

Economic Policy Uncertainty Spillovers in Small Open Economies: the Case of Hong Kong

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Abstract

This paper studies the extent to which economic policy uncertainty shocks in major economies affects real economic activity in small open economies. We use Hong Kong as a case study. Following Baker, Bloom and Davis (2016), we construct a newspaper-based economic policy uncertainty index for Hong Kong for the period 1998 to 2016. We estimate international spillovers of uncertainty and find large spillovers of uncertainty from major economies to Hong Kong. Furthermore, using a structural VAR approach, we show that a rise in domestic economic policy uncertainty leads to tight financial conditions, and lower investment and vacancy posting, which dampens domestic output growth.

Keywords: Policy uncertainty, spillovers, crisis transmission.

JEL classification: E32, F42, F44.

1. Introduction

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Heightened uncertainty is believed to be a key reason contributing to the weakness in global economic growth in recent years. In particular, a series of geopolitical and economic shocks, such as the European sovereign debt crisis and the Brexit referendum, are perceived to have raised economic policy uncertainty with repercussions on private domestic demand in many economies. One natural question for international macroeconomists and policymakers around the world is whether and to what extent economic policy uncertainty shocks originating in one country affect economic policy uncertainty and ultimately the business cycle in another country. In particular, the international transmission of economic policy uncertainty shocks may have large impacts on small-open economies with free capital mobility, sizable openness and a large financial sector. A large external sector and free capital mobility means that the economy is strongly affected by the external environment. The size of the financial sector matters because recent studies find that uncertainty shocks can affect financial conditions and hence the real economy (Gilchrist et al., 2014; Caldara et al., 2016).

We choose Hong Kong as a case study because its openness to trade and financial flows is among the highest in the world. For instance, in the year 2011-2015, Hong Kong's imports and exports added up to about 440% of GDP, and its trading and logistics industries accounted for around 20% of total employment. Hong Kong is also an international financial hub. During the same period, the ratio of average gross foreign assets to GDP was about 1400%.² With such a high degree of openness, the impact of uncertainty spillovers estimated using Hong Kong data can be viewed as the upper bound of the impact of external uncertainty shocks on a small open economy.

² Data on trade openness are sourced from the Census and Statistics Department of Hong Kong Special Administration Region. Data on gross external assets and liabilities come from International Financial Statistics.

Our empirical analysis comprises three steps. First, we compile an economic policy uncertainty index for Hong Kong for the period 1998M4-2017M4 using the Baker et al. (2016) method to count the number of related news articles. This method has several advantages. It captures a wide range of uncertainty in a timely manner. The measure is of high frequency and can go back for decades. Our constructed measure can be compared with economic policy indices for other countries constructed by Baker et al. (2016) as well. The resulting index is intuitive and signals high uncertainty during major past economic and political events. We compare our economic policy uncertainty index with another proxy of uncertainty based on realized stock market volatility and find that our index has stronger predictive power for real GDP growth.

In the second step, we examine to what degree uncertainty shocks in Hong Kong are ‘imported’ from the rest of the world. The Hong Kong economy is sensitive to economic developments in the US, and highly connected to other major economies such as the European Union, Mainland China and Japan. Following Diebold and Yilmaz (2009, 2014), we adopt a non-structural network-connectedness approach to study cross-country spillovers of economic policy uncertainty from these major economies to Hong Kong. To account for the small-open-economy nature of Hong Kong, we restrict uncertainty spillovers from Hong Kong to the rest of the world to be zero. We find that over 40% of Hong Kong’s economic policy uncertainty stems from its major trading partners. This figure is much larger than what is found in Klößner and Sekkel (2014) who study a network of G7 countries. Our finding

suggests that uncertainty spillovers are more important for financially-integrated small open economies.

The third step of the analysis investigates the impact of economic policy uncertainty on macro-financial conditions. We estimate a Structural Vector Autoregressive (SVAR) model using our constructed economic policy uncertainty index together with macroeconomic and financial variables of Hong Kong. We employ a standard Cholesky approach to identify an unanticipated shock to economic policy uncertainty. Our impulse response analysis shows that a one standard deviation increase in the uncertainty index results in a 1% fall in real output growth in 2-3 quarters. The shock works through financial, employment and investment channels.

The rest of the paper is organized as follows. Section 2 discusses the related literature. Section 3 describes the methodology we use to compile the economic policy uncertainty index for Hong Kong, followed by an assessment of its performance in predicting real GDP growth. Section 4 conducts an inward spillover analysis of uncertainty. Section 5 estimates a VAR model to assess the macro-financial impact of uncertainty on the Hong Kong economy. Section 6 reports results of our robustness checks. Section 7 concludes.

2. Related Literature

Our paper is related to the newspaper text search literature. Following the influential paper by Gentzkow and Shapiro (2010) which uses text search methods to study media slant, Baker, Bloom and Davis (2016) and Alexopoulos and Cohen (2015) use similar methods to extract uncertainty measures from newspapers. Lam (2017) is the

first to apply text search methods to newspapers in Hong Kong, focusing on political influences on newspaper advertisement behaviour. To the best of our knowledge, we are the first to construct a newspaper-based measure for economic policy uncertainty in Hong Kong.

Our paper is related to the literature on the international transmission of uncertainty shocks. On the theoretical side, Fernández-Villaverde et al. (2011) and Benigno et al. (2012) model uncertainty as stochastic volatility shocks and show that external uncertainty shocks are a key driver of business cycle volatilities in small open economies. Luk (2017) constructs a two-country model and shows that shocks in cross-sectional dispersions in productivity can transmit from a center economy to a small open economy through global banks and cross-border lending. The empirical literature typically uses VAR models to study the international transmission of uncertainty shocks. A growing literature studies how uncertainty shocks originating in the US transmit to the UK (Mumtaz and Theodoridis, 2015), Canada (Caggiano et al., 2017a) and Europe (Colombo, 2013). Similar to our research, Klößner and Sekkel (2014) use a network approach to study multi-country spillovers of uncertainty. We make additional identifying assumptions on the direction of spillovers to capture the small-open-economy nature of Hong Kong.

A third strand of literature studies the real effects of uncertainty shocks. Theoretical work points to investment, employment and financial channels. Bernanke (1983), Dixit and Pindyck (1994) and Bloom (2009) show that uncertainty can delay economic activities due to the real option value of ‘wait and see’ generated by the presence of adjustment costs or irreversibility. Leduc and Liu (2016) and Guglielminetti (2016) outline another option-value channel through which a rise in

uncertainty increases labor market search frictions and reduces vacancy posting. Finally, uncertainty also affects the economy through financial channels (Caldara et al., 2016; Christiano et al., 2014; Gilchrist et al., 2014; Arellano, Bai and Kehoe, 2016). Turning to the empirical literature, Bloom et al. (2016), Caggiano et al. (2017b), Colombo (2013) and Moore (2017) use a SVAR approach to estimate the real economic impacts of uncertainty shocks using newspaper-based uncertainty data. The literature mainly studies the US economy except for Moore (2017) which looks at Australia. In this paper, we study a financially-integrated small open economy and take financial factors into account by incorporating a financial condition index into a SVAR model.

3. Measuring Economic Policy Uncertainty in Hong Kong

This section discusses the compilation of our economic policy uncertainty index for Hong Kong. Since there is no newspaper-based economic policy uncertainty index for Hong Kong available, we compile the index following the Baker et al. (2016) methodology. Put simply, the method involves counting the frequency of news articles that contain terms relating to uncertainty. We use the *Wisers Information Portal*, a digital archive of Chinese news media in Hong Kong, to search for relevant Chinese words in the following ten major local Chinese newspapers: *Wen Wei Po*, *Sing Pao*, *Ming Pao*, *Oriental Daily*, *Hong Kong Economic Journal*, *Sing Tao Daily*, *Hong Kong Economic Times*, *Apple Daily*, *Hong Kong Commercial Daily*, and *Tai Kung Pao*.³ The dataset begins in April 1998, and so our index starts from the same time.

³ We do not include *Tin Tin Daily*, *Hong Kong Daily News* and *The Sun* which ceased publication in 2000, 2015 and 2016 respectively. We do not include free newspapers including *Metro Daily*, *Sky Post*, *Headline Daily*, *AM730* and *The Standard*. The economic policy uncertainty index is robust to the inclusion of the local English newspaper *South China Morning Post*.

Our set of relevant Chinese words (with translation into English) is summarized in Table A1 in Appendix A. They are classified into four categories: (1) ‘*Domestic (or variant)*’; (2) ‘*Economy (or variant)*’; (3) ‘*Uncertainty (or variant)*’; and, (4) at least one of the following terms: ‘*Policy (or variant)*’, ‘*Public*’, ‘*Expenditure (or variant)*’, ‘*Investment*’, ‘*Budget*’, ‘*Fiscal*’, ‘*SAR Government*’, ‘*Politics*’, ‘*Chief Executive*’, ‘*Interest*’, ‘*Reform*’, ‘*Optimize*’, ‘*Deficit*’, ‘*Tax*’, ‘*Regulation (or variant)*’, ‘*Hong Kong Monetary Authority*’, ‘*Reserves*’, or ‘*Linked Exchange Rate System*’. Criteria (1) – (3) contain the key words on uncertainty in Hong Kong, while criterion (4) captures key words on major local policy issues.⁴

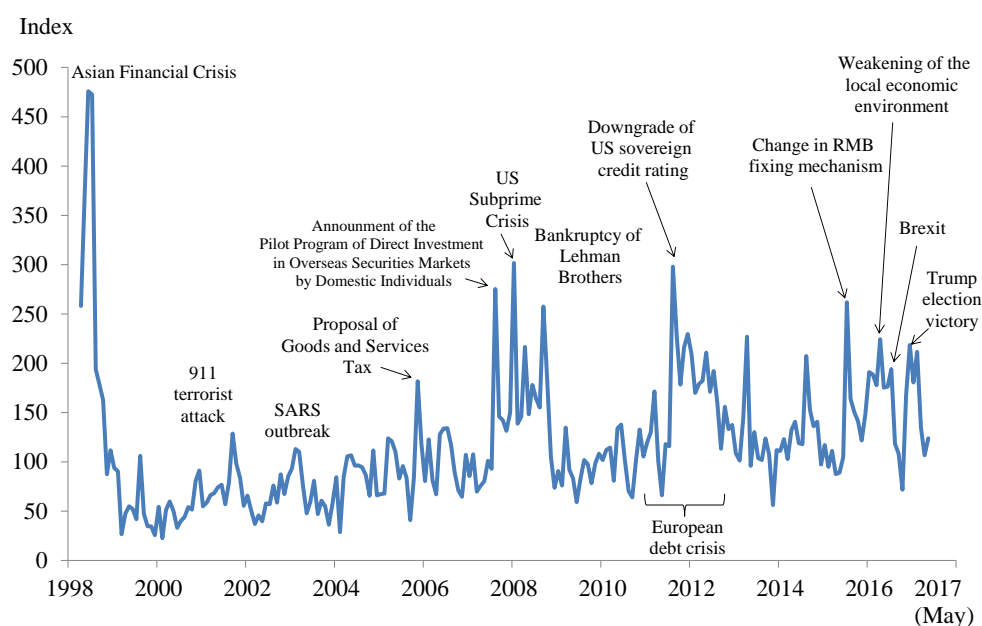
To control for the change in the volume of news articles across newspapers and time, we scale the number of articles meeting criteria (1) – (4) *in each month* by those that meet only criteria (1) and (2) (i.e. the base group of articles that are related to the Hong Kong economy only) *for the same month*.⁵ We then standardize the scaled series to a unit standard deviation, followed by an averaging of the resulting monthly series across the ten newspapers. We then normalize the index to have a mean of 100 for the period of April 1998 to December 2009, and seasonally adjust the index.

⁴ While dropping criterion (4) in the news search criteria would not materially affect the pattern of our economic policy uncertainty index as well as the results of our subsequent analysis, we prefer to retain it on the basis that (a) it can help ensure the relevancy of the news to Hong Kong; and (b) it makes our index readily comparable with other country’s indices constructed by Baker et al. (2016).

⁵ The compilation of our index differs from Baker et al. (2016) in the choice of the base of normalization. While Baker et al. (2016) normalize counts by the total number of all kind of articles (including sports, lifestyle etc), we normalize counts by the total number of articles on the economy only, as we believe that changing volume of unrelated articles (e.g. sports, lifestyle) due to social taste or editorial preference may introduce irrelevant fluctuation in the uncertainty index.

Figure 1 plots our economic policy uncertainty index, with key economic or political events highlighted to help with interpretation. As shown, fluctuations in our uncertainty index are broadly consistent with economic intuition, showing spikes during major global events such as the Asian Financial Crisis in 1997-98, the 9/11 terrorist attack in 2001, the US subprime crisis in 2007, the bankruptcy of Lehman Brothers in 2008, the downgrading of US sovereign credit rating in 2011, and the deepening of the European sovereign debt crisis in the same year. Our index also appears to be sensitive to local events, such as the outbreak of SARS in 2003, discussions about the implementation of goods and services tax in 2006, and the weakening of the local economic environment in early 2016.

Figure 1: Economic policy uncertainty index for Hong Kong



Source: Authors' estimates

We conduct three validity checks against our newspaper-based measure. First, our selection of newspapers does not account for the credibility of the newspapers. It is possible that newspapers with low credibility may distort our index. To investigate

this issue, we recalculate the index with the five most credible newspapers in our sample only. The credibility ranking is based on a Public Evaluation on Media Credibility Survey conducted by The Chinese University of Hong Kong in various years.⁶ Appendix B plots this credibility-adjusted index along with our baseline index. They move together closely, with a correlation of 0.94.

Second, our newspapers do not take into account for readership. To the extent that the newspapers themselves are a transmission mechanism for uncertainty shocks, newspapers with a larger readership can be expected to have a larger effect on the business cycle. We construct another index which uses only data in the *Oriental Daily* and *Apple Daily*, which together account for about 75% of total readership.⁷ The resulting readership-adjusted index is plotted in Appendix B. Although this index is more volatile, the peaks match those of the baseline index, and the correlation with our baseline index is 0.74. These findings suggest that our baseline index is robust to alternative specifications.

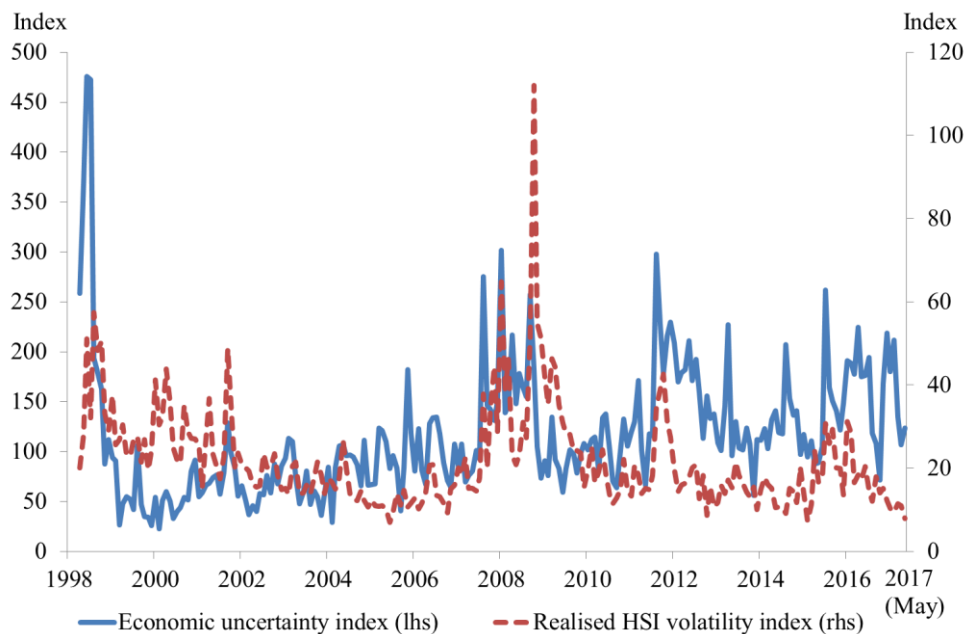
In the third exercise, we compare our economic policy uncertainty index with a measure of stock market volatility, which is another proxy of uncertainty commonly used in the literature. This paper chooses not to measure uncertainty by stock market volatility, as this volatility can be influenced by factors such as risk aversions in addition to uncertainty (Bekaert et al., 2013). That said, uncertainty can affect risk premium and hence asset pricing (Kostka and van Roye, 2017), and so major fluctuations in our economic policy uncertainty index should be reflected in higher stock market volatility. As shown in Figure 2, despite occasional divergences (say,

⁶ See the survey results of Public Evaluation on Media Credibility http://www.com.cuhk.edu.hk/ccpos/en/research/Credibility_Survey%20Results_2016_ENG.pdf.

⁷ See 2014 data from AC Nielsen Media Index Report. See also Table 1 of Lam (2017).

during the European debt crisis), our index largely spikes at around the same time as the realized volatility of the Hang Seng Index, especially during the Asian Financial Crisis, the Global Financial Crisis, downgrading of US sovereign credit rating, and the European sovereign debt crisis. On the other hand, our newspaper-based uncertainty index captures less financially related uncertainty that is not captured by stock market volatility, such as the proposal of goods and service tax in late 2005. The correlation between these two indices is 0.25.

Figure 2: Economic policy uncertainty index and realized HSI volatility index



Sources: CEIC and authors' estimates

As a further test, we compare the in-sample forecasting power of our uncertainty index for real GDP growth against that of the stock market volatility. Following Caldara et al. (2016), we use the simple uni-variate forecasting model below:

$$\Delta_h Y_{t+h} = \alpha + \sum_{i=1}^h \beta_i \Delta Y_{t-i} + \gamma_1 \text{Uncert}_t + \omega_{t+h},$$

where $\Delta_h Y_{t+h} = \frac{400}{h+1} \ln\left(\frac{Y_{t+h}}{Y_{t-1}}\right)$ is the h -quarters ahead annualized quarterly growth of real GDP, $\Delta_h \equiv \Delta$, and Uncert_t is either our economic policy uncertainty index (*EPU*) or the realized Hang Seng Index Volatility (*HSI vol.*), converted into quarterly frequency by averaging the monthly series. We estimate the model using ordinary least squares and use the full sample period starting from 1998Q2 for our estimation.

Table 1 shows the coefficient estimates of the forecasting model, with the t-statistics reported in brackets. A statistically significant coefficient suggests that the variable can help to predict real GDP growth. As shown in column 1 and 2, our economic policy uncertainty index (*EPU*) is highly significant at the one-quarter ahead ($h=1$) horizon, while the Hang Seng Index volatility (*HSI vol.*) is not. Similar findings also hold at the two-quarter ahead ($h=2$) horizon, as shown in column 5 and 6 of Table 1. Our uncertainty index compares favourably against one based on the volatility of the Hang Seng Index in predicting real GDP growth.

To check for robustness, we add the financial condition index (*FCI*) to the forecasting model as a control variable (see Chan et al., 2016).⁸ The weight of each component variable in the financial condition index is determined by its impact on real GDP growth, and a fall in the index corresponds to a tightening of local financial conditions. Chan et al. (2016) show that this index helps to predict real GDP growth.⁹ Controlling for such index in the forecasting model therefore allows us to examine the

⁸ Appendix C outlines the construction of the financial condition index.

⁹ We discuss the construction of the financial condition index in the Appendix.

marginal information content of our index. Column 3 and 4 of Table 1 show that our index is highly significant at the one-quarter ahead ($h=1$) horizon, while the Hang Seng Index volatility is not. Column 7 and 8 report similar findings at the two-quarter ahead horizon.

Altogether, our analysis indicates that our economic policy uncertainty index is intuitive and has relatively good forecasting power of real GDP growth than other commonly-used proxies of economic uncertainty.

Table 1: Coefficient estimates of the forecasting model

	1-quarter ahead ($h = 1$)				2-quarter ahead ($h = 2$)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>EPU</i>	-0.03*** [-3.41]		-0.02*** [-2.83]		-0.03*** [-3.08]		-0.03* [-1.91]	
<i>HSI vol.</i>		0.02 [0.63]		0.02 [0.45]		0.04 [1.13]		0.04 [1.01]
<i>FCI</i>			2.35*** [4.33]	2.72*** [4.57]			1.73*** [3.87]	2.12*** [5.21]
Adj. R^2	0.27	0.09	0.48	0.39	0.27	0.06	0.41	0.30

Note: The t-statistics reported in brackets are based on the heteroskedasticity- and autocorrelation-consistent asymptotic covariance matrix computed according to Newey and West (1987) with the automatic lag selection method of Newey and West (1994): * $p < 0.10$; ** $p < 0.05$; and *** $p < 0.01$.

4. Spillovers of Uncertainty

We can use our economic policy uncertainty index to study uncertainty spillovers from the rest of the world to Hong Kong. As a small open economy, the economic

policy uncertainty shocks facing Hong Kong inevitably stem in part from the external environment. Moreover, Hong Kong has trade and financial linkages with multiple major economies, so it is likely that Hong Kong imports economic policy uncertainty through these linkages. In the following we study spillovers from the US, Europe, Mainland China and Japan to Hong Kong, making use of the uncertainty indices created by Baker et al. (2016).¹⁰ We obtain monthly data over a sample period between April 1998 and December 2016.

Table 2 presents the correlation matrix for the policy uncertainty indices in our sample. Three key observations can be made. First, all pairwise correlations are positive (and statistically significant). Second, the pairwise correlation between the US and Europe is high, at 65%, in line with Colombo (2013)'s empirical findings.¹¹ Third, the pairwise correlation between Hong Kong and its major trading partners are positive but not high, between 26% and 48%.¹² This suggests that Hong Kong's uncertainty is influenced by economic policy uncertainty from multiple countries. For this reason, we include countries other than the US for the spillover analysis, departing from Caggiano et al. (2017a) and Mumtaz and Theodoridis (2015).

Table 2: Correlation matrix

¹⁰ The policy uncertainty measures are downloadable from <http://www.policyuncertainty.org>.

¹¹ The pairwise correlation between Europe and Mainland China (75%) is the highest in the table. As we explain below, this may be related to the data quality of the uncertainty index for China.

¹² It is surprising that the pairwise correlation between the US and Hong Kong is only 26%. The two series diverge on four occasions. First, in 2008-09, HK experienced the Asian financial crisis but the US did not, so EPU was high in HK and low in US. Second, in the early 2000s, the US experienced the dot-com bubble, but the crisis in Hong Kong was relatively minor. EPU was relatively low in HK and high in US. Third, in 2008-10, Hong Kong's economy was relatively strong due to strong Mainland Chinese growth and a domestic housing market boom, but US EPU was high in the aftermath of the global financial crisis. Fourth, in 2014 onwards, the EPU in HK was relatively high, which perhaps is related to local economic and political conditions.

	EU	US	CN	JP	HK
Europe (EU)	1.00				
United States (US)	0.65	1.00			
Mainland China (CN)	0.75	0.46	1.00		
Japan (JP)	0.50	0.52	0.39	1.00	
Hong Kong (HK)	0.37	0.26	0.36	0.48	1.00

Source: Authors' estimates

Note: this table shows the correlation matrix among all economic policy uncertainty indices in 1998M4-2016M12. All correlations are significantly different from zero at the 1 per cent level.

To identify the major driver of Hong Kong's economic uncertainty, we follow Diebold and Yilmaz (2009) and Klößner and Sekkel (2014)'s network approach to conduct a spillover analysis of uncertainty. Using the uncertainty indices above, we construct a connectedness table based on the shares of forecast error variance in various locations due to uncertainties arising elsewhere.

Specifically, we use the methodology of Diebold and Yilmaz (2009) and estimate a VAR model with p lags as follows:

$$Y_t = \phi_1 Y_{t-1} + \dots + \phi_p Y_{t-p} + \epsilon_t,$$

where ϵ_t is an i.i.d. shock, and ϕ_1, \dots, ϕ_p are the coefficient matrix of the lag terms, and Y_t is a vector of economic policy uncertainty indices of Hong Kong and its major trading partners. With stationarity, the VAR has a moving

average representation of $Y_t = \epsilon_t + A_1\epsilon_{t-1} + A_2\epsilon_{t-2} + \dots$. Let Σ_ϵ be the covariance matrix of ϵ_t , the h -step ahead forecast error covariance matrix is given by $\Sigma_{\epsilon,h} = \sum_{h=0}^{h-1} A_h \Sigma_\epsilon A_h'$. Using the lower-triangular Cholesky factor L of the Σ_ϵ matrix (i.e. $LL' = \Sigma_\epsilon$), we can write $\Sigma_{\epsilon,h} = \sum_{h=0}^{h-1} (A_h L)(A_h L)'$. Then, $\sum_{h=0}^{h-1} (A_h L)_{ij}^2$ can be considered as the contribution of shocks to variable j to variables i 's forecast error variance, which is a key measure in our analysis. In accordance with the indication of AIC, we set the lag length of the VAR model to $p = 4$ and conduct 12-month-ahead forecasts.

Based on the economic size of Hong Kong's major trading partners, we order the uncertainty index of the US or Europe either first or second in the VAR, followed by either the uncertainty index of Mainland China or Japan. In any case, Hong Kong's uncertainty index was ordered last, with its lag terms being restricted to zero in other economies' equations, on the assumption that Hong Kong's uncertainty does not spill over to other economies.

Table 3A shows the estimated spillovers of uncertainty from the 'source' economy in each column to the 'recipient' economy in each row. We report the estimates of spillovers across all four permutations of the system, so as to make our conclusion less susceptible to the ordering of variables. To understand this table, take for example the (1, 2) entry of 22.1 which means that the US uncertainty index contributes 22.1% of the 12-month-ahead forecast error variance to the European uncertainty index. The last column labelled 'from others' sums up all foreign contributions to a given country's uncertainty index. The next to last row labelled 'contribution to others' reports the sum of a country's contribution to other countries' uncertainty indices. Given our VAR specification, Hong Kong's uncertainty index

does not contribute to other countries' forecast error variance, and so the entry for Hong Kong is restricted to be 0. Finally, the last row labelled 'net' is the difference between 'contribution to others' and 'from others', which has a natural interpretation of the 'net export' of uncertainty to other countries.

The results in Table 3A are summarized as follows. First, self-contribution is typically large (over 50%). Second, the US and Europe are large net exporters of economic uncertainty, which reflects the size and centrality of these economies. Third, economic uncertainty in other countries contributes 29.6% to the forecast error variance of Hong Kong's uncertainty index, with uncertainty from Europe and the US playing a leading role, possibly reflecting the series of economic and political events that these economies have experienced in recent years. Notice that Hong Kong's net import of uncertainty from its major trading partners is much larger than found in Klößner and Sekkel (2014) for six developed countries ($\pm 15\%$). This finding suggests that international spillovers of uncertainty may be particularly important for small open economies with a high degree of openness.

One counterintuitive result in Table 3A is that the influence of Mainland China on itself is unreasonably low (59.1%). This is unreasonable because Mainland China has restrictions on private cross-border capital flows which should limit the degree of international uncertainty spillovers. We suspect the low self-contribution may be related to the fact that Mainland China's economic policy uncertainty index is compiled based on only one non-local English newspaper (the *South China Morning Post*, published in Hong Kong), which may capture journalists' perceptions of the uncertainty in the global environment rather than in Mainland China. We conduct a robustness check by replacing the Mainland China's economic policy uncertainty

index by the realised Shanghai Stock Exchange Composite Volatility. Table 3B shows the results with this change. The influence of Mainland China on itself is now more than 90%, which is in line with our intuition, and estimates among other economies do not change materially. In any case, our results indicate that Hong Kong's economic policy uncertainty receives notable spillovers.

Table 3A: Spillovers of uncertainty with Mainland China economic policy uncertainty index (updated)

	EU	US	CN	JP	HK	From others
Europe (EU)	74.7	22.1	1.7	1.6	0.0	25.3
United States (US)	17.3	81.4	0.7	0.7	0.0	18.7
Mainland China (CN)	26.5	13.9	59.1	0.6	0.0	40.9
Japan (JP)	13.8	12.0	0.6	73.8	0.0	26.4
Hong Kong (HK)	11.7	9.3	7.2	1.4	70.5	29.6
Contribution to others	69.3	57.3	10.1	4.1	0.0	
<i>Net</i>	44.0	32.0	-30.8	-22.3	-29.6	

Table 3B: Spillovers of uncertainty with realised Shanghai Stock Exchange Composite Volatility (updated)

	EU	US	CN	JP	HK	From others
Europe (EU)	75.0	22.6	0.6	2.0	0.0	25.1
United States (US)	17.2	81.8	0.3	0.8	0.0	18.2
Mainland China (CN)	0.4	2.0	96.8	0.8	0.0	3.2
Japan (JP)	14.5	12.5	0.8	72.3	0.0	27.8
Hong Kong (HK)	11.8	9.9	4.8	1.2	72.4	27.6

Contribution to others	43.9	46.9	6.4	4.7	0.0	
<i>Net</i>	18.8	21.9	3.2	-23.1	-27.6	

Source: Authors' estimates

Note: EU and the US would either be ordered first or second in the VAR, while CN and JP either third or fourth. The columns show the fraction of the forecast-error variance that the 'source' economy exports to other economies, based on the average of the estimates across four permutations of the ordering. Similarly, the rows indicate the fraction of the forecast-error variance that the 'recipient' economy imports from other economies.

Our findings therefore suggest that the external economic environment, in addition to trade and financial channels, can also lead to spillovers to Hong Kong by affecting economic policy uncertainty. The next logical question is whether a shock to economic policy uncertainty has quantitatively significant effects to real and financial variables in Hong Kong. This is investigated in the next section.

5. Macro-Financial Effect of Uncertainty

In this section, we analyze the real effects of economic policy uncertainty shocks. We adopt a Structural Vector Autoregressive (SVAR) model. A representation of the SVAR is:

$$B_0 X_t = c + B_1 X_{t-1} + B_2 X_{t-2} + \dots + B_p X_{t-p} + \epsilon_t$$

where c is a vector of constants, B_0, B_1, \dots, B_p are coefficient matrices, and ϵ_t is a vector of structural innovations. The vector X_t contains the following endogenous

variables: (1) economic policy uncertainty index (*EPU*); (2) financial condition index (*FCI*); (3) growth in posting of private sector vacancy (*vag*); (4) real private investment growth (*inv*) and (5) real GDP growth (*y*). The financial, labor market and investment variables are included to capture the different transmission channels of uncertainty shocks. All growth rates are measured on a year-on-year basis.¹³ We estimate the VAR model using quarterly data from 1998Q3 – 2016Q4 (because most of the real variables are only available in quarterly frequency). We set the lag length of the VAR model to one, as our sample size limits the degrees of freedom in our estimation.¹⁴

In our baseline specification, we use a standard Cholesky decomposition to recover the orthogonal shocks, with the ordering of the variables given above. The use of the Cholesky decomposition to identify uncertainty shocks is common in the literature (see Baker et al., 2016; Gilchrist et al., 2014; Colombo, 2013; Moore, 2017). However, there is no consensus regarding the ordering of economic policy uncertainty. For instance, Baker et al. (2016) and Gilchrist et al. (2014) order economic policy uncertainty first while Colombo (2013) and Moore (2017) order it last. We choose to order it first because the spillover analysis in the previous section suggests that innovations in uncertainty shocks are to a large extent externally driven and so do not respond to contemporaneous shocks in domestic variables immediately.

Figure 4 shows the impulse responses to a one standard deviation increase in the economic policy uncertainty index. Our impulse responses reveal a large and

¹³ Data on the real GDP, real private investment and private vacancy are sourced from the Census and Statistics Department of Hong Kong Special Administrative Region. Data on the world GDP are estimated by the authors.

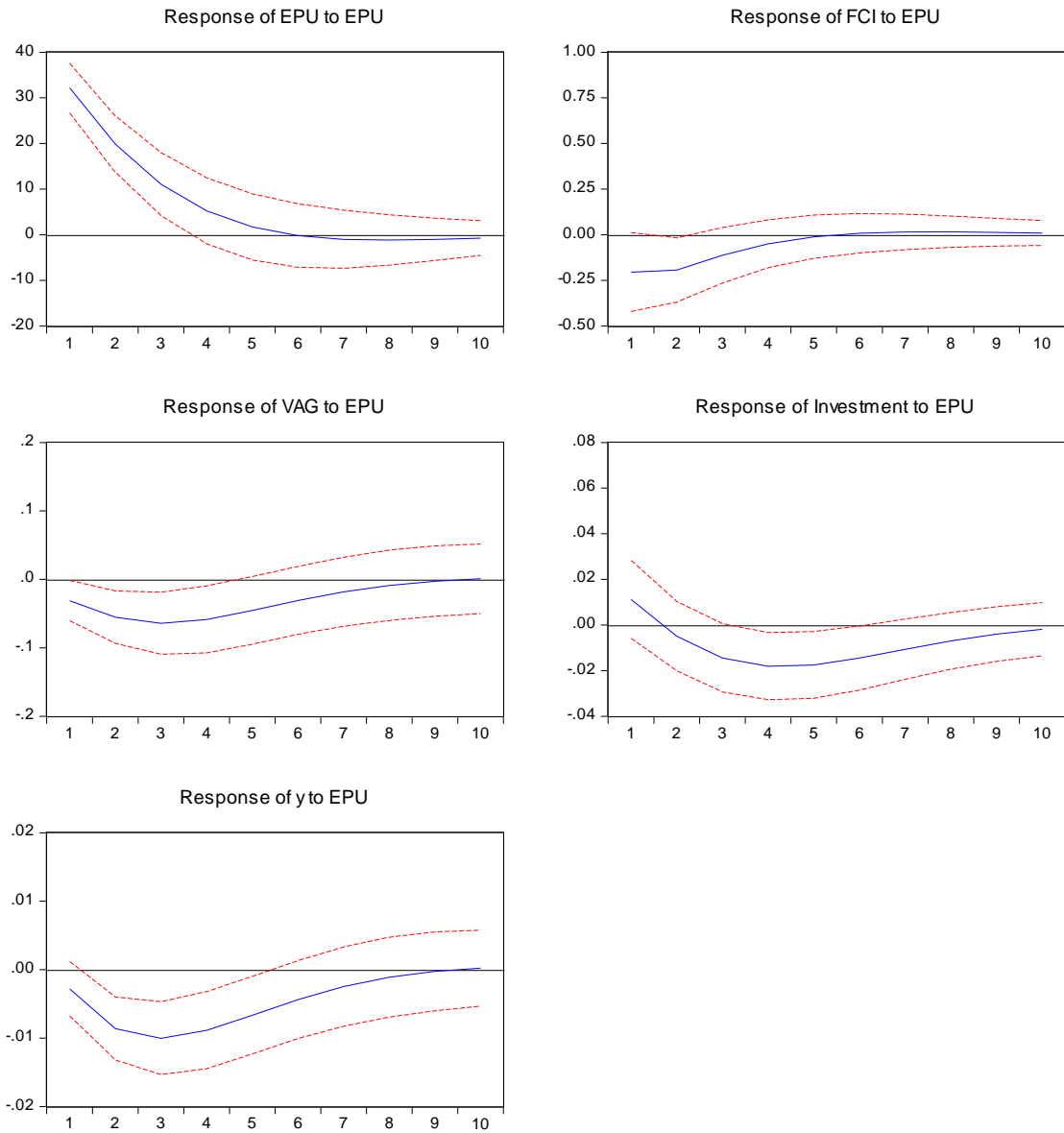
¹⁴ SIC chooses a lag length of 1, but AIC chooses a lag length of 5.

statistically significant drop in real GDP growth of about 1%, two to three quarters after the shock, returning to its the pre-shock level after one year. This effect is quantitatively similar to that found in Baker et al. (2016) (They find industrial production drops 1.1% at a maximum). Higher economic uncertainty leads to significantly tighter financial conditions on impact, followed by a dampening of private investment and private vacancy posting after a few quarters. The fall in all three variables is statistically significant, suggesting that all three transmission channels are at work.

We examined another specification in which we include property prices, total credit (both measured in year-on-year growth) and trade balance (in % GDP) in the SVAR. We order credit, property price and trade balance before real GDP growth (y), but we also check that changing the orderings do not have qualitative impacts to the impulse responses. Figure 5 shows that the impulse responses of the financial condition index, investment and vacancy posting are robust to including these additional variables (except that the fall in investment becomes marginally statistically insignificant). Moreover, higher economic policy uncertainty leads to a tightening of total credit growth and a fall in the property price. This suggests the impact of economic policy uncertainty may be amplified through the credit channel with collateral effect and wealth effects of economic agents. We do not detect any effects of economic policy uncertainty on the trade balance.

Figure 4. Impulse responses to one standard deviation innovation in the economic policy uncertainty index

Response to Cholesky One S.D. Innovations

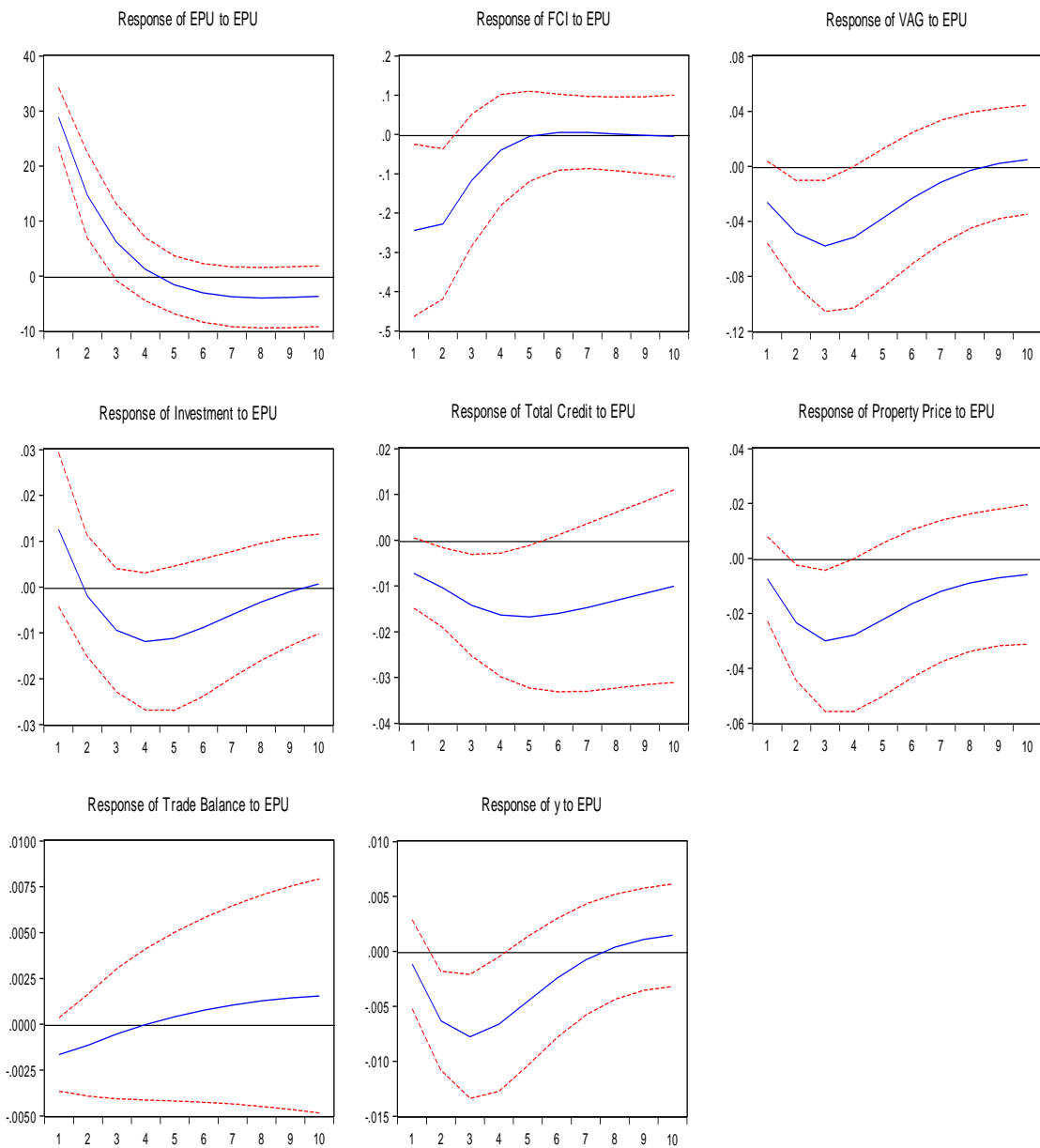


Source: Author's estimates.

Note: The solid lines denote the median IRFs. The dashed red lines denote 5% and 95% error bands, estimated using Monte Carlo simulation (with 100 simulations). Each period is a quarter.

Figure 5. Impulse responses to one standard deviation innovation in the economic policy uncertainty index

Response to Cholesky One S.D. Innovations



Source: Author's estimates.

Note: The solid lines denote the median IRFs. The dashed red lines denote 5% and 95% error bands, estimated using Monte Carlo simulation (with 100 simulations).

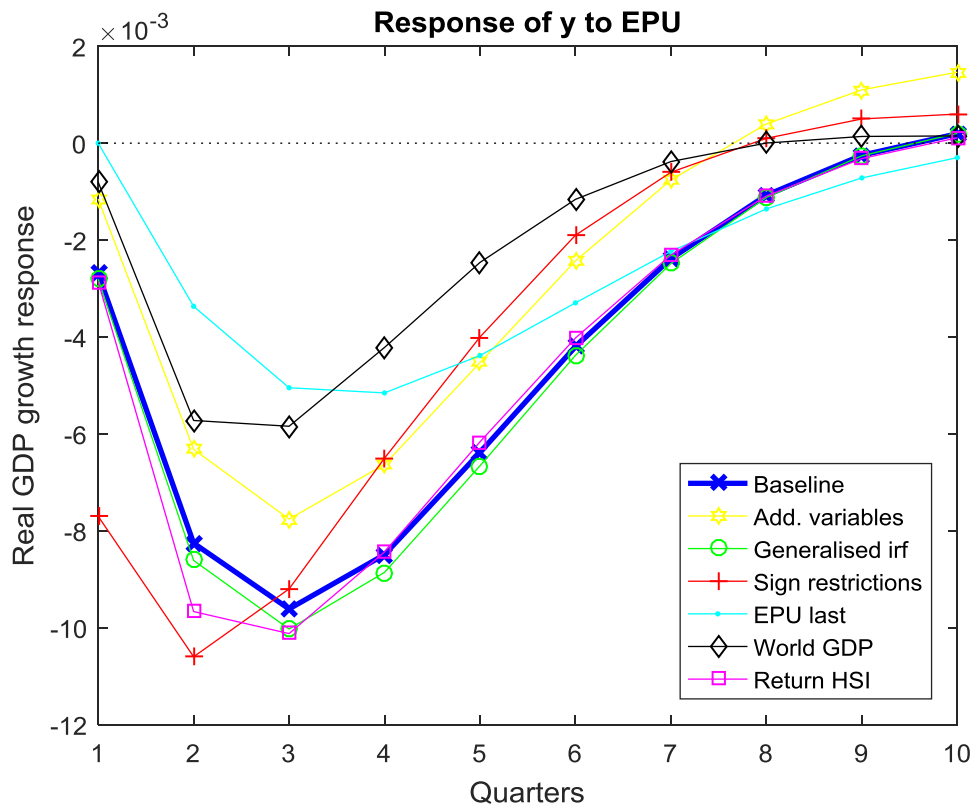
Each period is a quarter.

Besides including additional variables, we conduct a number of checks to our baseline specification to ensure that our results are robust to alternative specifications. First, to

avoid any dependence on the ordering of variables in the VAR model, we conduct our impulse response analysis using the generalized impulse response function (see Pesaran and Shin, 1998). Second, we use sign restrictions as an alternative identification scheme. We identify an uncertainty shock as one that increases uncertainty and decreases all other variables on impact. Third, we also consider a specification in which uncertainty shocks are ordered last. Fourth, to control for the influence from the external environment, we include world GDP growth (as measured by the growth in trade-weighted real GDP of Hong Kong's major trading partners) as an exogenous variable in the VAR. Fifth, we replace the financial condition index (*FCI*) with the average three-month return of the Hang Seng Index (*RHSI*), which is more transparent.

Figure 6 reports the impulse response of real GDP growth to a one standard deviation shock to the economic policy uncertainty index. Under alternative specifications the fall in economic activity is still quite similar to the baseline, with a maximum fall ranging between 0.5-1%. Appendix D provides details of these robustness checks and shows that the fall in economic activity under all alternative assumptions is statistically significant. We conclude that our findings are robust to alternative assumptions.

Figure 6. Hong Kong real GDP growth response to an EPU shock, with alternative specifications and identification assumptions



Source: Author's estimates.

5.1 Are uncertainty shocks supply or demand shocks?

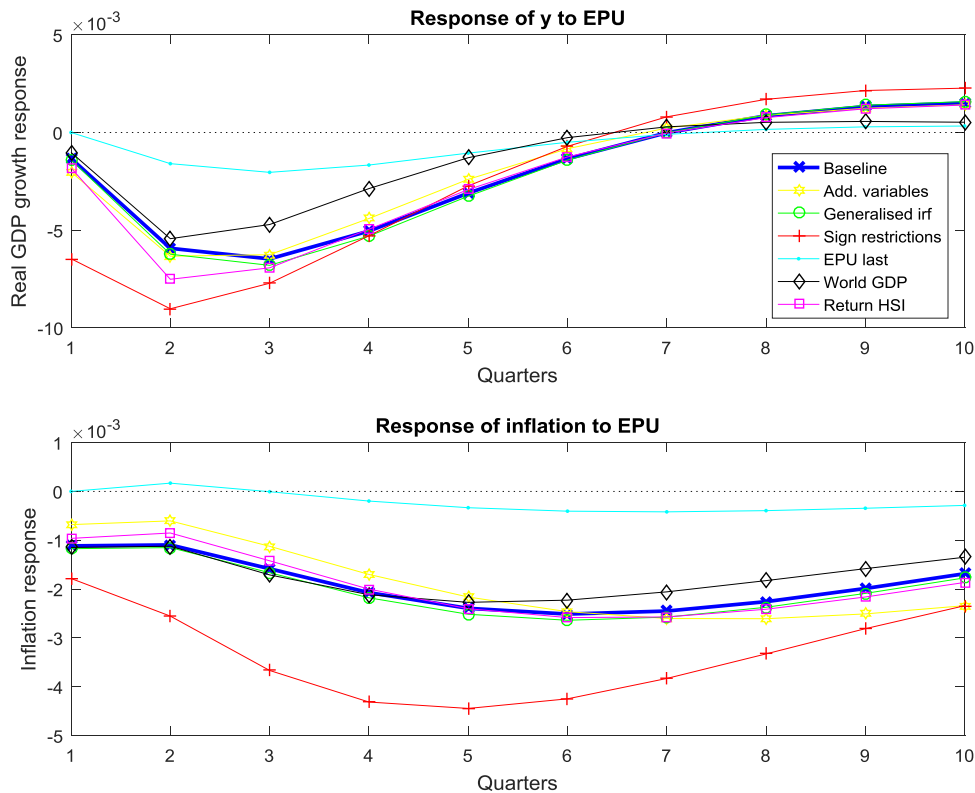
One interesting question in the uncertainty shock literature is whether uncertainty shocks are supply shocks or demand shocks (See Leduc and Liu, 2016). Since Hong Kong has a linked exchange rate system with the USD, an unanticipated EPU shock is not offset by domestic monetary policy. Because of this, our EPU index may shed light on this question.¹⁵

We follow Leduc and Liu (2016) to examine the joint dynamics of real GDP growth and inflation (year-on-year change in the GDP deflator). Specifically, we append

¹⁵ We thank an anonymous reviewer for pointing out the link between our work and Leduc and Liu (2016).

inflation to the baseline VAR specification and order inflation after real GDP growth. The SVAR model is estimated using quarterly data from 1998Q3-2016Q4.

Figure 7. Hong Kong real GDP growth and inflation response to an EPU shock, with alternative specifications and identification assumptions



Source: Author's estimates.

Figure 7 reports the results. In the baseline specification (thick blue lines), an unanticipated EPU shock induces a fall in real GDP growth as well as inflation. The decline in inflation has a peak effect occurring about 6 quarters from the impact period, but the effect is small and not statistically significant (error band not shown). Results are fairly robust to other specifications, which are also shown in the same figures. Overall, the inflation response to an EPU shock is negative but statistically

insignificant. The only exception is the sign restriction specification (red lines) where we restrict an EPU shock as one that raises uncertainty, worsens financial conditions, and reduces vacancy and private investment, but we do not make any restrictions on inflation. The decline in inflation is larger and statistically significant in this case. As the EPU shock reduces both aggregate activity and inflation, we have some evidence suggesting that uncertainty operates through an aggregate demand channel, which is consistent with Leduc and Liu (2016).

6. Robustness

We conduct additional analysis exploring the spillover of foreign economic policy uncertainty shocks and its effects on Hong Kong.¹⁶ Specifically, we use local newspapers to construct another measure, replacing “Domestic/ Hong Kong” with “Foreign/ International/ USA/ Europe/ Japan/ China”, and replacing Hong Kong-specific policy terms with general policy terms. We call the resulting index the Hong Kong-based global economic policy uncertainty (HKbGEPU) index.

We perform three analyses with this index. In the first exercise we compute pairwise correlations of HKbGEPU, HKEPU and the global EPU index (GEPU) index. The GEPU index is a GDP-weighted average of national EPU indices for 19 major economies, constructed by Davis (2016).¹⁷ The construction of most of the national EPU indices follows the Baker, Bloom and Davis (2016) approach, using the respective national newspapers. The GEPU index has a reasonably high correlation with HKbGEPU (0.67), which is considerably higher than its

¹⁶ To conserve space, only key findings are discussed in this section, and details of our analysis are presented in Appendix E.

¹⁷ The GEPU index is available at http://www.policyuncertainty.com/global_monthly.html.

correlation with HKEPU (0.46). In the second exercise, we re-do the spillover tables in Section 4, this time using HKbGEPU instead of HKEPU. Economic policy uncertainty in the rest of the world contributes 42% to the forecast error variance of HKbGEPU, which is larger than the 27.6% foreign contribution to the HKEPU index (reported in Table 3B). In the third exercise, we include HKbGEPU as an additional variable in the SVAR in Section 5. We find that an unexpected rise in HKbGEPU induces a substantial increase in the local EPU index, reduces vacancy, private investment and puts pressure on domestic output growth. Interestingly, an EPU shock generates a fall in output of similar magnitude. Overall, we interpret these results as further supporting evidence of our international uncertainty spillover channel.

7. Conclusions

In this paper, we used Hong Kong as an example to study the impact of uncertainty shocks from major economies on financially-integrated small-open economies. We constructed a newspaper-based economic policy uncertainty index for Hong Kong. Using the index, we show that there are sizable spillovers of economic policy uncertainty from the major economies to Hong Kong, and that a shock to uncertainty has a negative impact on real output growth rate in Hong Kong. In light of these findings, there is a need for a small open economy like Hong Kong to track economic policy uncertainty closely as it constitutes another key channel of international spillovers, in addition to the more standard effects through trade and financial channels.

Appendix A: Chinese terms for compiling economic policy uncertainty index

Table A1: Relevant Chinese terms (with translations to English) for compiling the economic policy uncertainty index

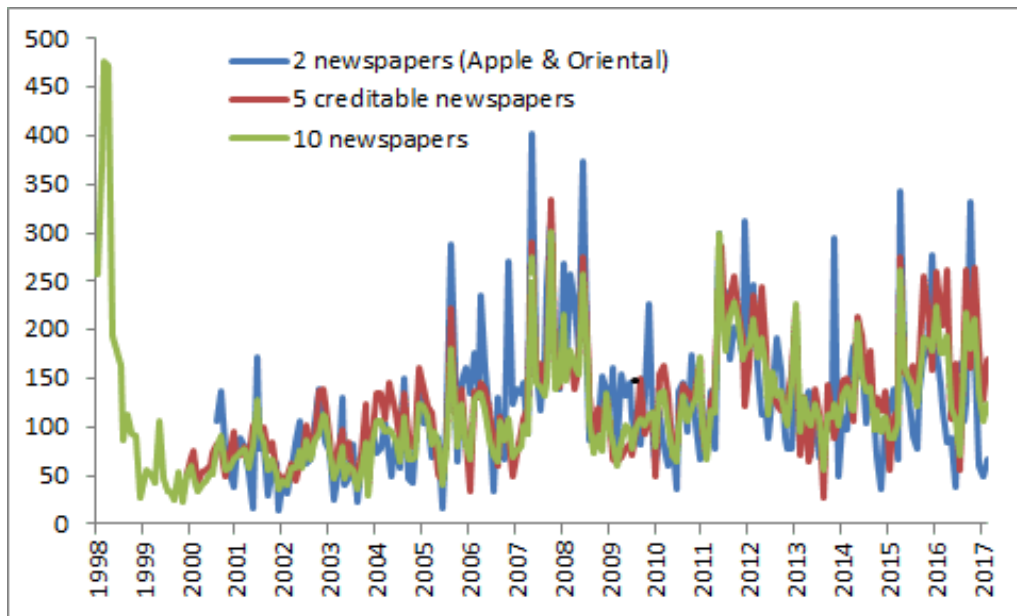
Criteria	English	Chinese
(1) Region	Domestic/Hong Kong	本地/本港/香港
(2) Economic	Economic/Economy/Financial	經濟/金融
(3) Uncertainty	Uncertainty/Uncertain/Unclear/ Unstable/Volatile/Unpredictable	不確定/不明確/不明朗/ 未明/不穩/波動/ 難料/難以預料/難以預測/ 難以預計/難以估計
(4) Policy terms	Policy/measures Public Expenditure/spending Investment Budget Fiscal SAR government Politics Chief Executive Interest Reform Optimize/refine Deficit Tax Regulation/rules Hong Kong Monetary Authority Reserves The Linked Exchange Rate System	政策/措施/施政 公共 支出/開支 投資 預算 財政 當局/政府/ 特別行政區/特區 政治 行政長官/特首 利率/利息/息口 改革 優化 赤字 稅 規管/規例/規則 金融管理局/金管局 儲備 聯繫匯率

Source: Authors' definition

Appendix B: Robustness of newspaper-based EPU indices

We check our baseline newspaper-based EPU index with two alternatives newspaper-based indices. The first alternative uses the 5 most credible newspapers in our sample to construct a credibility-adjusted index. The second alternative uses the two newspapers with the highest readership to construct a readership-adjusted index. Figure A1 compares the time plots of these alternative indices with the baseline.

Figure A1: Comparison of newspaper-based EPU indices



Source: Authors' estimates

Appendix C: Construction of the financial condition index (FCI)

In this Appendix, we outline the construction of the financial condition index used in our estimation. (Chan et al. (2016) provide the full detail of the construction and analysis of the financial condition index.) The methodology follows IMF (2015) and Osorio et al. (2011), and is based on a VAR model. We estimate the following VAR model:

$$X_t = A_0 + \sum_{i=1}^2 A_i X_{t-i} + \sum_{i=1}^2 B_i Y_{t-i}^* + \epsilon_t$$

where X_t is a vector of variables including Hong Kong's quarter-on-quarter real GDP growth, CPI inflation, and a list of financial variables: 3-month Hong Kong Interbank Offer Rate (HIBOR) (in quarterly changes), residential property prices (in quarter-on-quarter growth rate), the Hang Seng Index (in quarter-on-quarter growth rate), volatility of the Hang Seng Index, Hong Kong dollar real effect exchange rate (in quarter-on-quarter growth rate), Hong Kong dollar domestic loans (in quarter-on-quarter growth rate), and the spread of the 3-month HIBOR over the yield of the 3-month Exchange Fund Bill. Y_t^* is the weighted GDP of Hong Kong's trading partners.

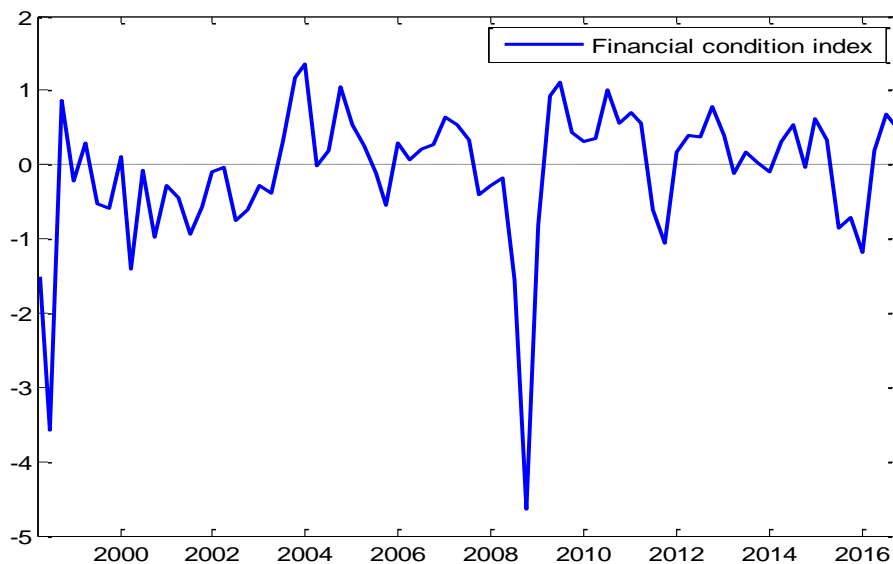
The financial index is constructed as:

$$FCI_t = \sum_{j=1}^n w_j (x_{j,t} - \bar{x}_j)$$

The financial index FCI_t is the weighted sum of deviation of a financial variable $x_{j,t}$ from its sample average \bar{x}_j . The weight w_j for financial variable j is given by the accumulated responses of real GDP growth within four quarters to a one-unit shock to the financial variable. The generalized impulse response function (Persaran and Shin,

1998) is used to measure the impact on real GDP growth from each financial variables to avoid any dependence of the estimated weighted on the ordering of the variables in the VAR. Given this definition, a fall in FCI_t is a tightening in financial condition. The resulting time series of FCI_t is shown in Figure A2. The index drops significantly in 1998Q3 and 2008Q3, corresponding to the Asian financial crisis and and the global financial crisis. Overall, the index makes intuitive sense.

Figure A2: Financial condition index

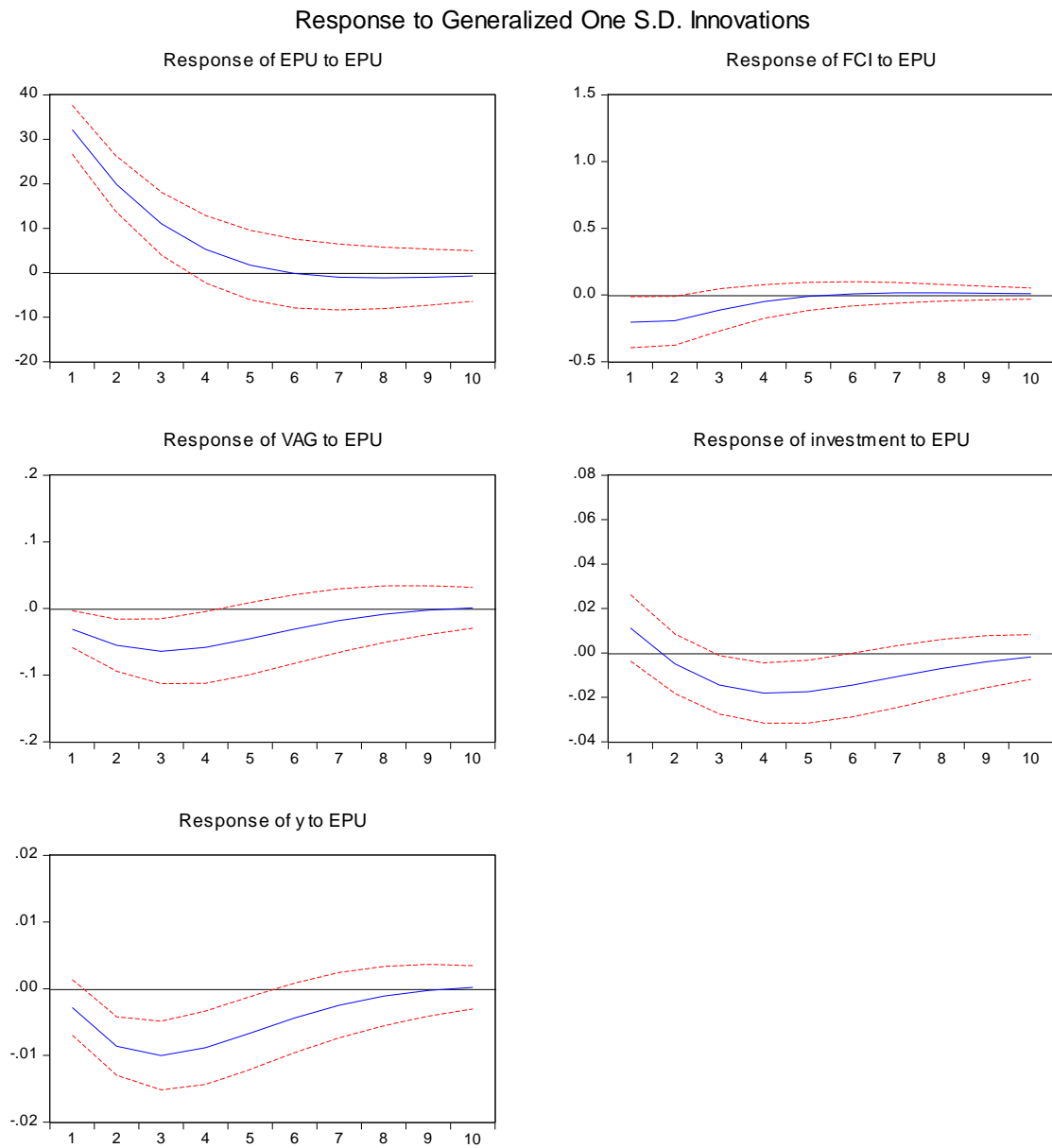


Source: Authors' estimates

Appendix D: Robustness in SVAR estimation of the macro-financial effect of uncertainty

In this Appendix, we report the detailed results of our impulse responses of a shock to an economic policy uncertainty shocks under different identification strategies and specifications discussed in Section 5 of the paper.

Figure A3: Generalized impulse responses to one standard deviation innovation in the economic policy uncertainty index

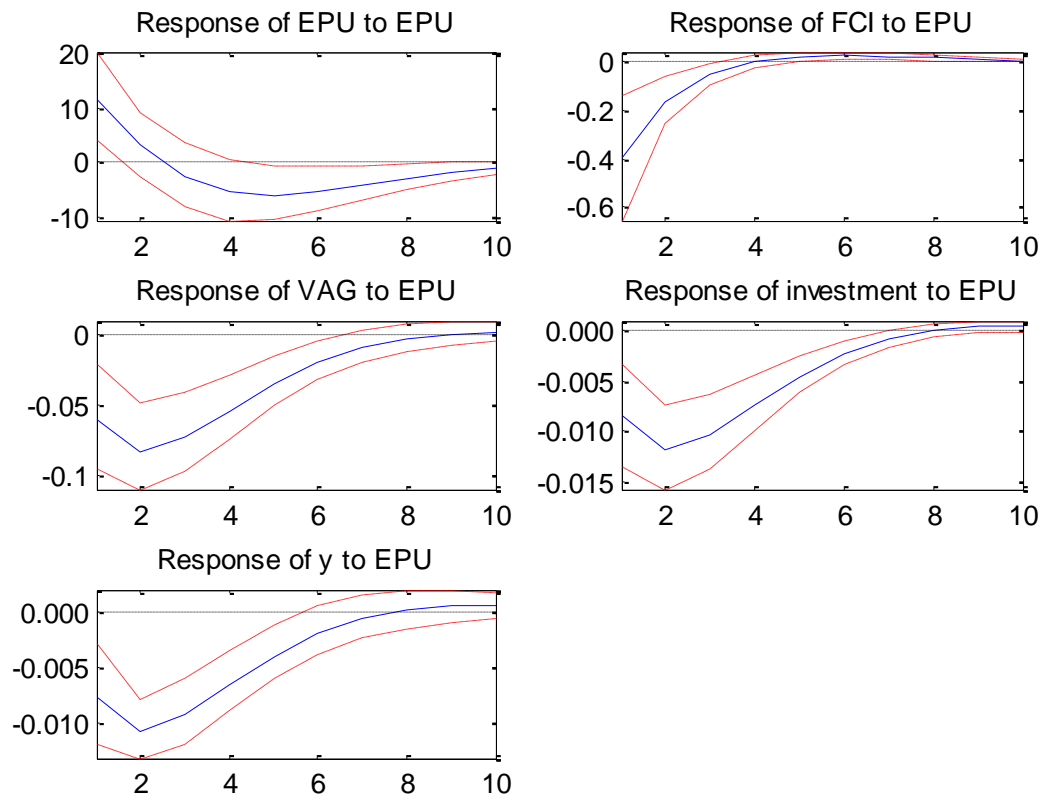


Source: Author's estimates.

Note: The solid lines denote the median IRFs. The dashed red lines denote 5% and 95% error bands, estimated using Monte Carlo simulation (with 100 simulations).

Each period is a quarter.

Figure A4: Impulse responses to one standard deviation innovation in the economic policy uncertainty index, uncertainty shock identified by sign restrictions

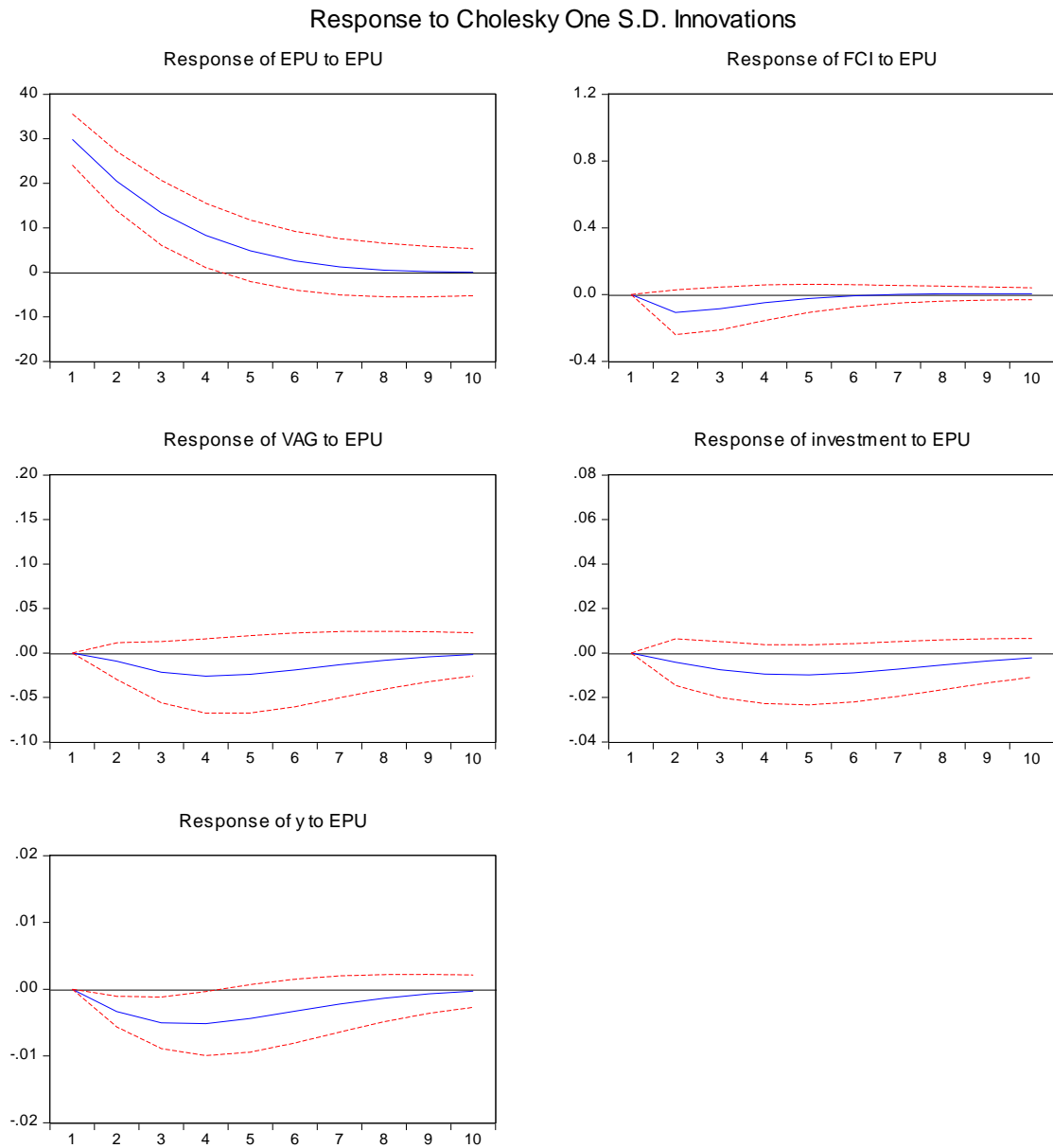


Source: Author's estimates.

Note: The solid lines denote the median IRFs. The dashed red lines denote 16% and 84% error bands, estimated using Monte Carlo simulation (with 10000 simulations).

Each period is a quarter.

Figure A5: Impulse responses to one standard deviation innovation in the economic policy uncertainty index, with the shock identified using Cholesky decomposition and EPU ordered in the last position

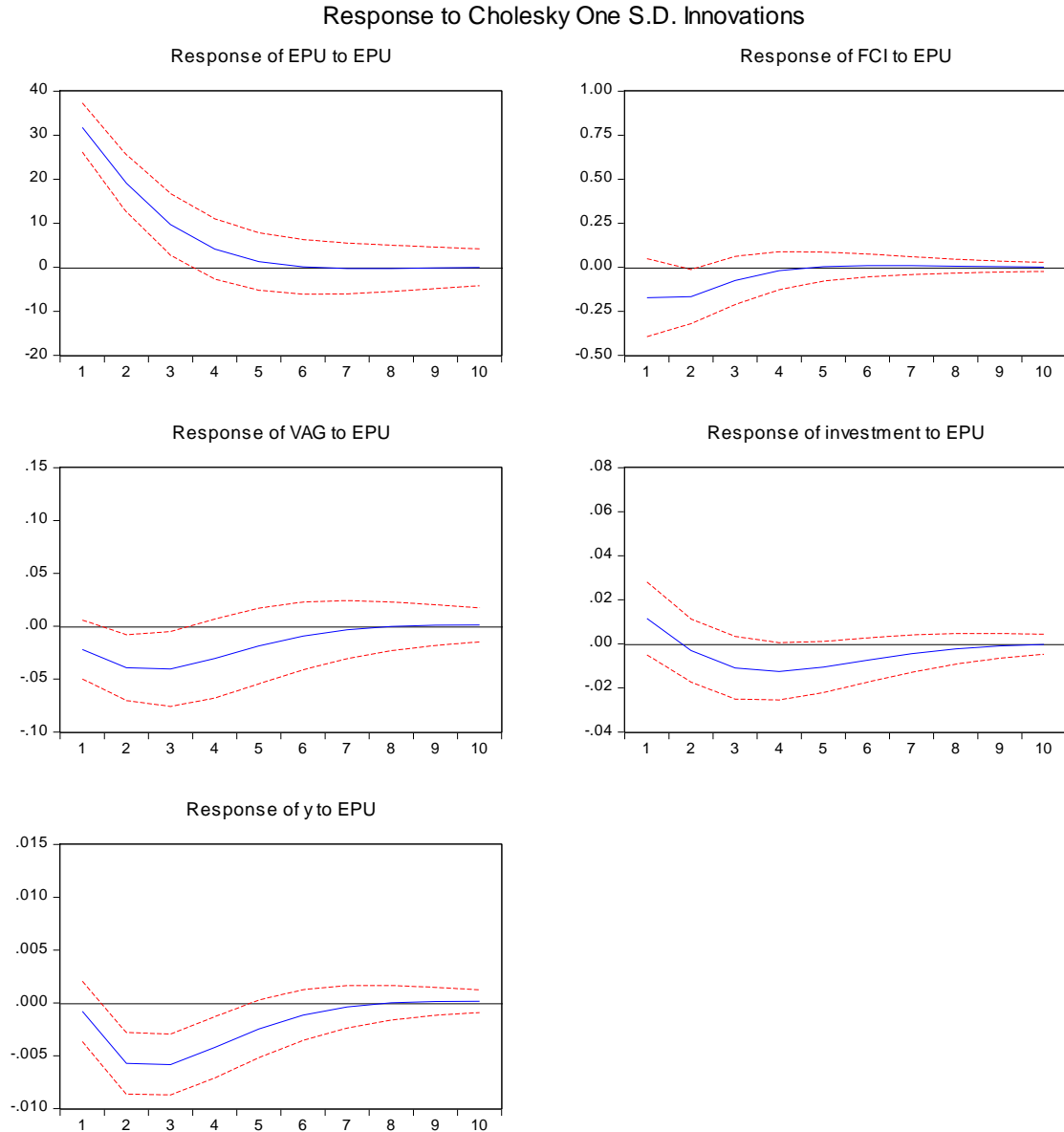


Source: Author's estimates.

Note: The solid lines denote the median IRFs. The dashed red lines denote 5% and 95% error bands, estimated using Monte Carlo simulation (with 100 simulations).

Each period is a quarter.

Figure A6: Impulse responses to one standard deviation innovation in the economic policy uncertainty index with trade-weighted real GDP of Hong Kong's major trading partners as control

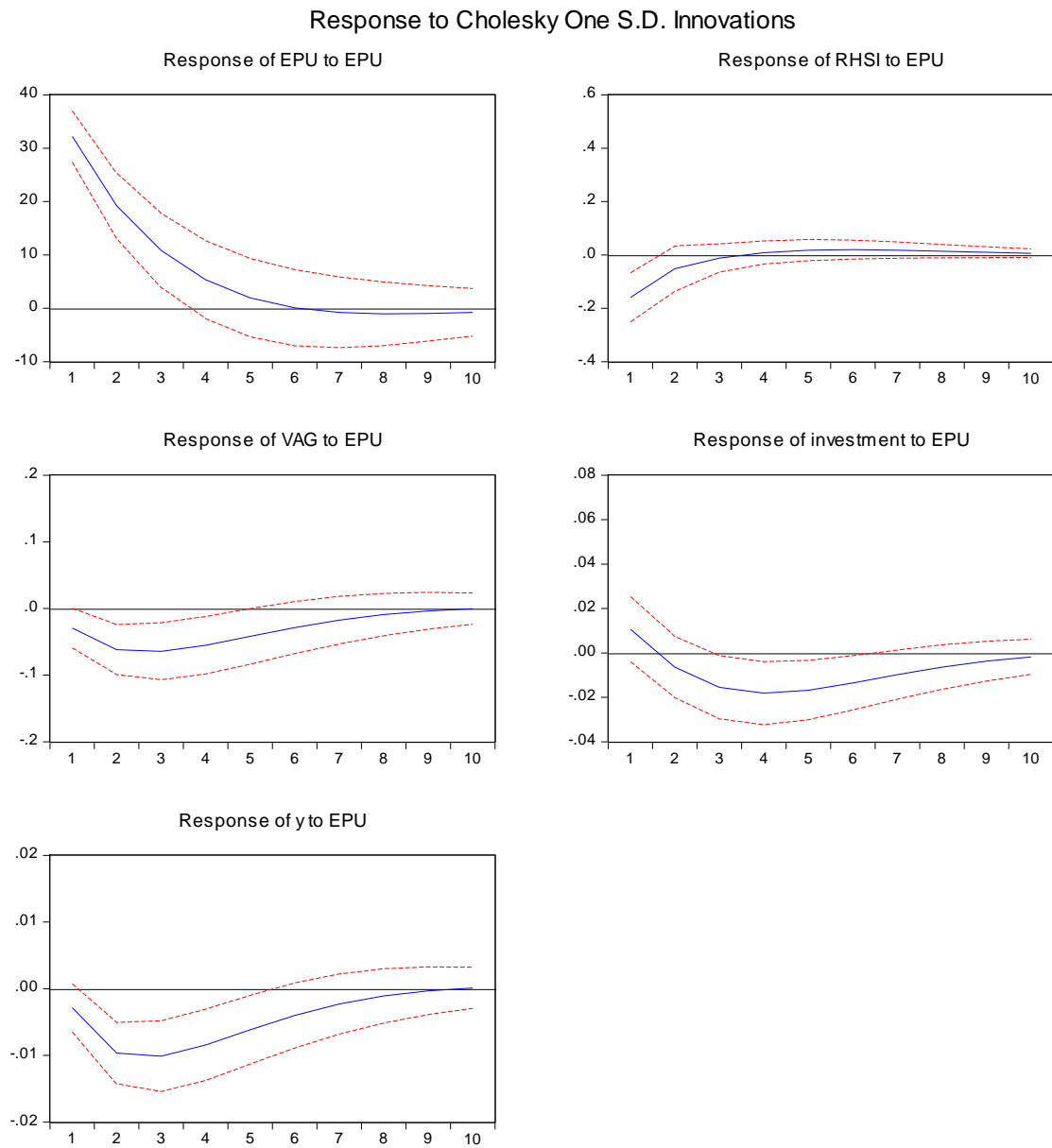


Source: Author's estimates.

Note: The solid lines denote the median IRFs. The dashed red lines denote 5% and 95% error bands, estimated using Monte Carlo simulation (with 100 simulations).

Each period is a quarter.

Figure A7: Impulse responses to one standard deviation innovation in the economic policy uncertainty index with RHSI



Source: Author's estimates.

Note: The solid lines denote the median IRFs. The dashed red lines denote 5% and 95% error bands, estimated using Monte Carlo simulation (with 100 simulations).

Each period is a quarter.

Appendix E: Construction of HKbGEPU index and other robustness checks

In this appendix, we discuss the construction of a Hong Kong-based global EPU index and our additional analysis using this index. Following the spirit of the text-searching methodology, we continue to use media reports to filter foreign uncertainty shocks. To capture the foreign original of the shocks, in the keyword search, we replace “Domestic/ Hong Kong” with “Foreign/ International/ USA/ Europe/ Japan/ China.”¹⁸ Furthermore, we replace “Chief Executive” with “President/Prime Minister”, “Hong Kong Monetary Authority” with “Central bank/ Federal reserve”, and we delete the term “The Linked Exchange Rate System”.¹⁹ We call the resulting index “Hong Kong based Global EPU index” (henceforth HKbGEPU).

We compute the correlations with our HKEPU index and the global EPU index (GEPU) index (Davis, 2016). The correlation matrix is shown in Table A2.

Table A2: Correlation matrix

	HKbGEPU	HKEPU	GEPU
HKbGEPU	1		
HKEPU	0.84	1	
GEPU	0.67	0.46	1

Source: Authors’ estimates

Note: this table shows the correlation matrix among all economic policy uncertainty indices in 1998M4-2016M12. All correlations are significantly different from zero at the 1 per cent level.

¹⁸ This is to say, in the “Region” criteria, we replace (本地/本港/香港) with (外地/外圍/國際/美國/歐洲/ 日本/中國/內地).

¹⁹ To be specific, in the “Policy terms” criteria, we replace (特別行政區/特區/行政長官/特首/金融管理局/金管局/聯繫匯率) with (總統/總理/首相/聯儲局/央行).

The table shows that HKbGEPU is highly correlated with HKEPU index, as expected. Moreover, GEPU has a reasonably high correlation with HKbGEPU index (0.67), and is considerably higher than its correlation with HKEPU (0.46). This result is consistent with the notion of international spillover of EPU shocks in the rest of the world to Hong Kong.

We re-do the spillover tables in Section 4, this time using HKbGEPU instead of HKEPU. The results are reported in Table A3. Several observations are in order. First, the first four rows of Table A3 are identical to the updated Table 3B. This is because we restrict that economic policy uncertainty in Hong Kong does not spill over to the rest of the world. Second, the spillovers from Europe, US and China to Hong Kong are substantially larger in Table A3. Finally, economic policy uncertainty in the rest of the world contributes 42% to the forecast error variance of HKbGEPU, which is around 50% larger than the foreign contribution to the HKEPU index (27.6%). We interpret these results as further supporting evidence of our international uncertainty spillover channel.

Table A3: Spillovers of uncertainty with realised Shanghai Stock

Exchange Composite Volatility

	EU	US	CN	JP	HK	From others
Europe (EU)	75.0	22.6	0.6	2.0	0.0	25.1
United States (US)	17.2	81.8	0.3	0.8	0.0	18.2
Mainland China (CN)	0.4	2.0	96.8	0.8	0.0	3.2
Japan (JP)	14.5	12.5	0.8	72.3	0.0	27.8

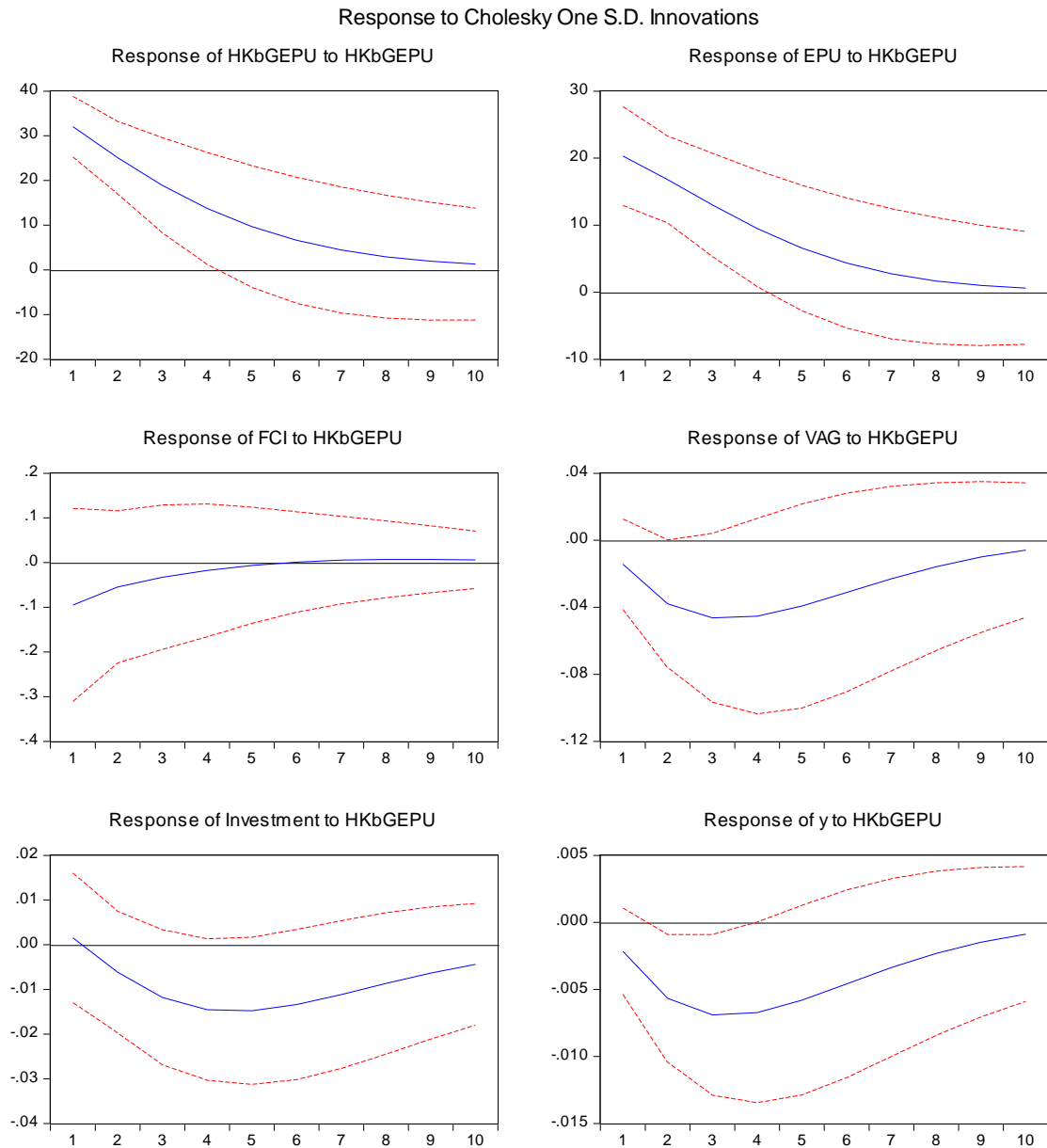
Hong Kong (HK)	17.5	13.4	10.3	0.9	58.1	42.0
Contribution to others	49.6	50.4	11.9	4.4	0.0	
Net	24.5	25.4	8.7	-23.4	-42.0	

Source: Authors' estimates

Lastly, we re-do the SVAR in Section 5. To gauge the effect of spillover of economic policy uncertainty from the rest of the world, we include HKbGEPU as an additional variable, so the vector $X_t = [HKbGEPU_t, EPU_t, FCI_t, vag_t, inv_t, y_t]'$. Since HKbGEPU captures foreign shocks, we expect that shocks hitting Hong Kong exert no contemporaneous effects on it. Consequently HKbGEPU is arranged in the first place. Figures A8 and A9 display the impulse responses to a one standard deviation increase in the HKbGEPU and HKEPU respectively.

Figure A8 shows that a standard deviation rise in the HKbGEPU index induces a substantial increase in the local HKEPU index, confirming the importance of the international uncertainty spillover channel. Both vacancy and investment are marginally statistically insignificant at 95% confidence interval, and the local financial condition does not seem to respond to the foreign uncertainty shock. However, the shock induces a decline in output growth in 2-4 quarters. Figure A9 shows an exogenous rise in the HKEPU index. As expected, it does not affect the perceived uncertainty in the rest of the world. The rise in local EPU index immediately worsens in the local financial condition, which leads to a fall in output growth after 2-3 quarters. Interestingly, both foreign and local EPU shocks generate fall in output of similar magnitudes.

Figure A8. Impulse responses to one standard deviation innovation in the HKbGEPU index

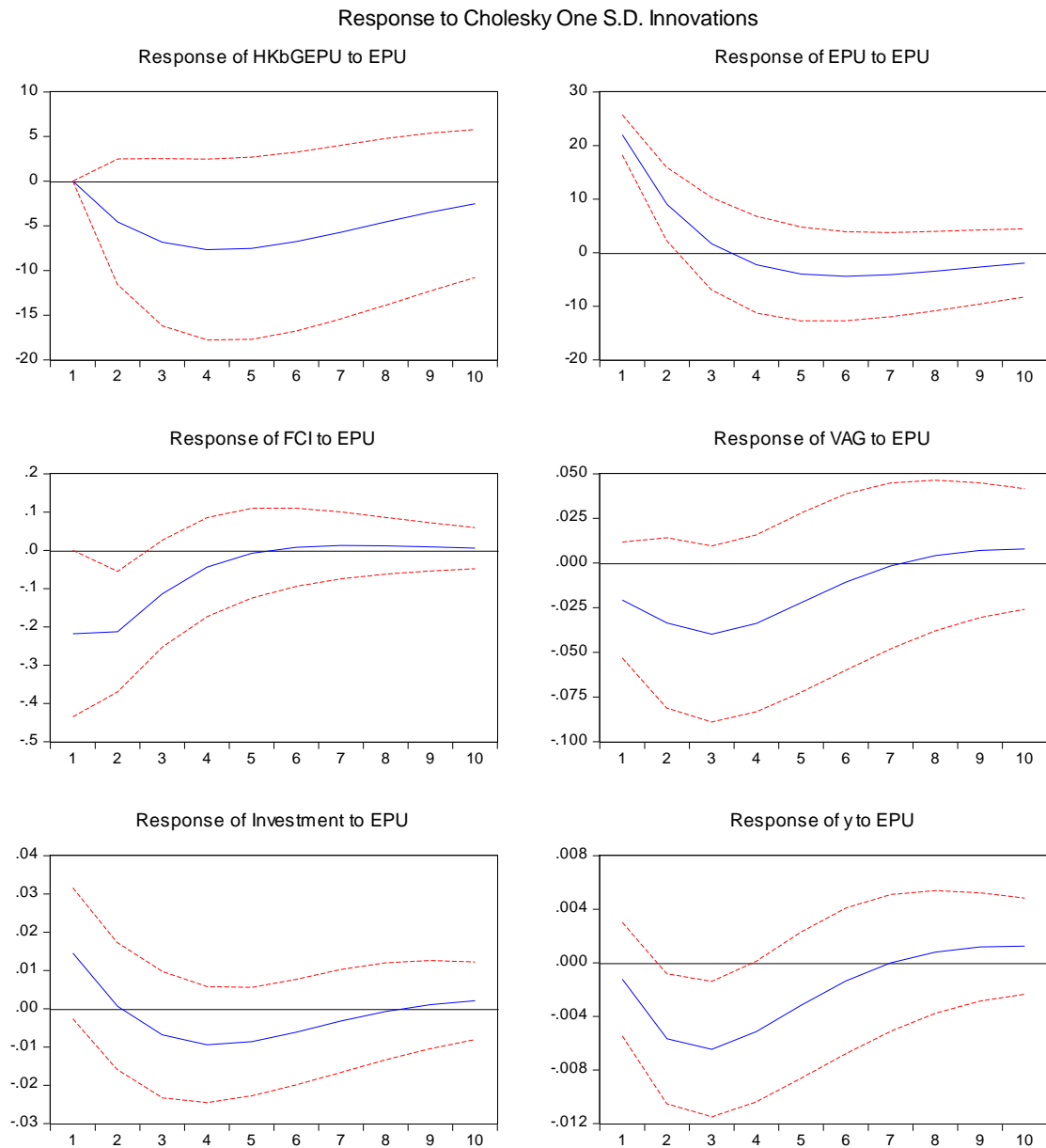


Source: Authors' estimates

Note: The solid lines denote the median IRFs. The dashed red lines denote 5% and 95% error bands, estimated using Monte Carlo simulation (with 100 simulations).

Each period is a quarter.

Figure A9. Impulse responses to one standard deviation innovation in HKEPU index



Source: Authors' estimates

Note: The solid lines denote the median IRFs. The dashed red lines denote 5% and 95% error bands, estimated using Monte Carlo simulation (with 100 simulations).

Each period is a quarter.

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