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Uncertainty shocks and monetary policy: evidence from the troika of China's economy

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ABSTRACT

Growth in China's economy is driven by the troika: consumption, investment and export. This paper examines the effect of uncertain events such as the global financial crisis in 2008, and the COVID-19 pandemic on the troika. Based on the construction of a new uncertainty index of China's economy, the relationship between uncertainty and growth in the troika is examined by using a TVP-VAR model. Results show that fluctuations in the uncertainty index during the COVID-19 epidemic had the greatest negative impact on consumption and investment at a magnitude of −0.27, notably greater than that during the period of the global financial crisis. The negative impact on export reached −0.73, smaller than that during the global financial crisis. Against a backdrop of the novel coronavirus epidemic, it is also found that expansionary monetary policies can have a relatively large impact on investment and export, reaching 1.75 and 1.57 respectively, while short-term impact on consumption is relatively weak, averaging at 0.51.

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1. Introduction

China's economic growth has slowed markedly in recent years. From 2010 to 2019, the country's average GDP growth rate was 7.7%, significantly lower than the 10.4% recorded for the first decade of this century. From the demand side, GDP consists of consumption, investment and net export, which can also be considered as the troika of a country's economic output. Therefore, China's slowdown in economic growth can be broken down into declining growths in its three demand-side components: From 2010 to 2019, the average annual growth rate in nominal prices for China's gross capital formation was 10.6%, a decline of 7.3 percentage points from the 17.9% recorded for the previous decade. For net export in goods and services, the 2010 to 2019 average growth rate was 8.0%, down 19.4 percentage points from 27.4% for the

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first decade of this century. While growth in consumption has increased mildly from an average rate of 12.0% in the years of 2000–2009 to 12.2% in 2010–2019, its magnitude was trumped by large declines in investment and net-export growth. Meanwhile, growth rates of the troika have been negative in the beginning of 2020 due to COVID-19. In order to cope with economic downturns, China's Politburo has stated that the country will pay more attention to demand-side reforms at its most recent meeting.

Although the recent slowdown in China's economic growth is partially due to structural adjustments, economic uncertainty is also an important contributor to its economic downturn (Stock & Watson, 2012). The uncertainty of major emergencies is unexpected or unpredictable, which may cause serious human impacts, such as the 9/11 terrorist attacks, the SARS epidemic, the global financial crisis and COVID-19 (Zhang et al.,2020). It can be observed that growth in the three driving forces of China's economy declined in recent years when the level of economic uncertainty rose. For example, the international financial crisis has had a significant impact on China's external demand, reflected by negative growth in export for 13 consecutive months, whereas the COVID-19 pandemic has led to double-digit drops in retail sales of consumer goods, investment in fixed assets (excluding rural households), and export of goods.

In response to relatively high levels of economic uncertainty, the People's Bank of China (PBC) has introduced expansionary monetary policies to ease the impact of different shocks on the economy. For example, PBC had lowered its reserve ratio four times counting from September in 2008 in light of the global financial crisis. With the economy strained by the COVID-19 pandemic, monthly year-on-year (y-o-y) M2 growth rate shot up significantly which means general money supply increased sharply. Therefore, it is important to accurately quantify the impact of economic uncertainty on growth in the troika of GDP growth, and to identify the role of monetary policy in response to uncertainties to understand the mechanisms through which economic uncertainty affects macroeconomic dynamics in order to provide policy suggestions.

This article builds on existing research in examining the effect of economic uncertainty on economic growth for the Chinese economy. The paper first constructs a composite index that measures China's economic uncertainty levels quantitatively, taking into account domestic and international indicators of economic outlook, economic policy, financial market performance, and commodity prices. To identify the impact of uncertainty shocks on the troika of GDP growth, the paper adopts a TVP-VAR model with stochastic volatility to simulate time-varying impulse responses in proxy variables for the three factors of GDP growth to fluctuations in the economic uncertainty index and M2. Lastly, the paper simulates time-point impulse responses to examine the effect of economic uncertainty and monetary stimulus on growth in the three factors. In allowing for time-varying model parameters, the TVP-VAR model with stochastic volatility is better suited to analyse the changing nature of macroeconomic dynamics, especially regarding how much the Chinese economy has changed structurally during the past 20 years. The model is also compatible with impulse response heterogeneity in consumption, investment, and export to uncertainty shocks at a given time-point.

The rest of the article is structured as follows: Section 2 provides a review of relevant literature; Section 3 constructs the China Economic Uncertainty Index; Section 4 introduces the data and econometric model used; Section 5 displays empirical results on the Chinese economy, followed by a final section of concluding remarks.

2. Literature review

The volume of studies concerning the impact of economic uncertainty on the troika of GDP growth has increased notably in the past years. The National Natural Science Foundation of China has continuously implemented the 2009–2013 major research plan of 'Unconventional Emergency Management Research', which has greatly promoted the construction of China's emergency management theoretical system and the development of interdisciplinary disciplines (Zhang et al., 2020). Meanwhile, the volume of studies concerning the impact of economic uncertainty on the troika of GDP growth has increased notably in the past years.

Early studies on consumption are largely based on expectational certainty. The assumption was relaxed when the element of uncertainty was introduced into consumption modelling, including uncertainty in income (Lugilde, 2018). For empirical studies focusing on Chinese household consumption, Luo (2004) used data from the Chinese Academy of Social Sciences Urban Household Survey to analyse the effect of uncertainty and other factors on urban household consumption. A significantly negative effect is noted. In studying private consumption during the phase of China's economic transition, Zang et al. (2018) and Wang and Xue (2019) thought high levels of uncertainty during this phase of surging economic growth has led to increasingly discretionary consumption behaviours in urban areas. On the contrary, Liu and Fan (2015) pointed to household consumption heterogeneity in response to uncertainty shocks. In specific, the study shows that uncertainty in income exerts a positive impact on private consumption for urban households, but negative for rural households. Multiple studies also emphasize the idiosyncratic nature of uncertainty shocks (pandemics, natural disasters, mass shootings, etc.) and ways in which they affect stability-seeking consumption behaviour (Minton & Cabano, 2021; Yang et al., 2020).

With respect to investment, the existing literature mainly focuses on the two areas of government investment and corporate investment. There is a general consensus that government investment would increase in light of high economic uncertainty. This strategy is observed to be particularly pronounced in China, with the government investing heavily in infrastructure to safeguard employment. However, two contrasting views are present regarding corporate investment. On one hand, a majority of studies demonstrate that higher levels of economic uncertainty have an inhibitory effect on firms' investment through reduced willingness to invest and increasing costs of financing (Bloom, 2014; Corneo, 2019; Huseyin & Mihai, 2015). On the other hand, some studies find economic uncertainty positively affecting corporate investment (Kraft et al., 2018; Oi, 1961). Scholars looking at the investment behaviour of Chinese firms further point to heterogeneity in how corporate investment responds to economic uncertainty. Xu et al. (2020) noted that firms tend to cut investment in real, physical assets while increasing investment in virtual assets in response to economic policy uncertainty. Meanwhile, Gu et al. found that through financing facilities at commercial banks, an uncertainty shock has a greater impact on firms and less foreign demand, and those that already face a larger set of financing constraints.

With respect to export, early studies adopt fluctuations in exchange rates as a reflection of economic uncertainty. Clark (1973) derived a negative correlation between the level of exchange rate fluctuations and trade volume within a framework of perfect competition. According to rules of international economics, export from any country are less competitive in foreign markets when the country's currency appreciates, therefore lowering foreign demand. However, the aforestated negative correlation was put into question upon a relaxation of model assumptions, leading to the conclusion of weak correlation between exchange rate volatility and levels of economic uncertainty. For a more precise measurement of economic uncertainty, scholars began to adopt fluctuations in asset prices as proxy to economic uncertainty (Bloom, 2009; Bonciani & Roye, 2016). Using asset price volatility, Taglioni and Zavacka (2012) found that American economic uncertainty had a notable impact on its imports, but only a minor one on export. A growing number of studies also use constructed uncertainty indices to measure trade policy uncertainty (Ballingall et al., 2020), such as the 'Economic Policy Uncertainty Index' constructed by Baker et al. (2016). Generally speaking, an increase in trade policy uncertainty negatively affects export and other major indicators of trade, while a decrease in trade policy uncertainty improves the quality of products exported (Handley & Limão, 2017).

Monetary policy is an important policy tool to ensure macroeconomic resilience in light of uncertainty. Monetary policy tools in the economic boom period are far better than the economic recession period (Tenreyro & Thwaites, 2016). Kent (2017) presented three dimensions of uncertainty that policy-makers face when making policy decisions: data uncertainty, model uncertainty and unexpected events. From the perspective of transnational influence, Balcilar et al. (2017) found that uncertainty regarding policy changes in the U.S. dampens the effect of monetary policy shocks in the Euro area. In China, Liu and Li, (2014) examined the impact of monetary policy rules on domestic inflation and output under different scenarios of economic uncertainty. Meanwhile, Tian and Lin (2016) showed that China's economic policy uncertainty has both an output effect and an inflation effect. Using a DSGE model to investigate monetary policy decisions during times of economic uncertainty, Zhuang et al. (2016) found that parameter uncertainty only affects the effect of monetary policy implementation.

3. Indexing economic uncertainty

3.1. Indicator selection

Two sets of existing indicators are selected for the purpose of measuring economic uncertainty in the Chinese economy. Indicators that capture domestic levels of economic uncertainty include China's OECD Composite Leading Indicator (CLI, X1), Economic Policy Uncertainty Index (EPUI, X2), rates of CPI volatility (X3), and the

Table 1. Descriptive statistics for indicators selected.

Variable	Min	Lower quartile	Median	Mean	Upper quartile	Max	SE
X1	89.6	99.5	100.3	100.0	100.8	102.7	1.4
X2	9.1	84.3	129.4	205.9	243.8	970.8	204.5
X3	0	0.5	1	1.5	2.3	6.4	1.3
X4	−27.4	−3.8	0.7	0.6	4.8	24.7	7.5
X5	95.9	99.5	100.1	99.9	100.5	101.6	1.0
X6	48.4	84	110.4	124.3	150.2	348.6	56.8
X7	6.7	10.6	13.5	15.2	18.4	48.3	6.6
X8	10.1	14.0	17.4	19.7	23.1	62.6	8.6
X9	27.2	61.1	82.8	104.9	127.4	545.1	71.9

Source: calculated according to TVP-SV-VAR model.

Shanghai Composite Index (SCI, X4). Indicators that reflect international levels of economic uncertainty include the Global OECD Composite Leading Indicator (X5), Economic Policy Uncertainty Index (X6), gold to crude oil ratio (X7), VIX 1-Month Implied Volatility index (X8), and Geopolitical Risk Index (X9). Table 1 provides descriptive statistics of the nine indicators used to construct the Uncertainty Index.

The Min-Max Normalization technique is adopted to convert all indicators selected into comparable non-dimensional values. Computation follows formulas as below:

$$\text{Positive indicator}: p_{ij} = \frac{X_{ij} - \min(X_j)}{\max(X_j) - \min(X_j)};$$

$$\text{Negative indicator}: p_{ij} = \frac{\max(X_j) - X_{ij}}{\max(X_j) - \min(X_i)}$$

where X_{ij} is the original indicator value for indicator j at time i, p_{ij} is the corresponding non-dimensional value after standardization.

3.2. Index construction

The China Economic Uncertainty Index is constructed as a weighted sum of the nine selected uncertainty indicators according to entropy weighting (weights displayed in Table 2). Economic policy and commodity prices are the two most heavily weighted, with weights reaching 0.160 and 0.146 respectively for the domestic market, while financial market volatility and geopolitical risk retain highest weights for the global market at 0.130 and 0.128 respectively.

3.3. Index validation

The computed China Economic Uncertainty Index time series is plotted in Figure 1. It can be seen that peaks of the index dovetail to major economic shocks, such as the SARS outbreak in February 2003, the global financial crisis during the period of December 2008 to March 2009, the European debt crisis around September 2011, and the COVID-19 outbreak in early 2020. The constructed Index reflects, to a relatively fine extent, the level of macroeconomic uncertainty faced by the Chinese economy as a result of unexpected shocks in the domestic and international market.

Table 2. Computed weights of uncertainty indicators selected.

Final index	Market of reference	Fields indexed	Indicator	Weight
China Economic Uncertainty Index	Domestic market	Economic outlook	China's OECD CLI	0.048
		Economic policy	China's EPUI	0.158
		Commodity prices	CPI volatility	0.144
		Financial market	SCI rate of change	0.020
	Global market	Economic outlook	Global OECD CLI	0.067
		Economic policy	Global EPUI	0.101
		Commodity prices	Gold to crude oil ratio	0.101
		Financial market	VIX Implied Volatility Index	0.128
		Geopolitics	Geopolitical Risk Index	0.126

Source: calculated according to TVP-SV-VAR model.

Figure 1. The China Economic Uncertainty Index.
Source: calculated according to TVP-SV-VAR model.

4. Data and methodology

4.1. Data

Due to the lack of higher frequency data for the three demand-side components of GDP, monthly data from January 2000 to April 2020 on total retail sales of consumer goods, fixed asset investment (excluding rural households), and export of goods are adopted as proxies for consumption, investment and export of goods and services respectively. The y-o-y growth rate of M2 is adopted as proxy for measuring the level of monetary policies introduced.

Two notable adjustments are made with respect to data processing. The cumulative growth rate of fixed asset investment (excluding rural households) published monthly by the National Bureau of Statistics (NBS) is converted into monthly y-o-y growth. Furthermore, NBS does not collect separate records for the month of January and February by convention to eliminate the effect of Chinese New Year on general economic activities. Same growth rates are assumed to apply for January and February.

Table 3 provides the lag length criteria value of the data. The paper follows Nakajima (2011) in setting the prior for initial states of our time-varying parameters.

Table 3. Lag length criteria value.

Lag	LL	LR	df	p	FPE	AIC	HQIC
0	−2533.07				21,340.8	21.3199	21.3434
1	−2227.08	611.97	16	0.000	1866	18.883	19.0006
2	−2189.27	75.615	16	0.000	1553.73*	18.6998*	18.9115*
3	−2173.37	31.812	16	0.011	1555.41	18.7006	19.0063
4	−2159.46	27.812*	16	0.033	1583.88	18.7182	19.118
5	−2150.05	18.829	16	0.278	1675.45	18.7735	19.2674

*represents the best option.
Source: calculated according to TVP-SV-VAR model.

The optimal number of VAR lag is 2, in accordance with the rule of minimum FPE, AIC, and HQIC values in models estimated with zero to five lags.

4.2. Model specification

The paper uses a TVP-VAR model with stochastic volatility to estimate the effect of economic uncertainty on growth in the troika factors of China's GDP. Building on the structural vector autoregressive model (SVAR) proposed by Sims (1981), the TVP-VAR model with stochastic volatility proposed by Primiceri (2005) relaxed prior assumptions of parametric invariability, allowing for both temporary and permanent temporal heterogeneity in model parameters. Since its introduction, the TVP-VAR model has been broadly used in macroeconomic research for its ability to capture the time-varying nature of economic dynamics. Nakajima (2011) defines the TVP-VAR model as the following:

$$y_t = X'_t \beta_t + A_t^{-1} \sum\nolimits_t \varepsilon_t, \quad t = s+1, \ldots, n, \tag{1}$$

where y_t is a scalar of observable endogenous variable; β_t, A_t and $\sum_t$ are all time-varying.

A number of notable assumptions are made for model specification. Namely, the matrix A_t is assumed to be a lower-triangular matrix. Parameters in Equation (1) are also assumed to follow a random walk process as follows:

$$A_t = \begin{cases} \beta_{t+1} = \beta_t + \mu_{\beta t} \\ \alpha_{t+1} = \alpha_t + \mu_{\alpha t} \\ h_{t+1} = h_t + \mu_{ht} \end{cases}, \begin{pmatrix} \varepsilon_t \\ \mu_{\beta t} \\ \mu_{\alpha t} \\ \mu_{ht} \end{pmatrix} \sim N\left(0, \begin{pmatrix} I000 \\ 0\sum_\beta 00 \\ 00\sum_\alpha 0 \\ 000\sum_h \end{pmatrix}\right),$$

where$h_{jt} = \log(\sigma_{jt}^2)$ for j = 1, …, k, I is an identity matrix, and $\sum_\beta$, $\sum_\alpha$ and $\sum_h$ are all positive definite matrices. Markov chain Monte Carlo (MCMC) sampling is used to obtain posterior parameter estimates.

A pre-run unit root test is conducted to avoid the possibility of a spurious regression. Test results show that the log difference of the China Economic Uncertainty Index, and the growth rate of consumption, investment and export are all stationary series with no unit root present. The consumption growth variable passed the 10% significance test, while the other three all passed the 1% significance test.

4.3. Parameter estimates

To obtain posterior estimates, this part draw 10,000 samples, in which the initial 1000 samples are used as a pre-run and discarded due to instability. Results of our parameter estimates are reported in Table 4. Convergence diagnostics (CD) and inefficiency factor are proposed to evaluate estimation performance. Along with parameters' inefficiency factor scores, it can be seen from results reported that all parameters have CD test values below the z score of 1.96 corresponding to a 5% significance test, indicating a failure to reject the null hypothesis of the pre-simulated Markov chain converging to the posterior distribution.

Further model efficiency tests conducted are illustrated in Figure 2. It is shown that sample autocorrelation decreases steadily for all parameters after the first 1000 draws that are discarded, while posterior densities display characteristics of a normal distribution, pointing to the efficacy of MCMC sampling in simulating posterior distribution of model parameters.

Table 4. TVP-VAR model with stochastic volatility parameter estimates.

Parameter	Mean	Std. dev.	95% CI	CD	Inefficiency
$(\sum_{\beta})_1$	0.0223	0.0024	[0.0181, 0.0276]	0.499	12.43
$(\sum_{\beta})_2$	0.0228	0.0026	[0.0184, 0.0286]	0.273	14.17
$(\sum_{\alpha})_1$	0.0695	0.0201	[0.0414, 0.1180]	0.161	92.66
$(\sum_{\alpha})_2$	0.0650	0.0171	[0.0404, 0.1078]	0.367	61.06
$(\sum_{h})_1$	0.3446	0.0726	[0.2207, 0.5084]	0.196	50.62
$(\sum_{h})_2$	0.4082	0.0771	[0.2746, 0.5799]	0.052	72.15

Source: calculated according to TVP-SV-VAR model.

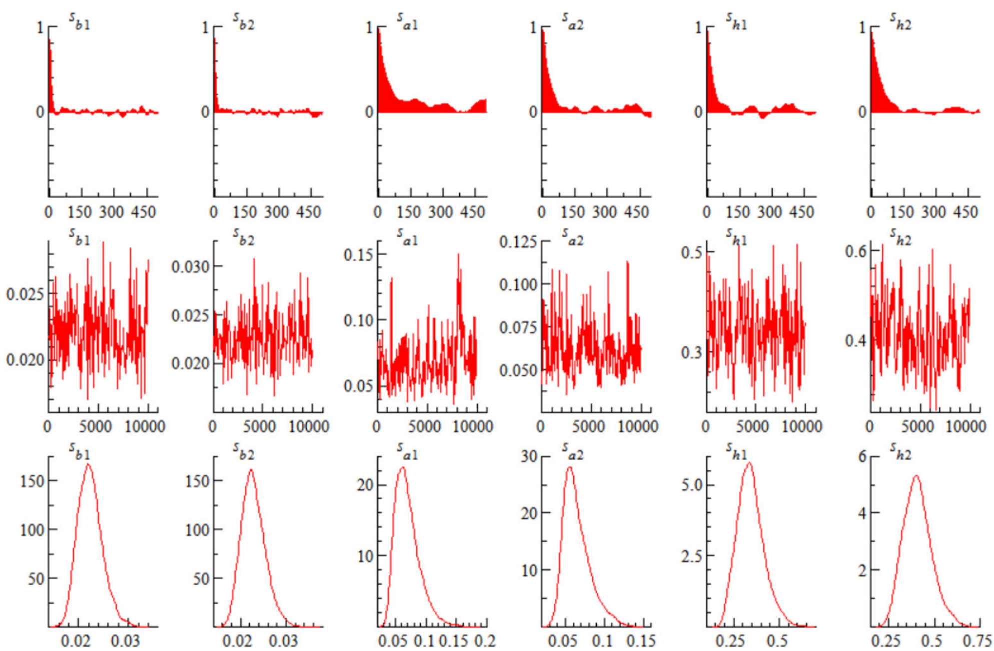


Figure 2. Sample autocorrelation (top), sample paths (middle) and posterior densities (bottom).
Source: calculated according to TVP-SV-VAR model.

5. Empirical results

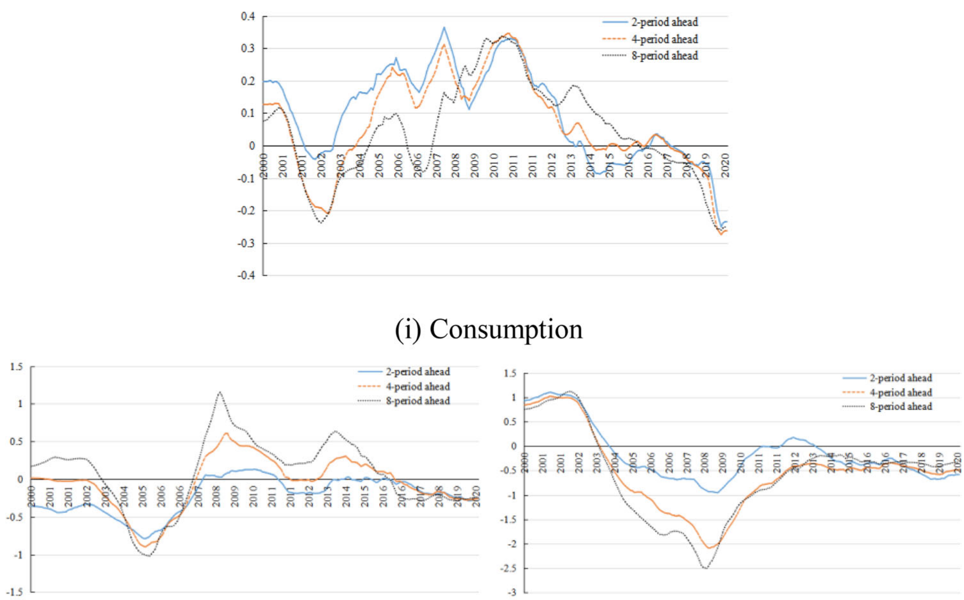
5.1. Time-series impulse response

5.1.1. Uncertainty shocks

Figure 3 shows the impulse response of the troika of GDP growth to uncertainty shocks for 2-, 4- and 8-month horizons over time. Overall, growth in export is shown to be most affected by shocks in our constructed uncertainty index, followed by investment, then consumption. Results show that consumption has been less volatile to economic uncertainty since 2013, the same year after which China's consumption growth entered a phase of lasting, albeit slow decline. The decline in consumption growth reflects to a certain extent the rise in quality and resilience of domestic consumption against a backdrop of rising resident disposable income. With respect to investment, a notable negative effect is observed for all months other than during the global financial crisis in 2008 and 2009 due to strong fiscal stimulus introduced (known as the 'four trillion' policy). Regarding export, positive impulse responses are recorded for immediate years following China's WTO accession. Otherwise, the impulse response of export to our economic uncertainty index stays negative since 2004, and dropped to its lowest level during the global financial crisis in late 2008 and early 2009. The impact of uncertainty on export has been less pronounced in recent years, but remains notably stronger than its impact on consumption and investment.

5.1.2. M2 shocks

To study the effect of monetary stimulus on the recovery of consumption, investment, and export, this part simulate impulse responses of the three factors of GDP



(i) Consumption

(ii) Investment (iii) export

Figure 3. Time-varying responses of three demand-side factors of GDP growth to the China Economic Uncertainty Index.
Source: calculated according to TVP-SV-VAR model.

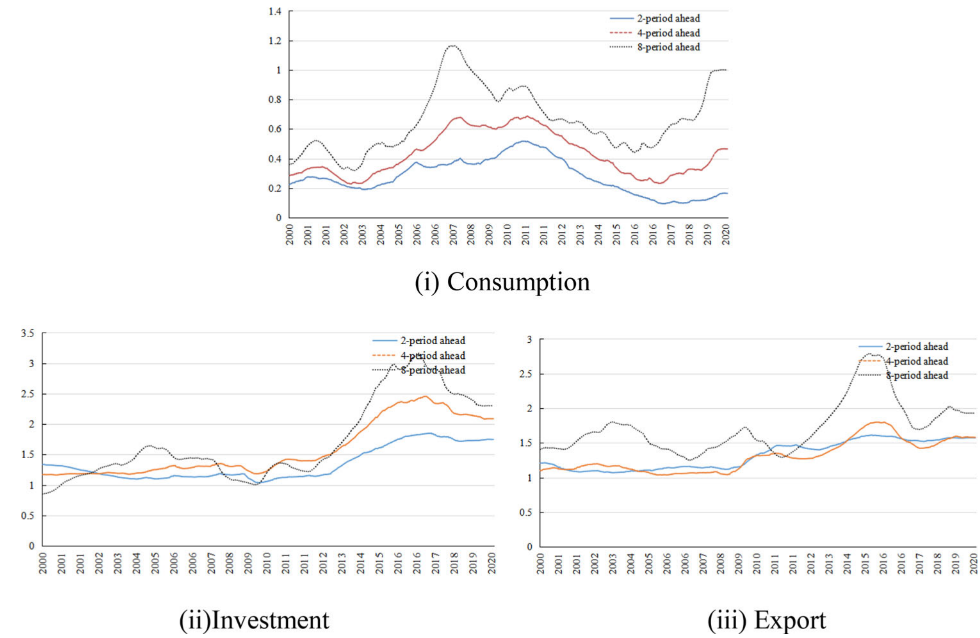


Figure 4. Time-varying responses of three demand-side factors of GDP growth to M2 shocks.
Source: calculated according to TVP-SV-VAR model.

growth to M2 levels. Results by time period are displayed in Figure 4. This part draws two major conclusions:

Firstly, using 2-month responses as an example, the range of response of consumption to a positive M2 shock is [0.095, 0.518] with a mean of 0.28. The range of impulse responses for investment is [1.035, 1.849] with a mean of 1.34. For export, impulse responses stay within [1.069, 1.612] with a mean of 1.32. The relatively large effect of a positive M2 shock on investment reflects expansionary monetary policies adopted by the central bank during periods of economic uncertainty that boost investment via lowering business lending costs. With respect to export, loose monetary policy supports higher levels of production and increases competitiveness for export products by lowering interest rates.

Secondly, the effect of monetary stimulus is stronger when applying a longer response time horizon. Results show that the impact of an M2 shock on the troika of GDP growth are more pronounced under the 8-month scenario compared to 4- and 2-month. For consumption, the average effect of a positive M2 shock is 0.66, greater than 0.43 and 0.28 recorded for the 4- and 2-month response scenario respectively. For investment, the average impulse response to a positive shock at 8-month time horizon reached 1.72, larger the 1.58 and 1.34 under the 4- and 2-month scenario respectively. With respect to export, the average response to a positive M2 shock at 8-month time horizon scores 1.73, larger than 1.30 under the 4-month scenario and 1.32 under the 2-month scenario.

5.2. Time-point impulse response

This section compares impulse responses of the troika of GDP growth to economic uncertainty and expansionary monetary policies during the 2008 global financial crisis to that of the COVID-19. Simulation results are reported in Figures 5 and 6.

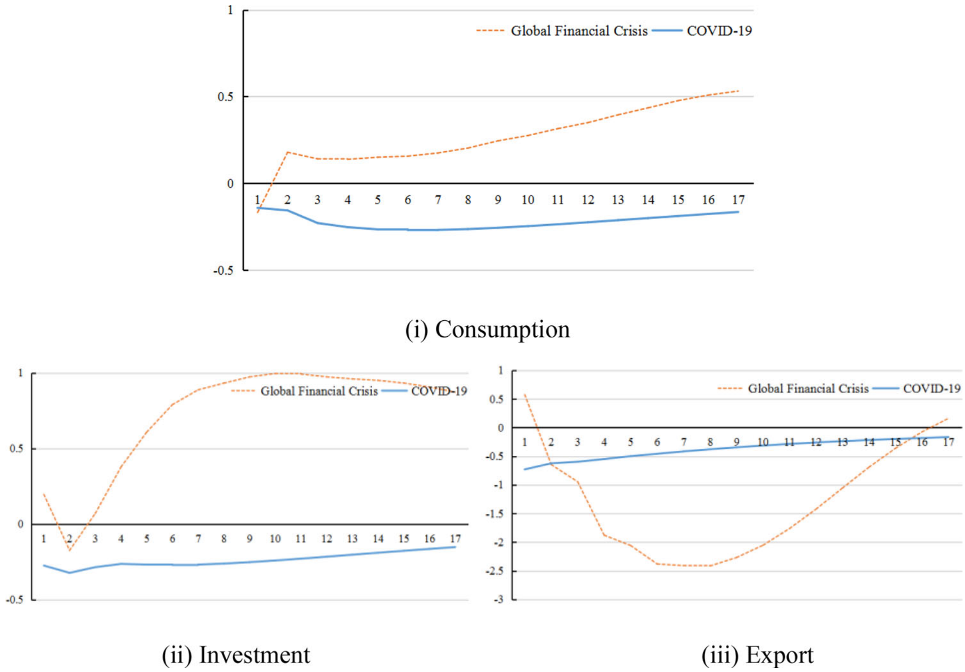


Figure 5. Time-point responses of the troika of GDP growth to shocks in the China Economic Uncertainty Index.
Source: calculated according to TVP-SV-VAR model.

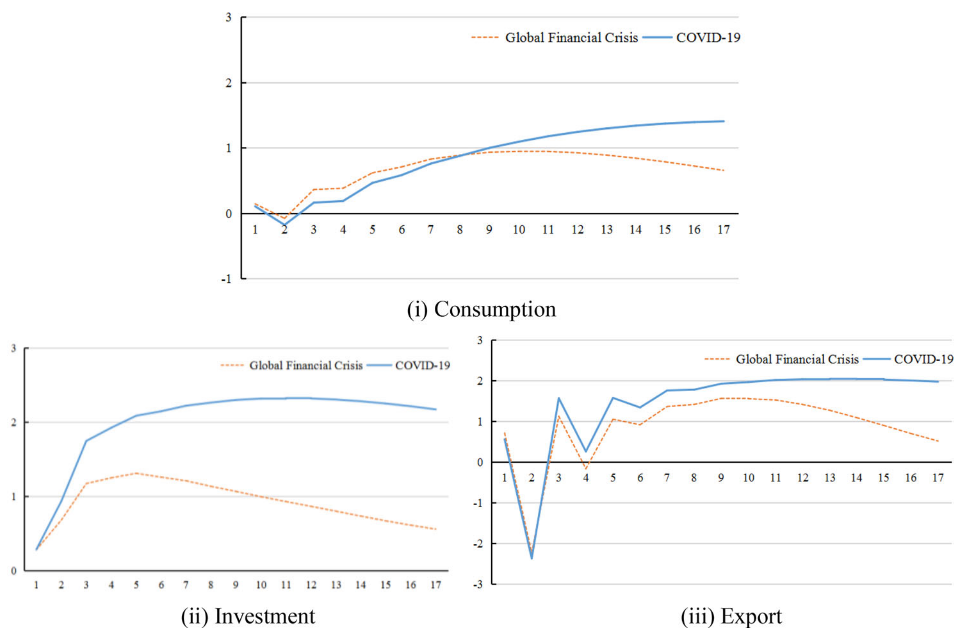


Figure 6. Time-point responses of the troika factors of GDP growth to M2 shocks.
Source: calculated according to TVP-SV-VAR model.

5.2.1. Uncertainty shocks

Consumption, investment and export diverged in response to economic uncertainty during the 2008 global financial crisis compared to their performance during the recent coronavirus outbreak. For consumption, a relatively small negative impact of economic uncertainty on domestic demand is observed under the 1-month horizon scenario, but impulse responses turn positive under the 2-month time horizon onwards. In terms of investment, a significantly positive response is recorded as a result of the 'four trillion' policy, which aimed to counter the worldwide crash in economic activity. For export, China's export growth saw a sharp decline as economies around the world experienced weak demand due to the financial crisis. The magnitude of impulse responses of export to a positive uncertainty shock dips to a low of −2.42.

During the COVID-19 pandemic, it can be seen that the impact of a positive uncertainty shock on domestic demand growth far exceeds that on foreign demand compared to impulse response during the global financial crisis. Estimated results show an impulse response as low as −0.27 across time horizons for both consumption and investment in response to a positive uncertainty shock during the COVID-19 pandemic, the magnitude of which significantly greater than during the global financial crisis. However, the greatest negative response recorded for export during the COVID-19 pandemic is −0.73, less than during the financial crisis.

5.2.2. M2 shocks

On one hand, expansionary monetary policies are shown to be of greater efficiency in promoting investment and export during the current coronavirus pandemic compared to during the global financial crisis. Results show that responses of investment to a positive M2 shock rise significantly in magnitude under the scenario of a 2-month or longer time horizon, stabilizing at a relatively high level with a high of 1.75. For export, impulse responses during the COVID-19 pandemic turn positive from the third month (1.57) and continues to diverge from trends for the financial crisis, stabilizing at around 2 to suggest a more sustainable effect. This quick recovery of export response is attested by data on China's trade in goods. The −20% negative growth in export of goods in USD for the first months of 2020 was reversed in April, when y-o-y growth reached 3.4%. From the perspective of domestic demand, growth in investment has also recovered faster than consumption.

On the other hand, monetary stimulus is less effective in encouraging consumption during the COVID-19 outbreak within a shorter time horizon, but more effective in the long run. The impact of a positive M2 shock during the coronavirus pandemic is observed to be smaller than during the financial crisis for a time horizon of up to 7 months. Data on retail sales of consumer goods attest to a slower recovery in consumption as compared to the other two driving forces of GDP growth from the pandemic. According to NBS, the y-o-y growth rate of total retail sales of consumer goods dropped to −20.5% for the months of January and February. Compared to concurrent data on investment and trade, monetary stimulus is suggested to have a relatively muted effect on consumption.

6. Conclusion

This paper generates a China Economic Uncertainty Index that dates back to January 2000 based on a basket of nine indicators that capture the level of uncertainty in various fields of the domestic and international economy. The economic uncertainty index constructed is shown to generally follow major unexpected events that had a major economic fallout faced by the Chinese economy. The Index is used to estimate the impact of economic uncertainty on growth in the three components, or driving forces of China's GDP growth adopting a TVP-VAR model with stochastic volatility. From a fixed-horizon, impulse responses of the proxy variable for export growth to an uncertainty shock are largest, followed by investment and consumption. Meanwhile, the expansionary monetary policies is shown to be effective to a certain extent in light of economic uncertainty. In specific, impulse responses of investment to M2 shocks are observed to be most pronounced, with consumption the least impacted. From a time-point perspective, the paper notes that the estimated response of domestic demand to a monetary stimulus shock is greater during the COVID-19 outbreak compared to that of the global financial crisis, while external demand recorded responses of a smaller magnitude compared to the financial crisis. The paper provides three policy suggestions based on observations extrapolated from model results.

Firstly, current policies that aim to safeguard foreign trade and foreign investment should continue to be effectively implemented as a second wave of the COVID-19 pandemic struck abroad. Despite depressed demand worldwide triggered by the COVID-19 outbreak, China's export have recovered in a relatively short time frame. Other than the country's increasing importance in the global value chain, discretionary monetary policies introduced also contributed to export growth. However, such growth is fragile in light of the hit of a second wave of concentrated COVID-19 infections oversees. As successful containment of COVID-19 has increasingly become a definitive factor to achieve sustainable economic recovery for all countries, China should continue enforcing its opening-up strategy to ensure flows of foreign trade and investment while resuming economic production with appropriate public health restrictions.

Secondly, the country should focus on changes in the structural composition of investment while taking advantage of growth driven by counter-cyclical fiscal and monetary policies. Growth in investment has traditionally acted as a buffer in countering economic downturns in China. In light of the COVID-19 pandemic, the effect of monetary stimulus is observed to be greatest for investment in our model results, with investment in fixed assets showing faster growth compared to consumption. However, it should be noted that strong growth in investment driven by loose fiscal and monetary policies does not provide a sustainable outlook for longer-term output growth.

Thirdly, further stimulus may be necessary for a complete rebound of retail sales to pre-pandemic levels. It is well-observed that the recovery of consumption to pre-pandemic levels is lagging behind compared to investment, net export, and overall economic production. The Chinese government and central bank introduced a set of expansionary fiscal and monetary policies of relatively moderate magnitude in response to the COVID-19 outbreak, the country should consider further targeted policy measures to bolster consumption.

The following aspects are worthy of in-depth study. Firstly, the indicators of uncertainty index such as confidence of consumer, financing condition of firms can be included. Secondly, based on the perspective of uncertainty shocks on driving forces of GDP, study can be considered of the successful experience and failed lessons of the Chinese government in coping with the different major events. Thirdly, it is worthwhile studying the macroeconomic effects of uncertain impacts at other levels is also meaningful, such as supply-side of economy. It is hoped that this article will play a role in attracting new ideas and promoting further research results.

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