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Measuring international uncertainty: The case of Korea

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HIGHLIGHTS

- We compare and contrast Korean and US uncertainties.
- Korean uncertainty is countercyclical, persistent, and skewed.
- Options-implied and textual proxies do not measure broad-based Korean uncertainty.

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ABSTRACT

We leverage a data rich environment to construct and study a measure of macroeconomic uncertainty for the Korean economy. We provide several stylized facts about uncertainty in Korea from 1991M10–2016M5. We compare and contrast this measure of uncertainty with two other popular uncertainty proxies, financial and policy uncertainty proxies, as well as the U.S. measure constructed by Jurado et al. (2015). We find that neither financial nor policy uncertainty proxies capture economy-wide uncertainty. Unlike our measure or financial uncertainty, policy uncertainty does not have much effect on real variables in Korea.

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1. Introduction

Macroeconomic uncertainty and its relationship with the business cycle has received much attention in the U.S. and internationally. Measuring uncertainty, however, has proven challenging because it is not directly observable. International studies largely proxy for uncertainty using option-implied/realized stock market volatility or an economic policy uncertainty index (e.g., Carriere-Swallow and Cespedes, 2013; Choi and Shim, 2016; Baker et al., 2016; Gourio et al., 2015).

Recently, Jurado et al. (2015) have provided a leading measure of "objective" uncertainty for the U.S. economy. This index has two attractive features: it is measured from macroeconomic data volatility in a reduced-form way and it covers a broad range of indicators spanning the entire macroeconomy. Internationally, this strategy for measuring uncertainty has remained unused because of data costs. This paper works to resolve this gap by using 112 data series to provide a broad-based measure of uncertainty for Korea. We hope that this paper encourages more work on uncertainty fluctuations in small open economies such as the Korean economy.[1]

2. Construction of the uncertainty measure

2.1. Methodology

Following Jurado et al. (2015), we define the uncertainty of an individual series as the conditional volatility of the unforecastable

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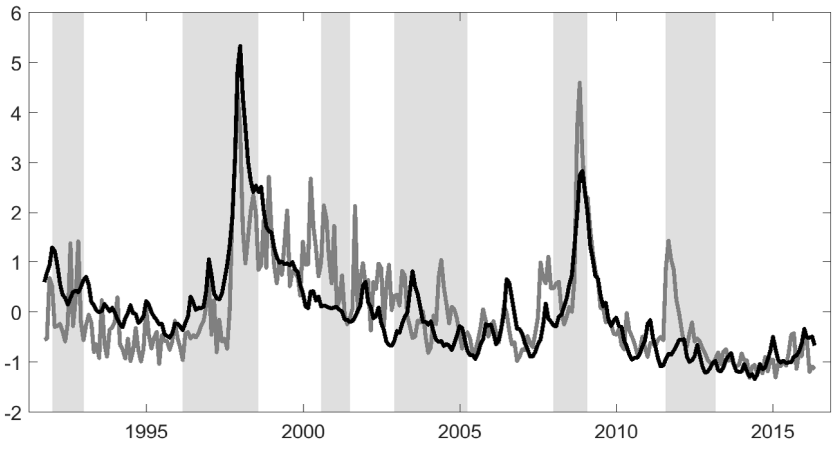
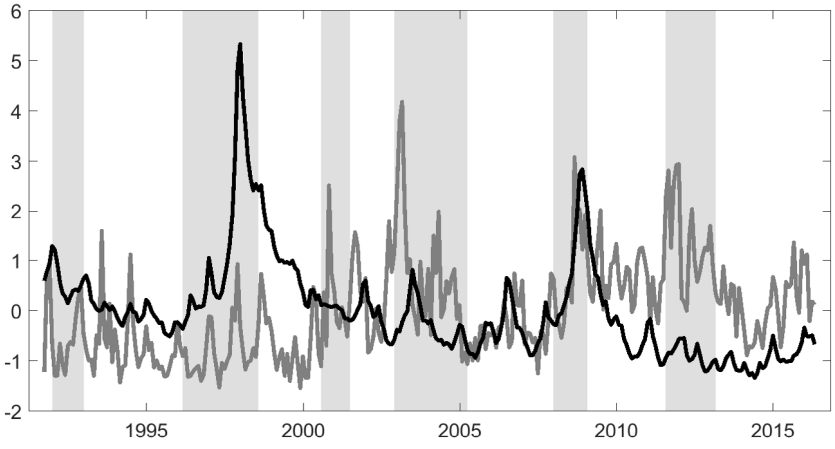
[1] We plan to make our estimated uncertainty indices available from our personal and journal websites.



(a) Uncertainty index (black) and OIV (gray).



(b) Uncertainty index (black) and EPU (gray).

Fig. 1. Korean economic uncertainty index (UI). *Note*: Uncertainty index overlaid with OIV (upper panel) and EPU index (lower panel) for 1991M10–2016M5. Pairwise correlations of these series are corr(UI, OIV) = 0.72, corr(UI, EPU) = −0.13, corr(OIV, EPU) = 0.17. "UI" denotes Korean uncertainty index, "OIV" denotes option-implied volatility, and "EPU" denotes economic policy uncertainty index.

component of the future values of that series. The h-period ahead uncertainty in the variable $y_{jt} \in Y_t = (y_{1t}, \ldots, y_{N_y t})'$ is defined as

$$U^y_{jt}(h) \equiv \sqrt{E\left[\left(y_{jt+h} - E\left[y_{jt+h}|I_t\right]\right)^2 \middle| I_t\right]} \tag{1}$$

where the expectation is taken with respect to the information set I_t available to agents at time t. If the expectation of the squared error in forecasting y_{jt+h} rises, uncertainty in the variable increases. We compute the individual uncertainties by modeling the individual series as factor augmented AR(p) models where both common factor and idiosyncratic shocks have stochastic volatility. The description of the model is in Appendix A.

A measure of macroeconomic uncertainty aggregates the individual uncertainties of each series at every date:

$$U^y_t(h) \equiv \sum_{j=1}^{N_y} w_j U^y_{jt}(h) \tag{2}$$

where w_j is a weight assigned to the uncertainty in the jth variable. Our baseline uncertainty measure is based on $w_j = 1/N_y$ and $h = 1$. This index measures an average difficulty of predicting a time series in the economy.[2]

[2] We also compute the aggregate uncertainty index with w_j obtained from the first principal component. The main features are not different from the simple average.

2.2. Data

We use 112 monthly time series that represent the Korean economy from 1991M10–2016M5. We categorize these 112 individual series into 9 groups: (1) Output; (2) Labor market; (3) Housing market; (4) Consumption, orders, and inventories; (5) Money and loans; (6) Bonds and stocks; (7) Prices; (8) Imports and exports; (9) External variables. For researchers interested in constructing an uncertainty index for other countries, we additionally in Appendix A analyze the most important data series to include in forming index.

We also compare our uncertainty index with two other popular uncertainty proxies. The first is the VKOSPI index, which is the Korean version of the VIX (option-implied volatility or OIV). The second is the economic policy uncertainty (EPU) index (Baker et al., 2016), which is a news-based uncertainty measure meant to capture movements in policy-related economic uncertainty.

3. Stylized facts about the Korean uncertainty index

3.1. Aggregate uncertainty measure

In Fig. 1, we present our uncertainty measure for Korea overlaid with other uncertainty proxies. The shaded areas are Korea's recessionary periods defined by the Korea National Statistical Office. We provide three stylized facts about uncertainty fluctuations.

Table 1
Korean economic uncertainty index (UI)

	UI	OIV	EPU	Corr.	UI	OIV	EPU	Corr.	UI	OIV	EPU
AR(1)	0.97	0.82	0.72	With IP(k)			With IP(k)				
Half life	22.02	3.51	2.07	$k=-1$	−0.18	−0.06	−0.21	$k=+1$	−0.22	−0.14	−0.26
Skewness	1.99	1.61	1.03	$k=-3$	−0.12	0.02	−0.15	$k=+3$	−0.18	−0.13	−0.28
Kurtosis	8.83	6.26	4.34	$k=-6$	−0.06	0.08	−0.12	$k=+6$	−0.03	−0.01	−0.20
IP-corr(0)	−0.21	−0.11	−0.24	$k=-12$	0.03	0.13	0.00	$k=+12$	0.44	0.30	−0.01

Table 2
Individual uncertainties and other uncertainty proxies.

Raking	With OIV		With EPU	
Top 1	KOSPI	0.79	PIP: Total	0.53
Top 2	TB3y-MSB1y spread	0.61	Baltic Dry index	0.51
Top 3	Turnover ratio	0.61	BoP: CA	0.48

Note: Numbers in the table are correlation between uncertainty proxies and corresponding individual uncertainties. "UI" denotes Korean uncertainty index, "OIV" denotes option-implied volatility, and "EPU" denotes economic policy uncertainty index. A detailed description of the individual series is in the online appendix.

First, our uncertainty measure typically starts going up at the beginning of recessionary periods and has local peaks in the middle of recessionary periods. The exception is the 2000M8–2001M7 recession when the Korean economy suffered several damaging domestic (Daewoo Motors' Bankruptcy) and foreign (9/11 attacks) economic events. Such shocks worsened Korea's economic performance, but did not affect overall uncertainty.

Second, the uncertainty index is persistent, positively-skewed, and fat-tailed. Table 1 presents descriptive statistics of our uncertainty measure. We also compute the same statistics for the other uncertainty proxies. They share similar properties, although our measure exhibits higher persistence, skewness, and kurtosis.

Third, our uncertainty index is countercyclical. Table 1 shows that the index's contemporaneous correlation with industrial production growth is −0.21.

The rest shows cross-correlations between our uncertainty measure and IP growth (correlation between the uncertainty index at t and IP growth at $t+k$). They are negatively correlated within 6 month leads and lags. However, the correlation between uncertainty and IP growth becomes positive as k becomes large and is maximized at $k=18$, which matches the average duration of recessions (18.4 months).

3.2. Comparisons with other uncertainty measures

Option-implied volatility.

Panel (a) in Fig. 1 shows the option-implied volatility (OIV). It generally moves together with our uncertainty measure with a correlation of 0.72. Although both measures move closely, there are differences. One example is the 2002M12–2005M4 recession. At the beginning of this recession, both uncertainty measures increased. Our uncertainty measure had its highest peak on 2003M7, driven by the Korean credit card lending boom (1999–2002) and bust (2003).[3] Unlike our uncertainty measure, the OIV had its highest peak around 2004M6 from news about policy rate increases by the Chinese government and the Federal Reserve, which distinguished the origin of this uncertainty from that of the 2003M7 peak. However, this heightened uncertainty in the international market did not translate into uncertainty about the overall Korean economy as our overall measure did not move much during this period.

Table 2 reveals this disconnect between the two uncertainty measures. It reports the three series-specific volatilities that are most associated with our uncertainty measures. The option-implied index is most related to uncertainty about financial variables such as the KOSPI index.

EPU.

The second panel in Fig. 1 shows the time series plot of the economic policy uncertainty (EPU) overlaid with our uncertainty measure. Our uncertainty measure and the EPU show quite different dynamics. For example, based on our measure, economic uncertainty was highest during the Asian financial crisis, while the EPU put low weight to the crisis. Other examples are periods with international affairs such as the 9/11 attacks, Gulf War II, and the Eurozone debt crisis that may have increased uncertainty outside the Korean economy but not inside.

The linear association between our uncertainty measure and the EPU is weaker than that between our uncertainty measure and the OIV.[4] One explanation for the low correlation is that some of the economic policy related uncertainty that the Korean news articles mentioned did not manifest as increases in the overall uncertainty of the Korean economy. Table 2 shows that the EPU index is correlated with uncertainties related to trade activities (or global economic conditions) such as the import price index, Baltic Dry index, and current account. This finding suggests that the index weighs heavily international affairs relative to domestic affairs.

Overall, our index is more correlated with the option-implied measure than the EPU, which suggests that market-based measures of uncertainty are more in line with the average volatility of the economy.

3.3. Dynamic responses

There has been a surge of interest in the real effects of uncertainty shocks (along with the papers in the introduction, e.g. Bloom, 2009; Caldara et al., 2016). We contribute to this literature by comparing and contrasting the real effects of uncertainty shocks using different uncertainty proxies. Fig. 2 shows the responses of industrial production to one standard deviation Cholesky-identified uncertainty shocks, with the uncertainty proxies ordered first. Further details of the VAR specification can be found in Appendix A. We find that shocks to all three uncertainty proxies lead to declines in the real economy. Our uncertainty index leads to the closest response quantitatively and qualitatively to the option-implied volatility. Both lead to maximal declines in industrial production of around 1%, although the response to the option-implied volatility produces a longer-lasting response. Uncertainty shocks identified using the EPU index, on the other hand, produce a milder (around a 0.3% decline) and largely insignificant response, consistent with Choi and Shim (2016). We argued that the EPU index captures uncertainty on international affairs and is more correlated with trade activities. Moreover, this uncertainty does not seem to translate into changes in aggregate Korean uncertainty, so it is perhaps not surprising that agents do not change their behavior much to this uncertainty.

[3] This recession is also known as the credit card crisis. See for example, Kang and Ma (2007).

[4] The correlation coefficient is small but negative (−0.13). The negative correlation is because the EPU has increased overtime while the UI has decreased overtime. The correlation between the UI and the EPU becomes 0.13 once we condition on a linear time trend.

Table 3
Korean and U.S. uncertainty measures.

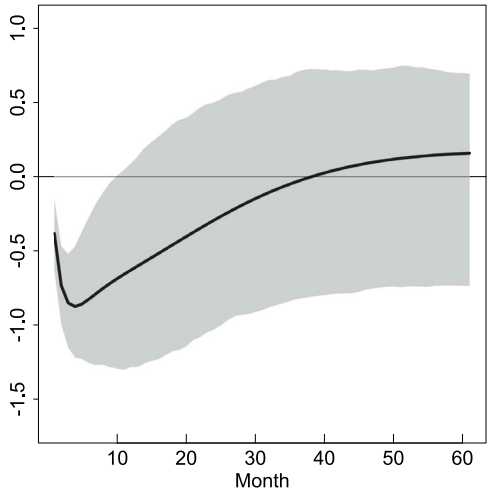
(a) Descriptive statistics

	Korea			U.S.		
	UI	OIV	EPU	UI	OIV	EPU
AR(1)	0.97	0.82	0.72	0.99	0.89	0.86
Half life	22.45	3.41	2.11	55.25	6.13	4.45
Skewness	1.95	1.59	1.09	2.17	1.97	1.09
Kurtosis	8.65	6.16	4.41	9.09	9.09	3.71
IP-corr(0)	−0.24	−0.14	−0.23	−0.82	−0.49	−0.35

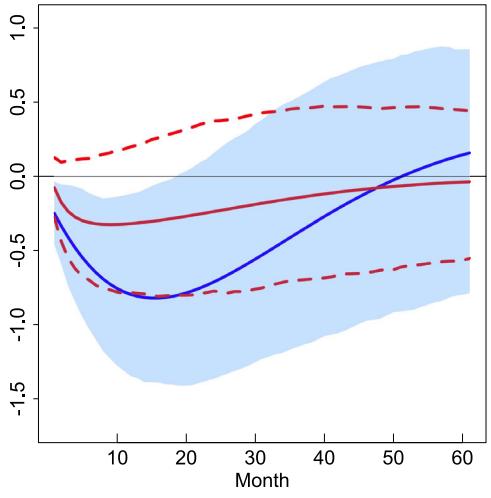
(b) Correlation among uncertainty measures

	UI-K	OIV-K	EPU-K	UI-US	OIV-US	EPU-US
UI-K	1.00	–	–	–	–	–
OIV-K	0.72	1.00	–	–	–	–
EPU-K	−0.12	0.19	1.00	–	–	–
UI-US	0.18	0.40	0.41	1.00	–	–
OIV-US	0.43	0.71	0.44	0.63	1.00	–
EPU-US	−0.14	0.09	0.69	0.34	0.45	1.00
UI-F	0.23	0.37	0.42	0.89	0.62	0.44

Note: Our sample for this table covers 1991M10–2015M04. K: Korea, US: United States. "UI" denotes Korean uncertainty index, "OIV" denotes option-implied volatility, "EPU" denotes economic policy uncertainty index, "UI-F" denotes external uncertainty index.



(a) UI.



(b) OIV (blue), EPU (red).

Fig. 2. IRFs of various uncertainty shocks on industrial production. *Note*: IRFs. VAR includes [uncertainty variable, KOSPI, IP, Employment, Policy rate]. "UI" denotes Korean uncertainty index, "OIV" denotes option-implied volatility, and "EPU" denotes economic policy uncertainty index. Details of the VAR exercise can be found in the online appendix. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

3.4. Comparison to U.S. index

The Korean and U.S. uncertainty measures share some common statistical properties. As we can see from Table 3a, economic uncertainty measures for both countries are persistent, positively skewed, fat-tailed, and countercyclical.

In Table 3b, we report relationships among the various uncertainty measures from Korea and the U.S. We find that these uncertainty measures are correlated with each other, except for the Korean uncertainty index-EPU index pair. Moreover, uncertainty in the Korean and U.S. financial markets are more related than are the broad-based uncertainty indices. This is sensible given that financial trading has less barriers than trading in other markets.

Furthermore, the Korean EPU index is more associated with U.S. uncertainty measures than Korean ones. This suggests that Korean newspapers overweight news about foreign policy-related uncertainty which may not pass through to the domestic market. This is consistent with the previous subsection: the Korean EPU index is related to international trade activities or global economic condition variables, which may not be relevant for uncertainty about the Korean economy. The Korean EPU index is also less correlated with the Korean VIX and uncertainty index relative to the U.S. EPU index's correlation with its U.S. counterparts.

Finally, we investigate the relationship between the foreign uncertainty measure (UI-F) and other Korean and U.S. uncertainty measures. We compute the UI-F as the average fluctuation of uncertainties of external variables.[5] The foreign uncertainty measure is more related to U.S. uncertainty measures than Korean uncertainty measures. Moreover, the UI-F's relationship with the Korean EPU is stronger than its relationship with other Korean uncertainty measures, which confirms again that the Korean EPU index seems to put more weight on uncertainty fluctuations outside rather than inside of the Korean economy.

4. Conclusion

We construct an uncertainty measure based on 112 economic time series for Korea. We provide a set of stylized facts about Korean economic uncertainty. In addition, we find that other uncertainty proxies are associated with specific sectors and do not represent uncertainty of the whole economy. One needs to be cautious about the use of news-based measures because journalists' view about uncertainty can be quite different across countries. For example, the EPU index for the Korean economy is more associated with foreign uncertainty.

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[5] External variables are variables that are determined almost (if not completely) exogenously outside the Korean economy. Details are given in the online appendix.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.econlet.2017.10.014.

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