

Uncertainty of Firms' Economic Outlook During the COVID-19 Crisis

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Abstract

This study documents firms' subjective uncertainty during the COVID-19 crisis in Japan using data from an original firm survey and publicly available government statistics. The contributions of this study are (1) the measurement of firms' uncertainty regarding their mid-term economic outlook as subjective confidence intervals, and (2) the comparison of firms' subjective uncertainty during the COVID-19 crisis with that of the Global Financial Crisis by using readily available official statistics. The results indicate that firms' subjective uncertainty increased substantially after the outbreak of the COVID-19 pandemic. The elevation of subjective uncertainty has been far more significant compared with the period of the Global Financial Crisis. However, the economic outlook's deterioration during the COVID-19 crisis has been smaller. The COVID-19 crisis is characterized as an unprecedented uncertainty shock.

Keywords: Uncertainty, Probability distribution, Economic outlook, COVID-19 JEL Classification: D84, E32, E37

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Uncertainty of Firms' Economic Outlook During the COVID-19 Crisis

1. Introduction

This study documents firms' subjective uncertainty during the COVID-19 crisis in Japan using unique data sets. The uncertainty's negative impact on economic activities through the "wait-and-see" mechanism has been highlighted in the literature. Moreover, empirical evidence has been accumulated, particularly since the Global Financial Crisis (GFC).¹ Accurate and timely measurement of uncertainty is essential in assessing the COVID-19's impact on economic activity.

Since economic agents' subjective uncertainty is difficult to measure directly, many proxies of uncertainty have been developed and used in past empirical studies. The representative proxy measures of uncertainty are stock market volatility (e.g., VIX), prediction errors derived from econometric models (e.g., Jurado *et al.*, 2015), firms' *ex-post* forecast errors (e.g., Bachmann *et al.*, 2013), and an index constructed from newspaper articles' frequency regarding uncertainty (EPU Index; Baker *et al.*, 2016).

These proxy measures have advantages and disadvantages. Theoretically, uncertainty measures should be ideally constructed from individual firms' point forecasts and probability distributions (Manski, 2004, 2018; Pesaran and Weale, 2006). The dispersed probability distribution can be directly interpreted as higher subjective uncertainty if such a measure is available. The Survey of Professional Forecasters in the United States, for example, has a long history of collecting forecasters' probability distributions of economic growth and inflation forecasts. At the firm- level, Guiso and Parigi (1999), Morikawa (2016), and Chen *et al.* (2020) have collected cross-sectional information about firms' probabilistic forecasts. More recently, official statistical surveys have started to ask about the subjective probability distribution of firms' business outlooks. Examples include the Management and Organizational Practices Survey (MOPS) in the United States and the JP-MOPS in Japan. Some firm surveys collect this information at monthly or quarterly frequencies (e.g., Coibion *et al.*, 2018; Altig *et al.*, 2020; Bloom *et al.*, 2020).²

¹ See Bloom (2014) for a survey.

² Studies using survey questions regarding firms' subjective uncertainty, although different from subjective probability distribution, include Bontempi *et al.* (2010) and Bontempi (2016) for firms in Italy, and Buchheim *et al.* (2020a, 2020b) for firms in Germany. Bontempi *et al.* (2010) and Bontempi (2016) used the range between its minimum and maximum sales growth rate, expected one year-ahead, as the measure of uncertainty. The firm survey used in the work of Buchheim *et al.* (2020a, 2020b) questions the firms' subjective uncertainty using a scale ranging from 0 (low uncertainty) to 100 (high uncertainty).

Analyses of uncertainty during the COVID-19 pandemic have been increasing rapidly worldwide (e.g., Altig *et al.*, 2020; Baker *et al.*, 2020; Ludvigson *et al.*, 2020). Altig *et al.* (2020) used monthly survey data for firms' subjective uncertainty. Specifically, the Survey of Business Uncertainty (SBU) for the United States and the Decision Maker Panel (DMP) for the United Kingdom are used in their study. They indicate that firms' subjective uncertainty over their one-year-ahead sales growth rate substantially increased in March and April 2020. However, it slightly decreased after May 2020.³ The SBU and the DMP used in their study, which collect information about sales forecasts and their probability distributions, are ideally designed to capture firms' subjective uncertainty. However, different from other uncertainty proxies such as the VIX and EPU indices, it is impossible to compare with past uncertainty shocks, including the GFC, since these new surveys began in 2016 and 2017.

Regarding Japan, Shinohara *et al.* (2021) indicate the movements of various uncertainty measures covering the early period of the COVID-19 crisis. The measures included are stock market volatility (Nikkei Volatility Index), macroeconomic uncertainty index (Jurado *et al.*, 2015), economic surprise index (Scotti, 2016), and EPU Index. All these uncertainty measures indicate an increase in uncertainty during the COVID-19 pandemic. However, firms' subjective uncertainty is not included in the analysis.

Therefore, this study documents Japanese firms' subjective uncertainty during the COVID-19 pandemic using two unique datasets. The first dataset was taken from an original firm survey which asked firms' point forecasts and subjective 90% confidence intervals regarding mid-term (five years) economic growth rate. The original firm survey was conducted before the pandemic (early 2019) and during the pandemic (late 2020). The second dataset is a long time series of quarterly government statistics (the Business Outlook Survey) containing information about the subjective uncertainty of firms' short-term (one-quarter and two-quarters) economic outlook.

This study contributes to literature in two ways. First, it is true that firm surveys for collecting information about the subjective probability distribution of forecasts have been increasing. However, the application to firms' mid-term economic outlook before and after the COVID-19 crisis has been nonexistent. Second, a comparison of firms' subjective uncertainty during the COVID-19 crisis and past shocks such as the GFC, using a long time series of official statistical data, has not yet been presented.

The results indicate that firms' subjective uncertainty substantially increased after the outbreak of the COVID-19 pandemic. Although the deterioration of economic outlook during the COVID-

³ Altig *et al.* (2020) documented uncertainty up to July 2020. According to the publicly available SBU and DMP data, subjective uncertainty over sales growth has continued to decrease until recently. However, the level of uncertainty is still higher than before the COVID-19 pandemic.

19 crisis was less severe compared to what happened during the GFC, the increase in the subjective uncertainty was far larger. This finding indicates that these two shocks have very different characteristics. While the GFC was a huge first-moment shock, the COVID-19 crisis can be characterized as a severe second-moment (uncertainty) shock.

The remainder of this paper proceeds as follows. Section 2 explains the design of original firm survey and reports on the change in firms' mid-term economic outlook uncertainty before and during the COVID-19 pandemic. Section 3 explains the Business Outlook Survey and presents the time-series movements of firms' subjective uncertainty. Section 4 concludes the paper and discusses its implications.

2. Subjective Uncertainty of Mid-term Economic Growth Forecast

2.1. Survey Design

The firm-level data used in this section are taken from the "Survey of Corporate Management and Economic Policy" (SCMEP). The SCMEP is an original firm survey designed by the author. It is conducted by the Research Institute of Economy, Trade, and Industry (RIETI) from January to February 2019 and August to September 2020.⁴ The 2019 SCMEP was sent to 15,000 Japanese firms. The firms were randomly selected from the registered list of the Basic Survey of the Japanese Business Structure and Activities (BSJBSA). The BSJBSA is an annual statistical survey conducted by the Ministry of Economy, Trade and Industry (METI).⁵ The firms that are registered in the BSJBSA have at least 50 employees and a capital of at least 30 million yen belonging to the manufacturing, wholesale, retail, and service industries.

The number of firms that responded to the 2019 SCMEP was 2,535. The 2020 SCMEP survey questionnaire was sent to firms that responded to the 2019 SCMEP. In the 2020 survey, the total number of firms that responded was 1,579. The following is the distribution by industry of the firms that responded to the 2020 survey: manufacturing 53.5%, information and communications 5.3%, wholesale 17.8%, retail 10.2%, service 9.0%, and others 4.2%. Concerning firm size (classified by capital over 100 million yen or less), 34.8% are large firms while 65.2% are small-and medium-sized firms.

The study's main survey items are the point forecast of Japan's economic growth rate for the

⁴ RIETI contracted out Tokyo Shoko Research, Ltd. to implement the survey.

⁵ The SCMEP respondents were the managers themselves or departments that can write their opinions on their behalf. The results of the BSJBSA can be obtained from the METI website (https://www.meti.go.jp/english/statistics/tyo/kikatu/index.html).

next five years (on an annual basis) and the forecast's subjective 90% confidence interval. The first question is "What do you think Japan's annualized real economic growth rate will be for the next five years?" This question asks the respondent to answer with a specific figure, rounded up to the first decimal place. Concerning forecast uncertainty, the second question is "Of the following choices, what is the range wherein the forecast above has a 90% probability of being met?" The eight choices are less than $\pm 0.1\%$, ± 0.1 -0.3%, ± 0.3 -0.5%, ± 0.5 -1.0%, ± 1 -2%, ± 2 -3 \Box , ± 3 -5 \Box , and $\pm 5\%$ or greater. Since some of the respondents answered the first question with extremely large absolute figures, we dropped the responses with absolute figures exceeding 10%.⁶

The 2020 survey contains a question regarding the firms' outlook for the end of the COVID-19 pandemic's timing. The question is "When do you think will the COVID-19 pandemic be resolved and when will you be able to resume business activities in the same way as you did before the COVID-19 outbreak?" The nine choices are September 2020, October–December 2020, January–March 2021, April–June 2021, July–September 2021, October–December 2021, first half of 2022, second half of 2022, and 2023 or beyond. In this study, we convert the answers to a continuous variable that indicates expected duration (quarters) of the COVID-19 crisis.⁷

2.2. Results

According to the tabulation, the means of mid-term economic growth forecasts in the 2019 and 2020 surveys are +0.4% and -0.5%, respectively. The forecasted mid-term economic growth rate declined by about 0.9% point after the COVID-19 pandemic. The distributions of the forecast's subjective uncertainty (90% confidence interval) are shown in **Table 1**. It is evident that the distribution shifted to the wider side of the confidence intervals. This indicates that firms' subjective uncertainty of mid-term economic growth increased substantially because of the COVID-19 pandemic.

After calculating the mean of confidence intervals by using the answer categories' central value (the maximum category is treated as $\pm 6\%$), the figure increased from $\pm 1.3\%$ in 2019 to $\pm 2.6\%$ in 2020. The result is almost unchanged even if we limit the sample of firms responding to the two surveys. **Figure 1** depicts the means and subjective probability distributions of the representative firm's growth forecast by assuming a normal distribution. We can visually observe a large

⁶ In the 2019 and 2020 surveys, 17 and 83 observations were dropped, respectively.

⁷ The length of quarters assigned to the choices are as follows: "September 2020"=0, "October-December 2020"=1, "January-March 2021"=2, "April-June 2021"=3, "July-September 2021"=4, "October-December 2021"=5, "First half of 2022"=6.5, "Second half of 2022==8.5, and "2023 or beyond"=10.5.

widening of the distribution's tails in 2020.

Table 2 presents the simple OLS regression results on the relationships between economic forecasts and the COVID-19 pandemic's expected duration. The coefficient of duration is negative and significant for economic growth forecast (column (1)), whereas it is negative and highly significant for forecast uncertainty (column (3)). The results are essentially unaffected when growth forecasts or uncertainty in the 2019 survey were included as control variables (columns (2) and (4)). However, the explanatory power of the expected duration until the end of the pandemic is limited as shown from the low R-squared value.

3. Long-Run Movement of Subjective Uncertainty

3.1. Business Outlook Survey

This section documents firms' subjective uncertainty using a published series of the Business Outlook Survey (BOS) from 2004Q2 to 2021Q1. The BOS, compiled jointly by the Cabinet Office and the Ministry of Finance, is a representative quarterly business survey in Japan along with the Bank of Japan's Tankan Survey (Short-Term Economic Survey of Enterprises in Japan). The BOS began in 2004 as a government statistical survey based on the Statistics Act. It covers incorporated firms with a capital of 10 million yen or more in all economic sectors. Approximately 15,000 firms were sampled in each survey. From the sample, about 80% responded on average.

The surveys were timed in the middle of February (Q1 survey), May (Q2 survey), August (Q3 survey), and November (Q4 survey). The results were released in the middle of March, June, September, and December, respectively. The BOS' questions include qualitative and quantitative items. Qualitative items include the expected business and economic conditions for the following two quarters. Quantitative items include planned and realized sales, profits, and investments. The present study focuses on the expectations for one-quarter-ahead and two-quarters-ahead domestic economic conditions.

As a unique characteristic of the BOS, the economic outlook choices include "unsure" in addition to "improvement," "no change," and "deterioration." These choices are used for calculating BSI (Business Survey Index). Specifically, BSI is calculated as the percentage of firms that chose "deterioration," subtracted from the percentages of firms that chose "improvement." Unlike other business surveys, the respondents can choose "unsure" when they are uncertain about the outlook. The percentages of firms that responded "unsure" have large time-series fluctuations. Although the BOS does not collect information on subjective probability distribution, the answer "unsure" represents subjective uncertainty about the near future of economy. The study

conducted by Morikawa (2018), using BOS' firm-level panel data (2004Q2–2017Q1), indicates that the answer "unsure" is a practically useful measure of firms' subjective uncertainty. ⁸ Since the percentage of firms responding "unsure" is being published, we can observe economic outlook (BSI) and uncertainty from the same publicly available survey data.

The BOS publishes tabulation results by firm size category (e.g., large, medium, and small) by industry (e.g., all, manufacturing, and non-manufacturing) quarterly. The present study calculates the figures for all firms by using the number of respondents, which is published by size categories, as weights, because the results for all size categories have not been published.

Morikawa (2018) pointed out that the percentage of firms that responded "unsure" had a strong seasonality. In the case of a one-quarter-ahead outlook, the percentage of those that answered "unsure" is very high in the Q1 (February) survey. In the case of a two-quarters-ahead outlook, the percentage of firms that answered "unsure" is very high in the Q4 (November) survey. We conjecture that fiscal (accounting) years matter for observed seasonality. Second-quarter forecasts (April–June) are those for the different fiscal years at the forecasting time in most Japanese firms. Thus, it might be difficult for these Japanese firms to report a Q2 forecast based on an established annual business plan and related information.⁹ Since it is preferable to adjust seasonality, we run simple OLS regressions using quarter dummies as explanatory variables and the residual series of the regressions are used for the analysis. The mean level is adjusted at the same time, because the regression includes the constant term.

3.2. Results

Figure 2 shows the BSI's time-series movements for domestic economic conditions after adjusting for seasonality. In the recent COVID-19 crisis, the BSI significantly deteriorated in the current quarter judgments. The magnitude of its deterioration was similar in size to the GFC period. However, in the cases of a one-quarter-ahead and two-quarters-ahead outlooks, the deterioration of economic outlook is more pronounced in the GFC period. **Figure 3** shows the seasonally adjusted series of the percentage of "unsure" responses, which is a measure of firms' subjective uncertainty. The figure jumped up between 2020Q1 and 2020Q2. After the first declaration of a State of Emergency in April 2020, firms' uncertainty over the Japanese

⁸ According to Morikawa (2018), the response "unsure" has positive correlations with other uncertainty proxies such as stock market volatility and the EPU index. Additionally, the response "unsure" has a negative association with the firm's actual investments.

⁹ Most Japanese firms' accounting year begins in April.

Economy's future course was significantly increased.¹⁰ The uncertainty increase for the twoquarters-ahead outlook is larger than that for the one-quarter-ahead outlook.

Similar to other major economies such as the United States, the stock market volatility (Nikkei VI) and the EPU index of Japan significantly increased in early 2020. However, these gradually decreased to the pre-pandemic levels by the end of 2020 (**Appendix Figure A1**). Conversely, firms' subjective uncertainty remains at a very high level, even in 2021Q1. The recent increase in uncertainty has been far larger when compared with the periods of the GFC. On the other hand, the deterioration of one-quarter-ahead and two-quarters-ahead BSI was far larger during the GFC.

Table 3 presents a comparison between the two crises. The GFC figures are the means from 2008Q3 to 2009Q2 and the COVID-19 crisis figures are the means from 2020Q2 to 2021Q1. The table suggests, from a viewpoint of business operation, that these two shocks are very different even though both shocks seriously affected the economy. Specifically, the GFC is characterized as a first-moment shock that firms predicted with certainty the economy's deterioration. However, the COVID crisis is characterized as a second-moment shock (or uncertainty shock), where the economy's future course is difficult to predict.

Figure 4 depicts the seasonally adjusted series of one-quarter-ahead subjective uncertainty by industry (manufacturing and non-manufacturing). **Figure 5** shows the series of two-quarters-ahead subjective uncertainty. These figures indicate that the industry differences are surprisingly small. Service industries such as hotels and accommodations, restaurants, and personal transportation services were seriously affected by the pandemic's spread and the execution of policy measures that restricted the people's movement. However, the movements of subjective uncertainty over economic conditions are not significantly different by industry.

Previous studies have indicated that an increase in uncertainty has a negative effect on investments through the option value mechanism of waiting. Morikawa (2018), using firm-level micro data of the BOS, shows that the response "unsure" has a significant negative association with firms' actual investments. We analyzed the relationship between the percentage of "unsure" responses and investments to verify this relationship at the aggregate level. Seasonally adjusted real quarterly investment data are taken from the National Accounts (Cabinet Office). The log-transformed series are used as the dependent variable ($lnINV_t$). The explanatory variables are the percentage of "unsure" responses ($Unsure_{t, t+n}$), BSI index ($BSI_{t, t+n}$), log GDP ($lnGDP_t$) of the current quarter, and lagged investments ($lnINV_{t-1}$). "Unsure" responses and the BSI are for the one-quarter-ahead (n=1) or two-quarters-ahead (n=2) economic conditions. This specification is based on the idea that investments depend on the economic activity's (GDP) current level, inertia

¹⁰ As stated before, the timing of the Q1 and Q2 surveys are the middle of February and May, respectively.

in investments, expectation of future economic conditions (BSI), and uncertainty. Hence, the equation to be estimated is expressed as follows:

$$lnINV_{t} = \alpha lnGDP_{t} + \beta lnINV_{t-1} + \gamma BSI_{t, t+n} + \delta Unsure_{t, t+n}$$
(1)

Table 4 presents the results of the OLS estimation. As expected, the *BSI* coefficients are positive and the *Unsure* coefficients are negative. Both are significant in one-quarter- and two-quarters-ahead outlook for economic conditions. The results suggest that heightened uncertainty over future economic conditions suppresses investments in the current quarter. However, the quantitative impact of uncertainty on investments is small, at least at the aggregate level. A one-standard-deviation greater uncertainty is associated with approximately 0.6% lower investments. As indicated in **Table 3**, "unsure" responses are 11.2% points (one-quarter-ahead outlook) and 14.6% points (two quarters-ahead outlook) higher than the historical average during the COVID-19 crisis period (2020Q2–2021Q1). According to the estimated *Unsure* coefficients, elevated uncertainty's impacts in this period may have reduced aggregate investments by about 1.2–1.6%.

4. Conclusion

This study presents descriptive observations of Japanese firms' subjective uncertainty during the COVID-19 pandemic. It used micro data from an original firm survey and publicly available aggregate data from government statistics. The contributions of this study are (1) the measurement of firms' uncertainty regarding their mid-term economic outlook as subjective confidence intervals, and (2) the comparison of firms' subjective uncertainty during the COVID-19 crisis with that of the GFC by using representative and readily available official statistics.

The main results are summarized as follows. First, firms' subjective uncertainty for mid-term economic growth, measured as point forecasts' subjective confidence intervals, substantially increased after COVID-19's outbreak. Second, firms' subjective uncertainty has continued to be high even in 2021. This finding is distinct from the observations from other uncertainty proxies such as stock market volatility and the EPU index. Third, although the economic outlook's deterioration during the COVID-19 crisis has been less severe than the GFC period, the elevation of the subjective uncertainty has been far more significant. This finding indicates that the two shocks are very different from a viewpoint of business operation. While the GFC was a huge first-moment shock, the COVID-19 crisis can be characterized as an unprecedented second-moment (uncertainty) shock.

The results of this study imply that the "unsure" response in the BOS contains valuable

information to capture firms' subjective uncertainty. An essential advantage of this publicly available data is its immediate availability at the time of release without waiting for the next quarter. This is different from uncertainty measures based on *ex-post* forecast errors. An obvious policy implication is that it is desirable to avoid the further increase in economic agents' uncertainty when designing policy measures in tackling the pandemic, even though huge uncertainty is inevitable.

References

- Altig, David, Jose Maria Barrero, Nicholas Bloom, Steven J. Davis, Brent H. Meyer, and Nicholas Parker (2020), "Surveying Business Uncertainty," *Journal of Econometrics*, forthcoming.
- Altig, Dave, Scott R. Baker, Jose Maria Barrero, Nicholas Bloom, Philip Bunn, Scarlet Chen, Steven J. Davis, Julia Leather, Brent H. Meyer, Emil Mihaylov, Paul Mizen, Nicholas B. Parker, Thomas Renault, Pawel Smietanka, and Gregory Thwaites (2020), "Economic Uncertainty before and during the COVID-19 Pandemic," *Journal of Public Economics*, Vol. 191, 104274.
- Arbatli, Elif C., Steven J. Davis, Arata Ito, Naoko Miake, and Ikuo Saito (2017), "Policy Uncertainty in Japan," NBER Working Paper, No. 23411.
- Bachmann, Rüdiger, Steffen Elstner, and Eric R. Sims (2013), "Uncertainty and Economic Activity: Evidence from Business Survey Data," *American Economic Journal: Macroeconomics*, Vol. 5, No. 2, pp. 217–249.
- Baker, Scott R., Nicholas Bloom, and Steven J. Davis (2016), "Measuring Economic Policy Uncertainty," *Quarterly Journal of Economics*, Vol. 131, No. 4, pp. 1593–1636.
- Baker, Scott R., Nicholas Bloom, Steven J. Davis, and Stephen J. Terry (2020), "COVID-Induced Economic Uncertainty," NBER Working Paper, No. 26983.
- Bloom, Nicholas (2014), "Fluctuations in Uncertainty," *Journal of Economic Perspectives*, Vol. 28, No. 2, pp. 153–176.
- Bloom, Nicholas, Steven J. Davis, Lucia Foster, Brian Lucking, Scott Ohlmacher, and Itay Saporta-Eksten (2020), "Business-Level Expectations and Uncertainty," NBER Working Paper, No. 28259.
- Bontempi, Maria Elena, Roberto Golinelli, and Giuseppe Parigi (2010), "Why Demand Uncertainty Curbs Investment: Evidence from a Panel of Italian Manufacturing Firms," *Journal of Macroeconomics*, Vol. 32, No. 1, pp. 218–238.
- Bontempi, Maria Elena (2016), "Investment-Uncertainty Relationship: Differences between Intangible and Physical Capital," *Economics of Innovation and New Technology*, Vol. 25, No. 3, pp. 240–268.
- Buchheim, Lukas, Jonas Dovern, Carla Krolage, and Sebastian Link (2020a), "Firm-Level Expectations and Behavior in Response to the COVID-19 Crisis," IZA Discussion Paper, No. 13253.
- Buchheim, Lukas, Carla Krolage, and Sebastian Link (2020b), "Sudden Stop: When Did Firms Anticipate the Potential Consequences of COVID-19?," IZA Discussion Paper, No. 13457.
- Chen, Cheng, Tatsuro Senga, and Hongyong Zhang (2020), "Measuring Business-Level Expectations and Uncertainty: Survey Evidence and the COVID-19 Pandemic," RIETI Discussion. Paper, 20-E–081.

- Coibion, Olivier, Yuriy Gorodnichenko, and Saten Kumar (2018), "How Do Firms Form Their Expectations? New Survey Evidence," *American Economic Review*, Vol. 108, No. 9, pp. 2671– 2713.
- Guiso, Luigi and Giuseppe Parigi (1999), "Investment and Demand Uncertainty," *Quarterly Journal of Economics*, Vol. 114, No. 1, pp. 185–227.
- Jurado, Kyle, Sydney C. Ludvigson, and Serena Ng (2015), "Measuring Uncertainty," *American Economic Review*, Vol. 105, No. 3, pp. 1177–1216.
- Ludvigson, Sydney C., Sai Ma, and Serena Ng (2020), "Covid19 and the Macroeconomic Effects of Costly Disasters," NBER Working Paper, No. 26987.
- Manski, Charles F. (2004), "Measuring Expectations," *Econometrica*, Vol. 72, No. 5, pp. 1329–1376.
- Manski, Charles F. (2018), "Survey Measurement of Probabilistic Macroeconomic Expectations: Progress and Promise," in Martin Eichenbaum and Jonathan A. Parker eds. NBER Macroeconomics Annual 2017, The University of Chicago Press, pp. 411–471.
- Morikawa, Masayuki (2016), "What Types of Policy Uncertainties Matter for Business?," *Pacific Economic Review*, Vol. 21, No. 5, pp. 527–540.
- Morikawa, Masayuki (2018), 'Measuring Firm-Level Uncertainty: New Evidence from a Business Outlook Survey,' RIETI Discussion. Paper, 18-E–030.
- Pesaran, M. Hashem, and Martin Weale (2006), "Survey Expectations," in Graham Elliott, Clive
 W. J. Granger, and Allan Timmermann eds. *Handbook of Economic Forecasting*, Vol. 1, Amsterdam: Elsevier, pp. 715–776.
- Scotti, Chiara (2016), "Surprise and Uncertainty Indexes: Real-Time Aggregation of Real-Activity Macro-Surprises," *Journal of Monetary Economics*, Vol. 82, September, pp. 1–19.
- Shinohara, Takeshi, Tatsushi Okuda, and Jouchi Nakajima (2021), "Characteristics of Uncertainty Indices in the Macroeconomy," *Economic Review*, forthcoming (in Japanese).

	(1) 2019 survey	(2) 2020 survey
Less than ±0.1%	13.3%	4.5%
±0.1%~0.3%	12.8%	3.5%
$\pm 0.3\%$ ~0.5%	19.2%	13.2%
±0.5%~1%	27.2%	13.1%
$\pm 1\%$ ~2%	9.5%	14.6%
±2%~3%	4.7%	13.3%
±3%~5%	5.5%	16.7%
$\pm 5\%$ or greater	7.6%	21.0%

Table 1. Distribution of subjective uncertainty in mid-term economic growth forecasts

Note: The categories are the annual economic growth rate's subjective 90% confidence intervals for the next five years.

Table 2. Expected duration until the end of the COVID-19 pandemic and the economic growth forecast and its uncertainty

	(1) Growth ^e ₂₀₂₀	(2) $\operatorname{Growth}^{e}_{2020}$	(3) Uncertainty ₂₀₂₀	(4) Uncertainty ₂₀₂₀
End of COVID-19 ^e	-0.0933 **	-0.0987 **	0.0730 ***	0.0821 ***
(Quarters)	(0.0371)	(0.0381)	(0.0232)	(0.0246)
Growth ^e 2019		0.0802 ***		
		(0.0169)		
Uncertainty ₂₀₁₉				0.1198 ***
				(0.0404)
Nobs.	1,353	1,274	1,286	1,140
<u>R²</u>	0.0046	0.0172	0.0075	0.0180

Notes: OLS estimations with robust standard errors are in parentheses. ***: <0.01, **: <0.05.

Table	e 3.	Com	parison	of	BS	SI and	l uncertaint	y in	the	GF	C ar	nd th	ne (CO	VID	-19	cris	is
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	(1) 1 qua	rter-ahead	(2) 2 quar	(2) 2 quarters-ahead			
	BSI	Uncertainty	BSI	Uncertainty			
GFC	-33.5	-2.4	-19.3	1.8			
COVID-19	-16.2	11.2	-4.9	14.6			

Notes: The tables are calculated from seasonally adjusted series for all size categories. GFC's percentage is the mean of the period from 2008Q3 to 2009Q2. The percentage of the COVID-19 crisis is the period's mean from 2020Q2 to 2021Q1.

	(1)	(2)
lnGDP _t	0.5439 ***	0.4868 ***
	(0.0915)	(0.0751)
$BSI_{t, t+1}$	0.0003 **	
	(0.0001)	
Unsure $_{t, t+1}$	-0.0015 **	
	(0.0006)	
$BSI_{t,t+2}$		0.0005 **
		(0.0002)
Unsure $_{t, t+2}$		-0.0012 **
		(0.0005)
lnINV _{t-1}	0.7494 ***	0.7591 ***
	(0.0412)	(0.0372)
Nobs.	66	66
R ²	0.9529	0.9533

Table 4. Firms' subjective uncertainty and investment

Notes: OLS estimations with robust standard errors are in parentheses. ***: 0.01, **: <0.05, *: <0.1. The dependent variable is the current quarter's log investment (*lnINV_t*). $BSI_{t, t+1}$ and $BSI_{t, t+2}$ denote one-quarter and two-quarters-ahead economic condition BSI (seasonally adjusted), respectively. *Unsure*_{t, t+1} and *Unsure*_{t, t+2} denote quarter-and two-quarters-ahead uncertainty (seasonally adjusted), respectively.



Figure 1. Representative firm's probability distribution of economic growth forecasts





Figure 2. BSI of economic condition

Note: Seasonally-adjusted series for all size categories

Figure 3. Uncertainty of economic condition



Note: Seasonally-adjusted series for all size categories



Figure 4. One-quarter-ahead uncertainty by industry

Note: Seasonally-adjusted series for all size categories

Figure 5. Two-quarters-ahead uncertainty by industry



Note: Seasonally-adjusted series for all size categories



Appendix Figure A1. Movements of Nikkei Volatility Index and EPU Index for Japan