. High (low) uncertainty is a month in which the cross-sectional standard deviation is above (below) average. The variables $\Delta E_t G_{t+1}$ and ΔSP_t denote the revisions to expected government spending and stock prices, respectively, on the days when the Japanese government announces the size of supplementary fiscal packages. The variables G_t, Y_t, and T_t denote government expenditure, real GDP, and tax revenue, respectively.

7. Conclusion

Our study develops a novel theoretical framework to analyze the signaling effects of fiscal announcements. The theory highlights the importance of accounting for economic agents' prior beliefs about the size of fiscal interventions in order to properly assess signaling dynamics. It also suggests that elevated macroeconomic uncertainty amplifies these effects. While signaling does not necessarily neutralize the impact of fiscal policy, it can significantly impair the government's ability to stabilize the economy.

To test the theory's key predictions, we construct a new dataset of narrative records from Japan. Our empirical analysis confirms that these predictions hold in the Japanese context. Specifically, fiscal announcements have negligible signaling effects when macroeconomic uncertainty is low. However, as uncertainty rises, signaling effects can partially undermine the effectiveness of fiscal news. Using a novel identification strategy within a threshold VAR framework, we provide the first quantitative assessment of the signaling effects of fiscal policy on real economic activity.

These findings open several important avenues for future research. One promising direction is to investigate whether fiscal authorities can strategically leverage signaling effects to influence private sector expectations without compromising policy credibility. Another is to extend the analysis to alternative fiscal instruments, such as debt issuance or tax announcements, which may generate distinct signaling dynamics. Finally, exploring the role of communication strategies in fiscal announcements – and whether targeted information disclosure can mitigate adverse signaling outcomes – would provide valuable insights. We intend to pursue some of these directions in future work.

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Online Appendices

The Signaling Effects of Fiscal Announcements

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Contents

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]

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

where $\varepsilon_t \sim \mathcal{N}\left(0, \sigma_\varepsilon^2\right)$. 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.

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

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

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

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

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 $I_t^p = \left\{a_t, s_t, X_{t|t}\right\}$.[2] The government, instead, acquires different information from the private agents.

[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.

[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.

It observes X_t with a measurement error (as in equation (A.3)) in addition to receiving the same common signal s_t observed by private agents. 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:

$$X_t = \gamma a_t + \lambda X_{t|t} + \varepsilon_t, \tag{A.5}$$

$$a_t = \alpha X_t + u_t, \tag{A.6}$$

$$s_t = X_t + \xi_t, \tag{A.7}$$

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]

$$\tilde{X}_t = \frac{\gamma}{1-\alpha\gamma} u_t + \frac{1}{1-\alpha\gamma} \varepsilon_t, \tag{A.8}$$

$$\tilde{a}_t = \alpha \tilde{X}_t + u_t, \tag{A.9}$$

$$\tilde{s}_t = \tilde{X}_t + \xi_t, \tag{A.10}$$

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

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

[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

$$
\begin{aligned}
\Sigma_z &= \begin{bmatrix} \sigma_u^2 & 0 \\ 0 & \sigma_\varepsilon^2 \end{bmatrix}, && \text{(A.15)} \\
\mathbf{V} &= E\left(\mathbf{z}_t \mathbf{e}_t'\right) = \begin{bmatrix} \sigma_u^2 & 0 \\ 0 & 0 \end{bmatrix}, && \text{(A.16)} \\
\mathbf{F} &= E\left(y_t y_t'\right) = \mathbf{D}\left(\mathbf{R}\Sigma_z\mathbf{R}'\right)\mathbf{D}' + \Sigma_e + \mathbf{DRV} + (\mathbf{DRV})', && \text{(A.17)} \\
\Sigma_e &= \begin{bmatrix} \sigma_u^2 & 0 \\ 0 & \sigma_\xi^2 \end{bmatrix}, && \text{(A.18)}
\end{aligned}
$$

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 ($\lambda = 0$) – 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), evincing that beliefs of agents 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 $\alpha = 0$, agents do not know if the observed changes in the policy action are driven by a policy shock (τ_t), or noise

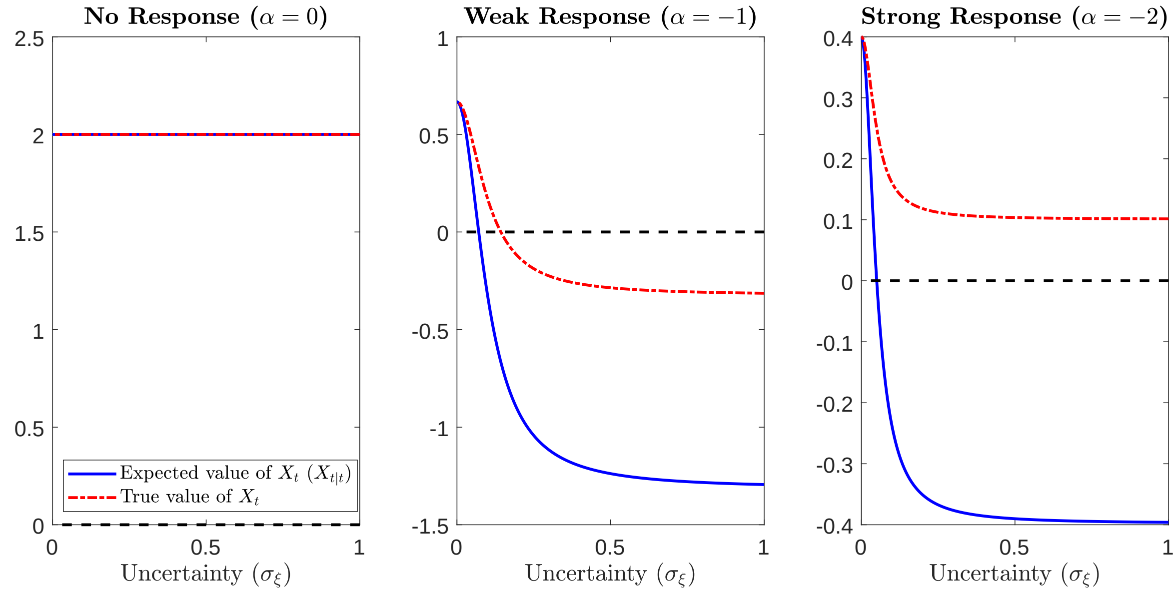


Figure A.5: **Signaling Effects of Economic Policy.** The response of agents' expectations, $X_{t|t}$, (blue solid line) and the economy, X_t, (red dotted-dashed line) to an autonomous unitary increase in the policy action ($u_t > 0$) as the private sector's prior uncertainty, σ_ξ, varies on the horizontal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

(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 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. Robustness for empirical analyses

This section presents more details and robustness for the empirical analysis. Subsection B.1 reports the full set of fiscal announcements starting from 1992 and more precise information on the timing of each fiscal announcement. Subsection B.2 informally evaluates the key theoretical prediction that signaling effects are stronger when uncertainty is higher. Subsection B.3 shows other specifications of our main regression. Subsection B.4 explains how the series of government spending forecast revision is constructed, and Subsection B.6 exhibits additional robustness for the VAR analysis.

B.1. Full set of fiscal announcements and their detailed timings

We have built our narrative series of fiscal announcements starting from 1992. However, in our empirical analysis in Section 3.1 we could only use the series starting from 2009, which is when the data on JCER ESP forecasts become available. Table B.1 reports the full set of fiscal announcements starting from 1992, while Table B.2 shows the detailed dates of the three phases for each fiscal announcement.

Table B.1: Dates of Fiscal Announcements: 1992–2022

(1) Dates	(2) Indicators	(3) Fiscal spending	(4) Total size	(5) Disclosure event
(a) *Countermeasures against the collapse of bubble economy*				
08/28/1992	$\mathbb{I}\{A_{1,t}\}$	n.a.	10.7 trn.	Meeting of relevant ministers
04/13/1993	$\mathbb{I}\{A_{2,t}\}$	n.a.	13.2 trn.	Meeting of relevant ministers
09/16/1993	$\mathbb{I}\{A_{3,t}\}$	n.a.	6.15 trn.	Government and ruling coalition agreement
02/09/1994	$\mathbb{I}\{A_{4,t}\}$	n.a.	15.25 trn.	Cabinet decision
09/20/1995	$\mathbb{I}\{A_{5,t}\}$	n.a.	14.22 trn.	Meeting of relevant ministers
(b) *Countermeasures against financial crisis in Japan*				
04/24/1998	$\mathbb{I}\{A_{6,t}\}$	n.a.	16.65 trn.	Meeting of relevant ministers
11/16/1998	$\mathbb{I}\{A_{7,t}\}$	n.a.	23.9 trn.	Meeting of relevant ministers
11/11/1999	$\mathbb{I}\{A_{8,t}\}$	n.a.	18 trn.	Meeting of relevant ministers
10/19/2000	$\mathbb{I}\{A_{9,t}\}$	n.a.	11 trn.	Meeting of relevant ministers
(c) *Countermeasures against global financial crisis*				
08/29/2008	$\mathbb{I}\{A_{10,t}\}$	2 trn.	11.5 trn.	Government and ruling parties' agreement
10/31/2008	$\mathbb{I}\{A_{11,t}\}$	5 trn.	26.9 trn.	Press conference by PM
12/19/2008	$\mathbb{I}\{A_{12,t}\}$	10 trn.	43 trn.	Meeting of relevant ministers
04/09/2009	$\mathbb{I}\{A_{13,t}\}$	15.4 trn.	56.8 trn.	LDP approval
12/08/2009	$\mathbb{I}\{A_{14,t}\}$	7.2 trn.	24.4 trn.	Cabinet decision
08/31/2010	$\mathbb{I}\{A_{15,t}\}$	915 bn.	9.8 trn.	Committee of relevant ministers
10/08/2010	$\mathbb{I}\{A_{16,t}\}$	4.9 trn.	20.8 trn.	Government and ruling parties' agreement
(d) *Supplementary budgets for recovery from Great East Japan Earthquake*				
04/18/2011	$\mathbb{I}\{A_{17,t}\}$	4 trn.	n.a.	Ruling parties' agreement
06/30/2011	$\mathbb{I}\{A_{18,t}\}$	2 trn.	n.a.	Government final plan
10/15/2011	$\mathbb{I}\{A_{19,t}\}$	12 trn.	n.a.	Ruling and opposition parties' agreement
(e) *Countermeasures against yen appreciation*				
10/25/2012	$\mathbb{I}\{A_{20,t}\}$	400 bn.	750 bn.	Government final plan
11/27/2012	$\mathbb{I}\{A_{21,t}\}$	880 bn.	1.2 trn.	Government final plan
(f) *Abenomics policy*				
01/11/2013	$\mathbb{I}\{A_{22,t}\}$	10.3 trn.	20.2 trn.	Press conference by PM
12/05/2013	$\mathbb{I}\{A_{23,t}\}$	5.5 trn.	18.6 trn.	Meeting of Government and ruling parties
12/29/2014	$\mathbb{I}\{A_{24,t}\}$	3.5 trn.	n.a.	Meeting of government and ruling parties
08/02/2016	$\mathbb{I}\{A_{25,t}\}$	13.5 trn.	28.1 trn.	Meeting of government and ruling parties
12/05/2019	$\mathbb{I}\{A_{26,t}\}$	13.2 trn.	26.0 trn.	Meeting of government and ruling parties
(g) *Countermeasures against COVID-19 pandemic*				
02/14/2020	$\mathbb{I}\{A_{27,t}\}$	15.3 bn.	500 bn.	Novel Coronavirus Response Headquarters
03/11/2020	$\mathbb{I}\{A_{28,t}\}$	430 bn.	1.6 trn.	Novel Coronavirus Response Headquarters
04/07/2020	$\mathbb{I}\{A_{29,t}\}$	39.5 trn.	108.2 trn.	Meeting of government and ruling parties
05/27/2020	$\mathbb{I}\{A_{30,t}\}$	72.7 trn.	117.1 trn.	Meeting of government and ruling parties
12/08/2020	$\mathbb{I}\{A_{31,t}\}$	40.7 trn.	73.6 trn.	Meeting of government and ruling parties
11/19/2021	$\mathbb{I}\{A_{32,t}\}$	55.7 trn.	78.9 trn.	Meeting of government and ruling parties
(h) *Countermeasures against price increases*				
04/27/2022	$\mathbb{I}\{A_{33,t}\}$	6.2 trn.	13.2 trn.	Press conference by PM
10/28/2022	$\mathbb{I}\{A_{34,t}\}$	39 trn.	71.6 trn.	Meeting of government and ruling parties

Notes: The table summarizes information about fiscal announcements in Japan for the period 1992-2022. It provides the date (column 1), the indicator variables (column 2), the amount of fiscal spending (column 3) the total size of fiscal packages (column 4), and the event where the final scale of the package was disclosed (column 5). The timing of each announcement is identified from the *Nikkei* newspaper. Fiscal spending consists of national and local government actual spending and fiscal investment and loans. The total size comprises loans from government financial institutions in addition to fiscal spending. In the fiscal packages before 2000, only the total size is reported. Only fiscal spending was released in the series of supplementary budgets in 2011, while the total size was not disclosed.

Table B.2: Dates of Fiscal Announcements: 1992–2022

Indicator	Dates of Announcements Order	Size	Ratify
(1) $\mathbb{I}\{A_{1,t}\}$	07/31/1992	08/28/1992	10/30/1992
(2) $\mathbb{I}\{A_{2,t}\}$	04/02/1993	04/13/1993	05/14/1993
(3) $\mathbb{I}\{A_{3,t}\}$	09/08/1993	09/16/1993	11/30/1993
(4) $\mathbb{I}\{A_{4,t}\}$	12/27/1993	02/09/1994	02/14/1994
(5) $\mathbb{I}\{A_{5,t}\}$	08/29/1995	09/20/1995	09/29/1995
(6) $\mathbb{I}\{A_{6,t}\}$	02/17/1998	04/24/1998	05/11/1998
(7) $\mathbb{I}\{A_{7,t}\}$	10/06/1998	11/16/1998	11/27/1998
(8) $\mathbb{I}\{A_{8,t}\}$	10/08/1999	11/11/1999	11/25/1999
(9) $\mathbb{I}\{A_{9,t}\}$	09/20/2000	10/19/2000	11/10/2000
(10) $\mathbb{I}\{A_{10,t}\}$	08/04/2008	08/29/2008	09/29/2008
(11) $\mathbb{I}\{A_{11,t}\}$	10/09/2008	10/31/2008	12/22/2008
(12) $\mathbb{I}\{A_{12,t}\}$	12/15/2008	12/19/2008	12/22/2008
(13) $\mathbb{I}\{A_{13,t}\}$	03/13/2009	04/09/2009	04/27/2009
(14) $\mathbb{I}\{A_{14,t}\}$	11/12/2009	12/08/2009	12/15/2009
(15) $\mathbb{I}\{A_{15,t}\}$	08/20/2010	08/31/2010	
(16) $\mathbb{I}\{A_{16,t}\}$	09/28/2010	10/08/2010	10/26/2010
(17) $\mathbb{I}\{A_{17,t}\}$	03/29/2011	04/18/2011	04/22/2011
(18) $\mathbb{I}\{A_{18,t}\}$	06/14/2011	06/30/2011	07/05/2011
(19) $\mathbb{I}\{A_{19,t}\}$	07/12/2011	10/17/2011	10/21/2011
(20) $\mathbb{I}\{A_{20,t}\}$	10/18/2012	10/25/2012	
(21) $\mathbb{I}\{A_{21,t}\}$	11/16/2012	11/27/2012	
(22) $\mathbb{I}\{A_{22,t}\}$	12/27/2012	01/11/2013	01/16/2013
(23) $\mathbb{I}\{A_{23,t}\}$	09/11/2013	12/05/2013	12/13/2013
(24) $\mathbb{I}\{A_{24,t}\}$	11/19/2014	12/29/2014	01/13/2015
(25) $\mathbb{I}\{A_{25,t}\}$	07/13/2016	08/02/2016	08/25/2016
(26) $\mathbb{I}\{A_{26,t}\}$	11/08/2019	12/05/2019	12/16/2019
(27) $\mathbb{I}\{A_{27,t}\}$	02/07/2020	02/14/2020	
(28) $\mathbb{I}\{A_{28,t}\}$	03/02/2020	03/11/2020	
(29) $\mathbb{I}\{A_{29,t}\}$	03/30/2020	04/07/2020	04/08/2020
(30) $\mathbb{I}\{A_{30,t}\}$	05/15/2020	05/27/2020	05/28/2020
(31) $\mathbb{I}\{A_{31,t}\}$	11/10/2020	12/08/2020	12/16/2020
(32) $\mathbb{I}\{A_{32,t}\}$	10/08/2021	11/19/2021	11/29/2021
(33) $\mathbb{I}\{A_{33,t}\}$	03/29/2022	04/27/2022	05/18/2022
(34) $\mathbb{I}\{A_{34,t}\}$	09/30/2020	10/28/2020	11/09/2022

Notes: The table summarizes the dates of fiscal announcements over the period 1992–2022, as reported in the *Nikkei* newspaper. The dates "Order" are the dates in which the Prime Minister orders the fiscal stimulus packages or supplementary budgets. The dates "Size" are those in which the draft of the package is finalized. Lastly, the dates "Ratify" are those in which the budget supporting the fiscal stimulus package is officially ratified by the Cabinet. Some packages using reserve funds do not require additional budget approval and therefore do not have a Ratify date.

B.2. Uncertainty Measures

This section presents the two measures of uncertainty used in the main text. Subsection B.2.1 shows the Nikkei volatility index, a stock market measure of uncertainty, while Subsection B.2.2 presents households' and firms' survey measures of disagreement.

B.2.1. The Nikkei Volatility Index

In Section 5, we use the Nikkei 225 Volatility Index (Nikkei VI) – a daily measure of the expected volatility of stock prices – as a proxy for stock markets' uncertainty. This index reflects the stock market's uncertainty regarding the near-term economic outlook. Figure B.1 shows the time profile of daily Nikkei VI.

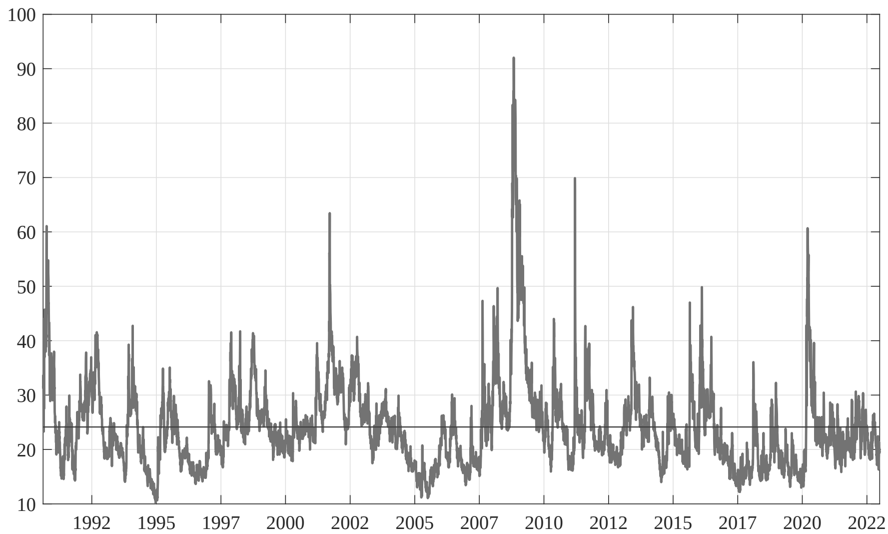


Figure B.1: **Nikkei 225 VI.** This figure shows the daily variation in Nikkei 225 VI. The horizontal black line is the historical average of Nikkei 225 VI.

B.2.2. Households' disagreement

We now look at survey expectations of households and firms. Households' expectations come from the *Consumer Confidence Survey*, a survey administered monthly by the Cabinet Office since 2004.[5] It covers 8,400 households selected from over 50 million households nationwide by excluding foreigners, students, and households living in institutions and it surveys the consumer perceptions on a broad range of issues including overall livelihood, asset prices, and economic growth. Respondents answer each question on a one-to-five scale: improve, improve slightly, no change, worsen slightly, and worsen. We focus on the items about the outlook for overall livelihood, asset prices, and income growth over the next six months.

Figure B.2 shows the cross-sectional standard deviation in the responses of household expectations from the *Consumer Confidence Survey*, related to questions about livelihood (Panel a), asset prices (Panel b), and income growth (Panel c). We normalize the standard deviation to

[5]The predecessor survey began in 1957, and surveyed only urban households twice a year. Instead, the current monthly survey covers households nationwide.

be equal to one in the initial period, and the solid horizontal line represents the sample average of standard deviation for each survey.

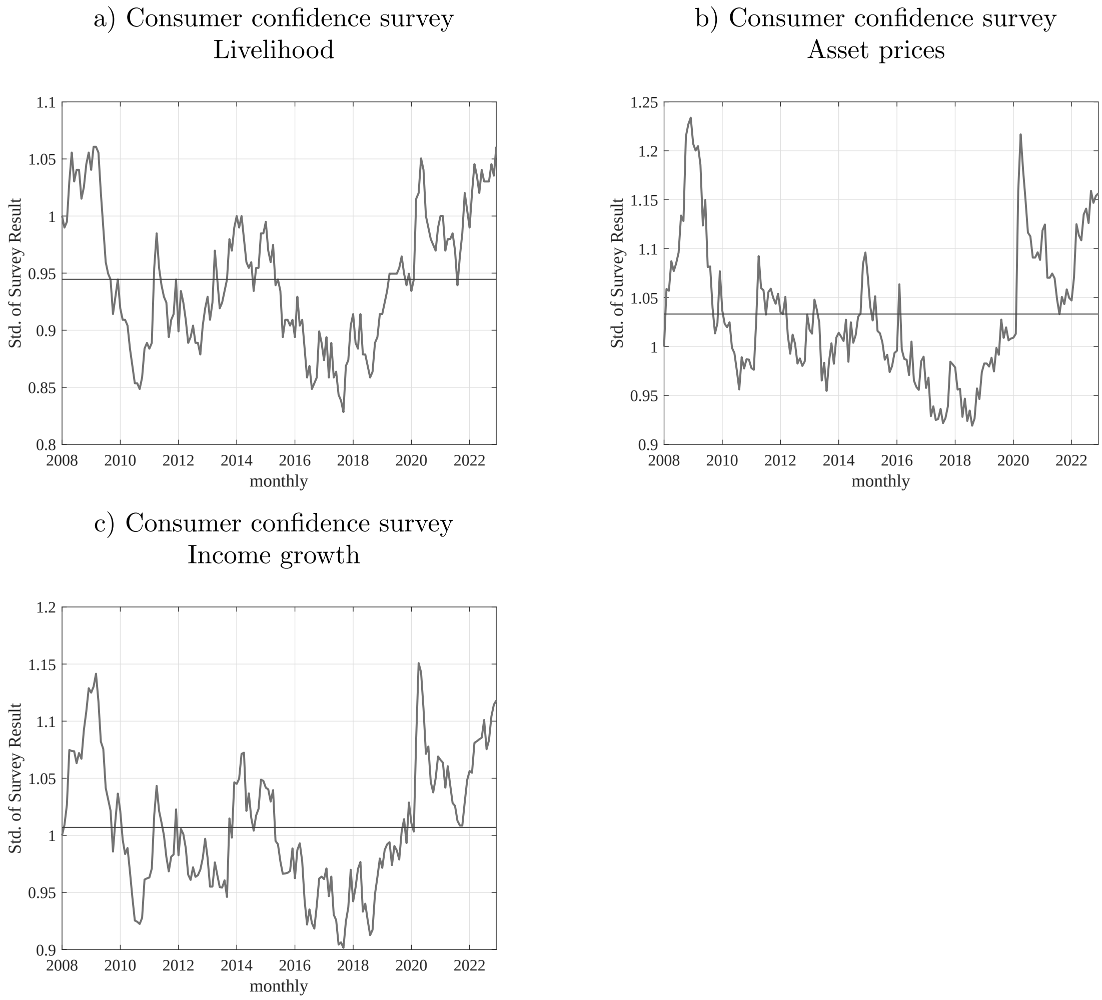


Figure B.2: **Standard deviation of survey results.** This figure shows the standard deviation of the answers to the *Consumer Confidence Survey* in the period January 2008– December 2022 for the period 1990Q1 – 2022Q4. We compute standard deviations as follows. First, we calculate the weighted average of the results by multiplying the evaluation points for each alternative and the component ratio. We set the evaluation points in the *Consumer Confidence Survey* as +1 (improve), +0.75 (slightly improve), +0.5 (no change), +0.25 (worsen slightly), and 0 (worsen). Then, for each alternative, the square of the deviation between the evaluation point and the weighted average is calculated in each period, and the squared root of its sum, weighted by the component ratio, is used as the standard deviation. For comparison, we normalize the standard deviation at the initial point to be equal to one.

In Section B.2.1, we have used Nikkei 225 VI as a proxy of stock market's uncertainty. A major difference between Nikkei 225 VI and the survey measures is the frequency, the former being available at daily frequency, while the latter at lower frequency. Table B.3 shows the correlation coefficients between the dispersion in the survey expectations (for the survey questions about livelihood, asset prices and income growth) and the Nikkei VI converted into the monthly basis by time average. The p-values (in parentheses) test the hypothesis that the correlation between variables is equal to zero. The entries show that the correlations between the Nikkei VI and the different measures of consumer confidence from the Consumer Confidence Survey (last row) are positive at a 1% significance level, indicating that the Nikkei VI robustly tracks the dispersion in the expectations from survey data.

Table B.3: Correlations among the consumer confidence and the Nikkei VI

	Consumer confidence survey			Nikkei VI
	Overall livelihood	Asset prices	Income growth	
Overall livelihood	1			
Asset prices	0.86 (0.00)	1		
Income growth	0.94 (0.00)	0.91 (0.00)	1	
Nikkei VI	0.39 (0.00)	0.55 (0.00)	0.39 (0.00)	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 January 2008 – December 2022. The values in parenthesis indicate the p-value for the hypothesis that the correlation between variables is insignificant.

B.3. Impact Effects of Fiscal Announcements: Robustness Checks

Table B.4 shows estimates of our regression 8, where we substitute the dependent variable with the Japanese government bond volatility index, which we take as a measure of sovereign risk. We show that fiscal announcements trigger a decrease in such volatility, suggesting that they do not lead to an increase in sovereign risk.

Table B.5 shows estimates of our baseline regression 8, where we replace the stock market index Nikkei 225 with TOPIX. The main difference is that while Nikkei 225 is an average stock price index of 225 stocks selected from the first section of the Tokyo Stock Exchange (TSE), TOPIX is obtained from averaging the price index of all stocks listed in the first section of TSE. We show that our results are robust to using this different stock market index.

Table B.4: Effects of fiscal announcements on Japanese government bond volatility index

VARIABLES	ΔJGB_VIX$_t$ (1)	(2)	(3)
$\mathbb{I}\left\{A_t^{\text{size}}\right\}$	-4.466^{*}		
	(2.847)		
$\mathbb{I}\left\{A_t^{\text{size}}\right\} \times VI_{t-1}$	-0.439		
	(0.151)		
$\mathbb{I}\left\{A_t^{\text{size}}\right\} \times VI_{t-1} \times \Delta E_t G_{t+1}$	-1.133		
	(6.221)		
$\mathbb{I}\left\{A_t^{\text{order}}\right\}$		3.339	
		(3.629)	
$\mathbb{I}\left\{A_t^{\text{order}}\right\} \times VI_{t-1}$		0.343	
		(1.447)	
$\mathbb{I}\left\{A_t^{\text{order}}\right\} \times VI_{t-1} \times \Delta E_t G_{t+1}$		-2.635	
		(3.765)	
$\mathbb{I}\left\{A_t^{\text{ratify}}\right\}$			5.101
			(5.013)
$\mathbb{I}\left\{A_t^{\text{ratify}}\right\} \times VI_{t-1}$			-3.078
			(2.706)
$\mathbb{I}\left\{A_t^{\text{ratify}}\right\} \times VI_{t-1} \times \Delta E_t G_{t+1}$			21.892
			(19.045)
$\Delta E_t G_{t+1}$	1.618	-9.380^{**}	-7.694
	(5.722)	(5.455)	(6.663)
VI_{t-1}	-0.140	-0.165	-0.154
	(0.152)	(0.156)	(0.147)
Δs_{t-1}	-0.384^{***}	-0.401^{***}	-0.391^{***}
	(0.133)	(0.137)	(0.132)
$\Delta DJIA_{t-1}$	-0.751^{***}	-0.768^{***}	-0.766^{***}
	(0.208)	(0.206)	(0.207)
$\Delta EXCH_{t-1}$	-1.050^{**}	-1.067^{**}	-1.067^{**}
	(0.483)	(0.478)	(0.476)
ΔJGB_VIX_{t-1}	-0.172^{***}	-0.172^{***}	-0.172^{***}
	(0.070)	(0.070)	(0.070)
$BOND_{t-1}$	-0.175	-0.181	-0.180
	(0.244)	(0.246)	(0.240)
Constant	0.134	0.092	0.102
	(0.190)	(0.194)	(0.190)
Observation	3324	3324	3324
Adj. R-squared	0.057	0.057	0.057

Notes: This table shows the estimates of regressing the change in Japanese government bond volatility index ($\Delta JGB_{VIX\,t}$) on the indicator variables and control variables for the sample period from 2009 to 2022. We show the results by changing the timings of indicator variables, i.e., $\mathbb{I}\left\{A_t^{\text{size}}\right\}$, $\mathbb{I}\left\{A_t^{\text{order}}\right\}$, and $\mathbb{I}\left\{A_t^{\text{ratify}}\right\}$. The control variables includes the revision of expectations about government spending $\Delta E_t G_{t+1}$, the lagged volatility index (VI_{t-1}), the Dow Jones Industrial Average for the US Stock Market at trading closure in the preceding day ($\Delta DJIA_{t-1}$), the yen–dollar nominal exchange rate ($\Delta EXCH_{t-1}$), the ten-year Japanese Government Bond (JGB) yields ($BOND_{t-1}$), and one lag in the change in stock prices (Δs_{t-1}). Newey-West HAC standard errors are in parentheses. The 1%, 5% and 10% significant levels are denoted by $***$, $**$ and $*$, respectively.

Table B.5: Impact effects of fiscal announcements on stock prices: TOPIX

VARIABLES	ΔTOPIX$_t$ (1)	(2)	(3)
$\mathbb{I}\left\{A_t^{\text{size}}\right\}$	-0.026 (0.153)		
$\mathbb{I}\left\{A_t^{\text{size}}\right\} \times VI_{t-1}$	-0.284^{**} (0.149)		
$\mathbb{I}\left\{A_t^{\text{size}}\right\} \times VI_{t-1} \times \Delta E_t G_{t+1}$	-2.282^{***} (0.453)		
$\mathbb{I}\left\{A_t^{\text{order}}\right\}$		0.107 (0.221)	
$\mathbb{I}\left\{A_t^{\text{order}}\right\} \times VI_{t-1}$		-0.234^{*} (0.147)	
$\mathbb{I}\left\{A_t^{\text{order}}\right\} \times VI_{t-1} \times \Delta E_t G_{t+1}$		0.374 (0.614)	
$\mathbb{I}\left\{A_t^{\text{ratify}}\right\}$			-0.222^{*} (0.145)
$\mathbb{I}\left\{A_t^{\text{ratify}}\right\} \times VI_{t-1}$			0.980^{***} (0.319)
$\mathbb{I}\left\{A_t^{\text{ratify}}\right\} \times VI_{t-1} \times \Delta E_t G_{t+1}$			-1.199 (1.557)
$\Delta E_t G_{t+1}$	-0.992^{***} (0.337)	0.366 (0.439)	-0.239 (0.749)
VI_{t-1}	0.049^{*} (0.035)	0.045 (0.037)	0.038 (0.036)
$\Delta TOPIX_{t-1}$	-0.092^{***} (0.026)	-0.091^{***} (0.026)	-0.093^{***} (0.026)
$\Delta DJIA_{t-1}$	0.507^{***} (0.036)	0.506^{***} (0.036)	0.510^{***} (0.035)
$\Delta EXCH_{t-1}$	-0.415^{***} (0.060)	-0.401^{***} (0.064)	-0.401^{***} (0.063)
ΔJGB_VIX_{t-1}	-0.001 (0.003)	-0.001 (0.003)	-0.001 (0.003)
$BOND_{t-1}$	-0.074^{*} (0.048)	-0.071^{*} (0.049)	-0.066^{*} (0.049)
Constant	0.039^{*} (0.028)	0.036 (0.030)	0.034 (0.029)
Observation	3324	3324	3324
Adj. R-squared	0.253	0.249	0.251

Notes: This table shows the estimates of regressing the change in TOPIX on the indicator variables and control variables for the sample period from 2009 to 2022. We show the results by changing the timings of indicator variables, i.e., $\mathbb{I}\left\{A_t^{\text{size}}\right\}$, $\mathbb{I}\left\{A_t^{\text{order}}\right\}$, and $\mathbb{I}\left\{A_t^{\text{ratify}}\right\}$. The control variables includes the revision of expectations about government spending $\Delta E_t G_{t+1}$, the lagged change in the volatility index (ΔVI_{t-1}), the Dow Jones Industrial Average for the US Stock Market at trading closure in the preceding day ($\Delta DJIA_{t-1}$), the yen–dollar nominal exchange rate ($\Delta EXCH_{t-1}$), the ten-year Japanese Government Bond (JGB) yields ($BOND_{t-1}$), and one lag in the change in stock prices ($\Delta TOPIX_{t-1}$). Newey-West HAC standard errors are in parentheses. The 1%, 5% and 10% significant levels are denoted by $***$, $**$ and $*$, respectively.

B.4. The series for the revision of the forecast of government spending

In this Appendix, we describe the construction of our series for the revision of the forecast of government spending. We use forecast data on government spending from *JCER ESP Forecast*, published by *Japan Center for Economic Research*, which collects professional economists' forecasts of various economic variables. Government expenditure forecasts have been included in the survey since June 2009. Each month, forecasters make forecasts on the annual growth rate of government expenditure for one and two fiscal years ahead. The Japanese fiscal year (FY) starts in April and ends the following March, so the forecasted period measured by the monthly basis is different each month. For example, consider the forecasts of government expenditure annual growth rates for FY2009 and FY2010, which are released in June 2009 and July 2009. In this case, the monthly basis forecast periods are 21 months for June 2009 release (there are nine months remaining in FY2009 and 12 months in FY2010), and 20 months for the July 2009 release. Exploiting this forecast data, we construct a monthly series of the quasi one-year (i.e., 12 months) ahead forecasts of government expenditure growth rates by taking a weighted average of the forecasted value for each fiscal year and the number of months included within 12 months from the period of forecasting. To be specific, a quasi one-year-ahead forecasts in June 2009, denoted as $E_t\hat{G}_{t,t+12}$, is computed as:

$$E_t\left[\hat{G}_{t,t+12}\right] = \frac{9}{12} \times E_t\left[G_{FY2009}\right] + \frac{3}{12} \times E_t\left[G_{FY2010}\right],\ t = 2009\text{M}06,$$

where E_tG_{FY2009} and E_tG_{FY2010} denote the forecasts of annual growth rates of government expenditure for FY2009 and FY2010 at period t (= June 2009). We first-difference this series to construct the revision of forecast on the one-year-ahead government expenditure growth rate:

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

We use $\Delta E_t\left[\hat{G}_{t,t+12}\right]$ in the month when fiscal announcements are released as our government expenditure forecast revision in f_t. As for the macroeconomic variables included in y_t, they are taken from the *JCER Monthly GDP Estimate*, also published by the *JCER*. Differently from the official statistics that are released at quarterly frequency, these estimates are available at monthly frequency.

B.5. Interpretation of the VAR identifying restrictions in the stylized model

In this Appendix, we interpret the identifying restrictions in the VAR model using the stylized model in Section 2.

The VAR identifies strong and mild signaling effects that either reverse or dampen the expansionary impact of an announced fiscal stimulus, respectively, labeling them: (i) *fiscal news with significant signaling effects* when private sector expectations about public spending and stock prices move in opposite directions, and (ii) *fiscal news with minor signaling effects* when public spending and stock prices move in the same direction.

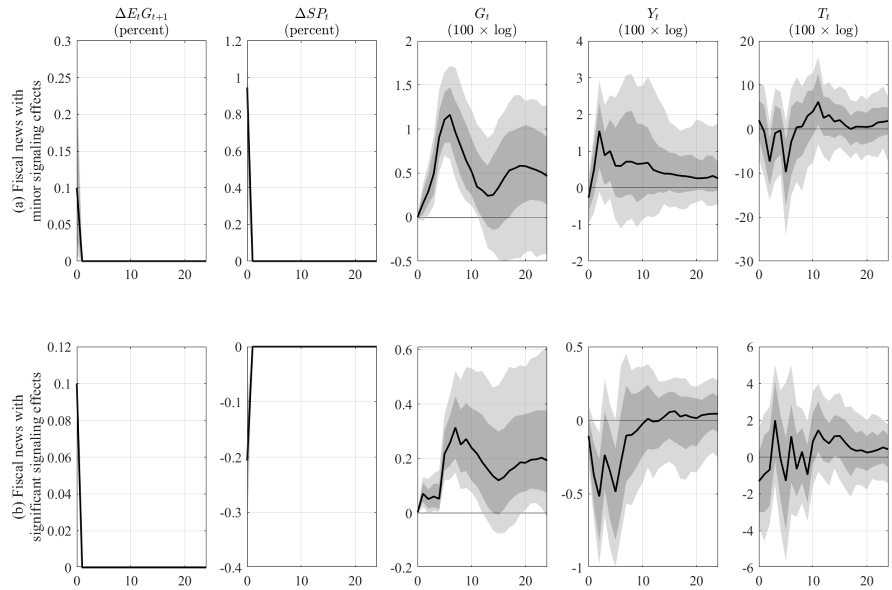
Both types of fiscal news can be interpreted through the lens of the simple model of signaling effects introduced in Section 2. Fiscal news are either policy shocks, ε_a, – i.e., a non-systematic deviation from the usual way the government responds to a downturn – or noise shock in the policy maker's signal, ξ^g, – i.e. a change in the policymaker's assessment of the economic outlook. In the stylized model, both shocks give rise to a policy surprise from the perspective of the private sector, $a - E(a|s^p) = 0$. The different level of signaling effects carried by the two shocks can be captured by varying the accuracy of the signal received by the private sector, σ_ξ.

When the private signal is less (more) precise, uncertainty is higher (lower), implying that the private sector will try to extract more (less) information regarding the state of the economy from the policy action, making signaling effects of fiscal news stronger (weaker).[6] See the exercise performed in Section 2.4, where we show that fiscal news with significant signaling effects are less expansionary than fiscal policy shocks, and might, in fact, be even contractionary.

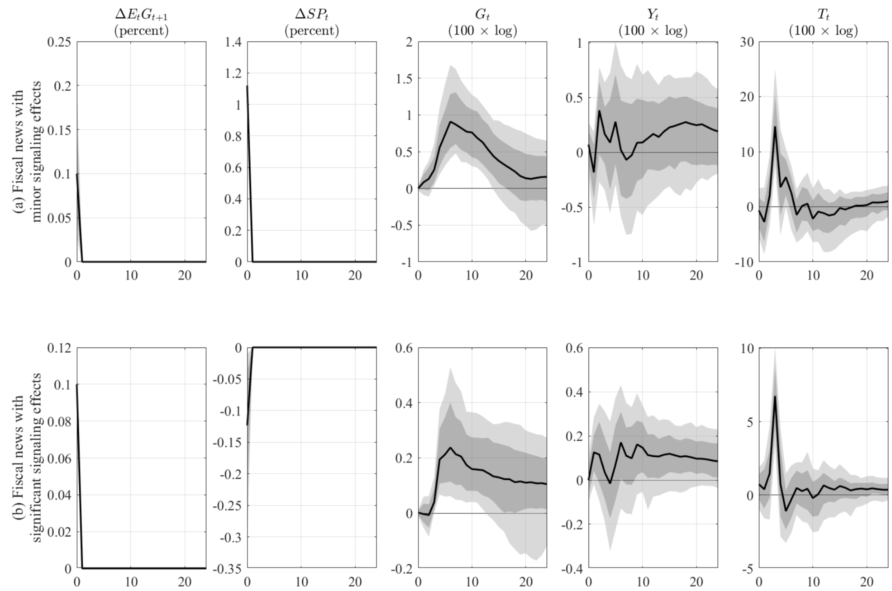
B.6. Robustness of VAR analysis

In Section 6 we estimated the threshold VAR by splitting the sample into high and low uncertainty periods – respectively higher and lower than the sample average. To gauge uncertainty we used the cross-sectional standard deviation of the response concerning the outlook for overall livelihood over the next six months. In Figures B.3 and B.4 we use the response concerning asset prices and income growth instead. The overall picture does not change compared to Figure 4, where we used the survey question on livelihood. Signaling effects are stronger when uncertainty is high. As in Section 5 we used the Nikkei VI as our measure of uncertainty, Figure B.5 shows the VAR impulse responses where we use the monthly average of the Nikkei 225 VI as our uncertainty measure. The Figure still conveys the same message: that fiscal news propagates differently depending on whether there are strong or mild signaling effects and this occurs when uncertainty is high.

[6] Reducing the accuracy of the private signal is tantamount to increasing the private sector's uncertainty in the stylized model.

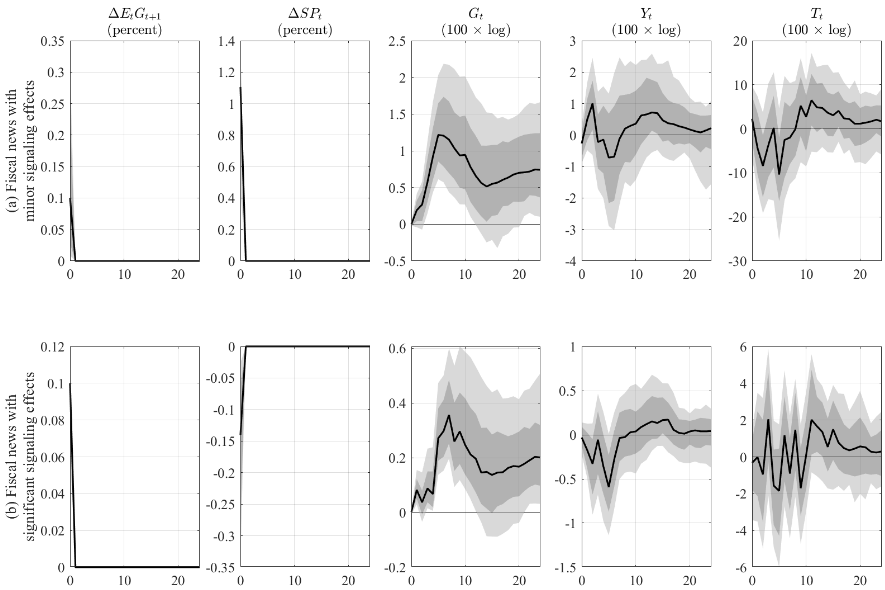


a) High uncertainty

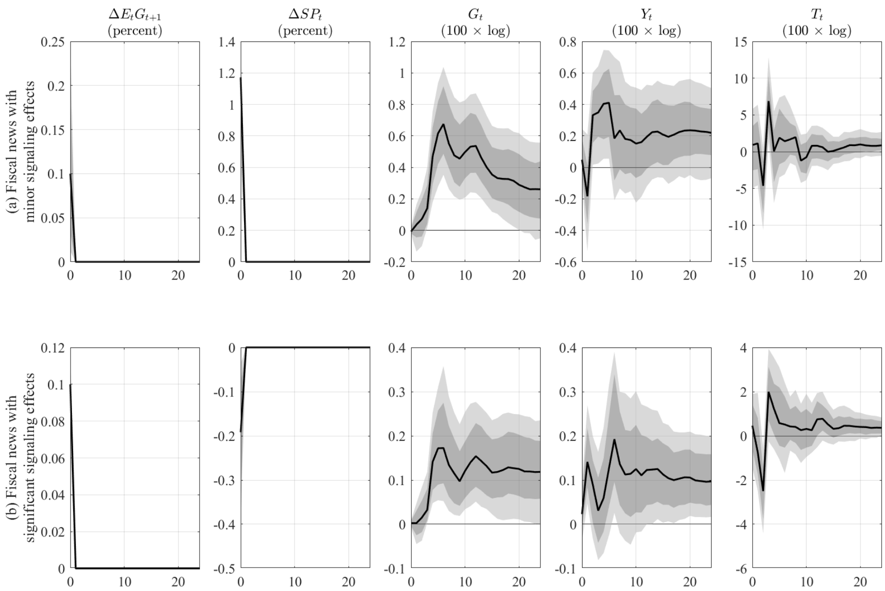


b) Low uncertainty

Figure B.3: **Impulse response functions.** This figure shows the impulse response functions of the threshold VAR model where uncertainty is higher or lower than the sample mean. The black line shows the median impulse response. The dark- and light-shaded areas correspond to 68% and 90% confidence bands, respectively. The magnitude of the shock is normalized to yield a median impact of 10 basis points on the revision of expectations about future government spending. The x-axis shows months. Uncertainty is measured as the cross-sectional standard deviation in the responses of household expectations from the Consumer Confidence Survey, related to the question about asset prices over the next six months. High (low) uncertainty is a month in which the cross-sectional standard deviation is above (below) average.

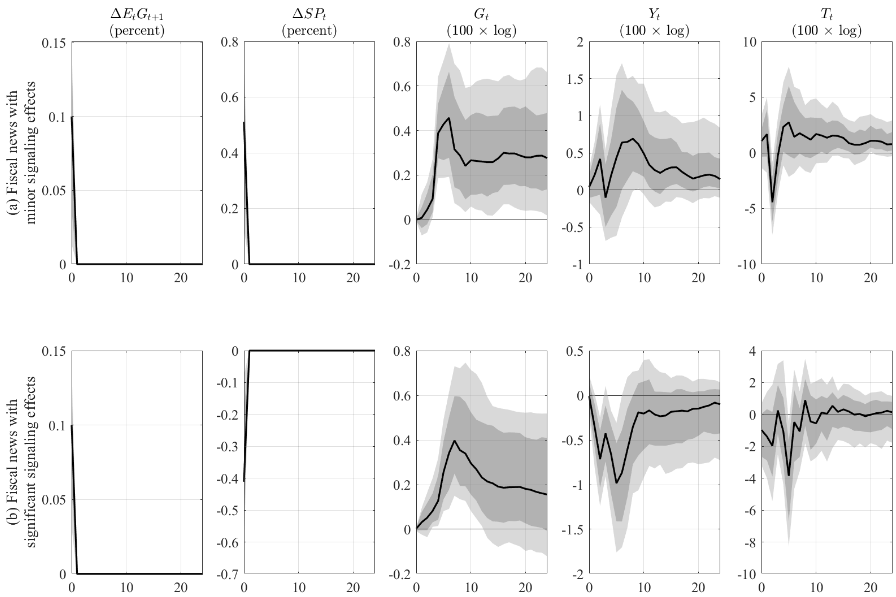


a) High uncertainty

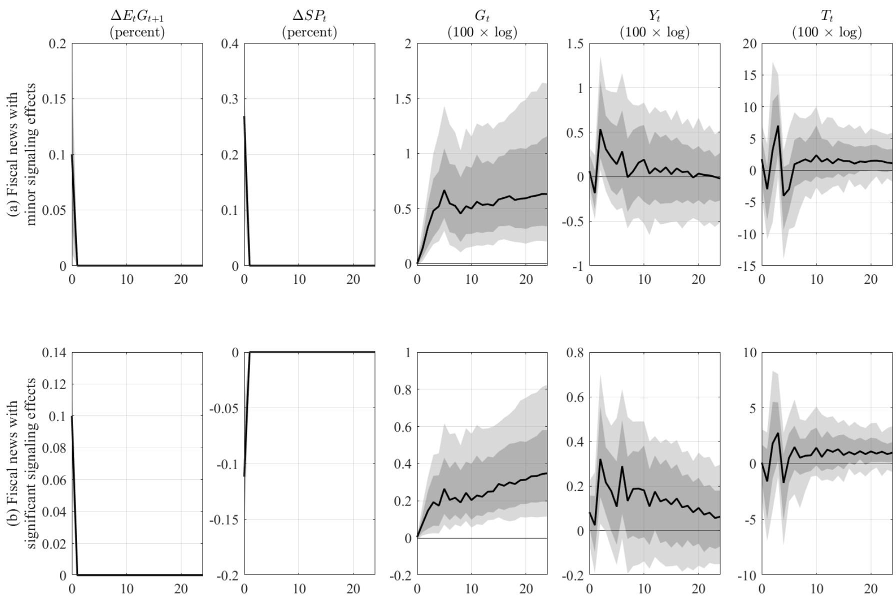


b) Low uncertainty

Figure B.4: **Impulse response functions.** This figure shows the impulse response functions of the threshold VAR model where uncertainty is higher or lower than the sample mean. The black line shows the median impulse response. The dark- and light-shaded areas correspond to 68% and 90% confidence bands, respectively. The magnitude of the shock is normalized to yield a median impact of 10 basis points on the revision of expectations about future government spending. The x-axis shows months. Uncertainty is measured as the cross-sectional standard deviation in the responses of household expectations from the Consumer Confidence Survey, related to the question about income growth over the next six months. High (low) uncertainty is a month in which the cross-sectional standard deviation is above (below) average.



a) High uncertainty



b) Low uncertainty

Figure B.5: **Impulse response functions.** This figure shows the impulse response functions of the threshold VAR model where uncertainty is higher or lower than the sample mean. The black line shows the median impulse response. The dark- and light-shaded areas correspond to 68% and 90% confidence bands, respectively. The magnitude of the shock is normalized to yield a median impact of 10 basis points on the revision of expectations about future government spending. The x-axis shows months. Uncertainty is measured as the monthly average of the Nikkei 225 volatility index.

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