The Dynamic Effects of Economic Policy Uncertainty on Education Market Return Dynamics

Wang Gao[1], Qian Cao[2](✉), and Linlin Zhang[3](✉)

[1] School of Finance, Hebei University of Economics and Business, Shijiazhuang, China
[2] Institute of Science and Technology Information, Beijing Academy of Science and Technology, Beijing, China
cq071016@163.com
[3] School of Information Technology, Hebei University of Economics and Business, Shijiazhuang, China
zhanglineducation@foxmail.com

Abstract. In order to better explore the impact of economic policy uncertainty on the education market, this paper uses the time-varying parameter - random fluctuation vector auto regression (TVP-SV-VAR) model to analyze the impact of economic policy uncertainty (EPU) on the education rate of return and the education volatility. The results show that EPU has a significant time-varying effect on the return rate of China's education market, and the short-term effect is the most significant. In terms of education volatility, EPU has a stronger influence on education market volatility in the medium and long term. In addition, when a crisis or major event occurs, the impact of EPU on China's education market is greater and has a lag effect, among which the China-Us trade dispute and the impact of COVID-19 make the biggest contribution to market volatility.

Keywords: economic policy uncertainty · education · dynamic effects · TVP-SV-VAR

1 Introduction

Over the last two decades, the development of education industry financialization has spawned many private educational institutions and enterprises, thus the consumer finance in the field of educational training has experienced an explosive growth [1]. Such process expands ways for funds-raising and enhance supply of high-quality education resources. However, the disorderly expansion of education capital has caused the instability of the industrial structure, making it more vulnerable and sensitive to risks and uncertainties [2]. Based on this point, it is necessary to explore the impact of uncertain factors on education. In our work, we take economic policy uncertainty (EPU) for the main study. Economic policy uncertainty refers to the uncertainty caused by the government's failure to specify the direction and intensity of economic policy expectations, implementation and position changes. Unclear policies will inevitably have a profound impact on the education industry [3].

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As an important basic strategic industry, China's education is inevitably affected by these economic uncertain events. Some scholars have studied the relationship between economic uncertainty and education [4]. However, the dynamic relationship between education and economic policy uncertainty has not been researched, which could make us better understand the change law of education market in order to take timely measures to eliminate the crisis and predict their changes and to adopt risk hedging and management measures in a timely manner. To this end, we check the dynamic relations between economic policy uncertainty and education finance market gold return dynamics via the time varying parameter-stochastic volatility-vector auto regression (TVP-SV-VAR) model [5]. TVP-SV-VAR could use flexible and simple specifications. In this paper, dynamic specification can help us explore how the interaction between EPU and the education financial market evolves over time, which is particularly valuable because our data covers several crisis periods, such as European debt crisis, and COVID-19, all of which lead to sudden changes in economic policy. From the perspective of econometrics, TVP-SV-VAR method could deal with nonlinear and potential structural shocks, thus avoiding endogenous problems.

2 Methodology and Data

2.1 Time Varying Parameter-Stochastic Volatility-Vector Auto Regression

Compared with VAR model, TVP-SV-VAR has two more factors: time-varying parameters and random fluctuation, expanding the scope of application. Consider a basic structural VAR model:

$$Ay_t = B_1 y_{t-1} + B_2 y_{t-2} + \cdots + B_z y_{t-s} + \mu_t\,,\ t = s+1, ..., n \tag{1}$$

where t and s represents time and the number of lag periods, respectively; y_t is the $k \times 1$ vector of our research variables, and $A, B_1, \ldots, B_s$ are $k \times k$ matrices of coefficients. The disturbance u_t is a $k \times 1$ structural shock and, we assume that $u_t \sim N(0, \Psi\Psi)$, where

$$\Psi = \begin{pmatrix} \sigma_1 & 0 & \cdots & 0 \\ 0 & \ddots & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ 0 & \cdots & 0 & \sigma_k \end{pmatrix} \tag{2}$$

σ is the standard deviation. Assuming that structural shocks are subject to recursive identification, that is to say, A is a lower triangular matrix:

$$A = \begin{pmatrix} 1 & 0 & \cdots & 0 \\ a_{21} & \ddots & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ a_{k1} & \cdots & a_{k,k-1} & 1 \end{pmatrix} \tag{3}$$

Equation (1) can be transformed into the following reduced form VAR model:

$$y_t = \Phi_1 y_{t-1} + \Phi_2 y_{t-2} + \cdots + \Phi_s y_{t-s} + A^{-1}\Psi\varepsilon_t\,,\ \varepsilon_t \sim N(0, I_k) \tag{4}$$

where $\Phi_i = A^{-1}B_i$, for $i = 1, ..., s$. Then, we stack the elements in the rows of the Ψ_i's to form β ($k^2 s \times 1$ vector), and defining $X_t = I_k \otimes \left(y_{t-1}^{'}, \cdots, y_{t-s}^{'}\right)$, where $\otimes$ is the Kronecker-product, the model could be expressed as

$$y_t = X_t\beta + A^{-1}\Psi\varepsilon_t \tag{5}$$

where all the parameters in equation are not changing with time. We consider a time-varying parameter condition. The TVP-SV-VAR model could be written as:

$$y_t = X_t\beta_t + A_t^{-1}\Psi_t\varepsilon_t,\ t = s+1, \ldots, n \tag{6}$$

where the coefficients β_t, and the parameters A_t and Ψ_t are all time-varying.

According to Primiceri (2005b), the lower-triangular elements in A_t can be transformed as $a_t = \left(a_{21}, a_{31}, a_{32}, a_{41}, ..., a_{k,k-1}\right)'$ and $h_t = \left(h_{1,t}, ..., h_{kt}\right)'$, $h_{j,t} = log\sigma_{jt}^2$, for $j = 1, ..., k$, and $t = s+1, ..., n$. We assume that the time-varying parameters follow a random walk process as follows:

$$\begin{array}{l} \beta_{t+1} = \beta_t + u_{\beta t},\ \beta_{s+1} \sim N\left(\mu_{\beta_0}, \Psi_{\beta_0}\right), \\ a_{t+1} = a_t + u_{at},\ a_{s+1} \sim N\left(\mu_{a_0}, \Psi_{a_0}\right), \\ h_{t+1} = h_t + u_{ht},\ h_{s+1} \sim N\left(\mu_{h_0}, \Psi_{h_0}\right), \end{array} \quad \begin{pmatrix} \varepsilon_t \\ u_{\beta t} \\ u_{at} \\ u_{ht} \end{pmatrix} \sim N\left(0, \begin{pmatrix} I & 0 & 0 & 0 \\ 0 & \Psi_\beta & 0 & 0 \\ 0 & 0 & \Psi_a & 0 \\ 0 & 0 & 0 & \Psi_h \end{pmatrix}\right) \tag{7}$$

And for convenience, Ψ_β, Ψ_a and Ψ_h are all set to diagonal matrices. Furthermore, we use Markov Chain Monte Carlo (MCMC) algorithm for simulation sampling to lower the computational complexity of likelihood function, and estimate the model according to the posterior distribution, and the sampling frequency is 10,000 times [6].

2.2 Data

The data of economic policy uncertainty is daily and derived from https://economicpolicyuncertaintyinchina.weebly.com. For details, please refer to Huang and Luk [7]. For educational market data, we select education stock index from https://choice.eastmoney.com, which is compiled based on industry classification of China Securities Regulatory Commission. The sample period covers the period from Aug 4, 2011 to Jun 17, 2022, including 2503 observations. Moreover, the educational return (R) series is computed as the first difference of the natural logarithms of the original prices, and the educational volatility (V) series are obtained from GARCH (1,1). Examining the skewness and kurtosis values, all variables are found non-normality and display excess kurtosis. The unit root tests (ADF and PP) indicate that all variables are stationary, indicating that the data could be used to TVP-SV-VAR model.

Table 1. TVP-SV-VAR model estimation and diagnosis results.

		Mean	Stdev	95%L	95%U	Geweke	Inef.
EPU-R	$(\psi_b)_1$	0.0067	0.0007	0.0056	0.0082	0.594	62.10
	$(\psi_b)_2$	0.0072	0.0009	0.0058	0.0091	0.132	84.86
	$(\psi_a)_1$	0.0049	0.0003	0.0043	0.0055	0.264	32.69
	$(\psi_h)_1$	0.2820	0.0270	0.2123	0.3327	0.001	150.25
	$(\psi_h)_2$	0.3785	0.0238	0.3350	0.4286	0.105	37.89
EPU-V	$(\psi_b)_1$	0.0022	0.0002	0.0018	0.0027	0.244	110.56
	$(\psi_b)_2$	0.0023	0.0003	0.0018	0.0029	0.303	111.69
	$(\psi_a)_1$	0.0006	0.0008	0.0005	0.0010	0.320	9.76
	$(\psi_h)_1$	0.2452	0.0206	0.2053	0.2847	0.038	60.39
	$(\psi_h)_2$	3.3298	0.3570	2.3695	3.7330	0.002	343.55

3 Empirical Findings

3.1 Preliminary Tests and Model Setting

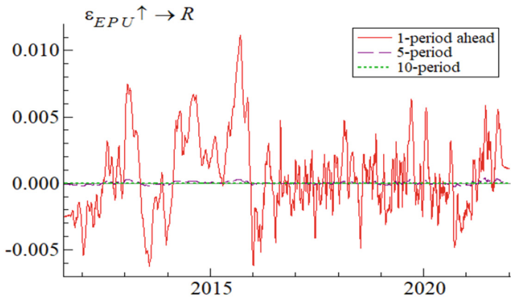
Table 1 shows the mean, standard deviation, 95% confidence interval and diagnostic statistics of the model parameters. The models have a small invalid factor. In summary, the estimations of the TVP-SVAR-SV model parameters in this paper are effective.

3.2 Dynamic Effects of EPU on Educational Market

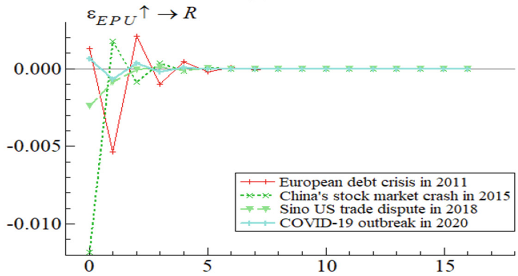
After estimating the parameters of the TVP-SVAR-SV model, we plot the impulse responses of the education index corresponding to the one-standard-deviation integrated EPU shock at 1, 5, 10 days of lag (one trading day, one trading week and two trading weeks, respectively), and at four specific points in time (European debt crisis, China's stock market crash, Sino-US trade dispute and COVID-19, respectively), see Fig. 1 and Fig. 2.

It can be seen from Fig. 1 that, apparently, the amplitudes and trends of impulse responses of return caused by economic policy uncertainty shocks are different. First, overall, the impulse responses are more likely to react positively educational market it can hedge against economic uncertainty to some extent, due to resilience and rigidity of education. Secondly, the 1-period EPU shocks are time-varying and presenting significant alternating effect of positive and negative, while the 5-period and 10-period effects reduce to zero and almost remain unchanged over total sample period, implying that the intertemporal effect of EPU on the return of educational market only exists in a short period of time. Thirdly, the dynamic effect after 2015 is stronger than before. This phenomenon could be explained by the fact that China's education goes on the road of industrialization and financialization. We further our analysis of to four important events. It can be seen from Fig. 1(b) that impulse responses of return to EPU shocks present significant hysteretic effect, which initially react negatively, then turn to positive two period later, and gradually decrease to zero after six periods, where the greatest influence event is China's stock market crash in 2015. We can conclude that the EPU does have a significant lagging influence on China's educational market.

Furthermore, we build another TVP-SV-VAR model like the previous section to analysis the impact on volatility of education markets during different periods and at different time points (see Fig. 2). Compared with return, the dynamic impulse responses of EPU shocks on volatility becomes more significant. Through observation the characteristics of impulse responses in the pictures, the entire sample period could be divided into two phases. Before 2016, the results indicate volatility clustering, high frequency and large fluctuating. But then, the amplitude of impact has become relatively small, but it is generally positive. This means volatility measure of education-type asset is important for portfolio hedge in the face of economic policy uncertainty. Panel b in Fig. 2 presents the response of education volatility to EPU shocks at four big events. We observe that at the time of China's stock market crash in 2015, EPU had a significant and persistent positive impact on education volatility with the effect decreasing dramatically up to one day and experiencing a slow and steady growth afterwards. The effect of EPU on returns, by contrast, displays an initial negative shock and then trends toward zero rapidly after five days. In the course of the Sino-US trade dispute in 2018 and COVID-19 outbreak in 2020, however, remarkable and persistent positive effect of EPU shocks on education volatility, suggesting that the feature of the event can act as a important determinant for how education reacts to EPU risks.



(a)



(b)

Fig. 1. Dynamic effects of EPU on return

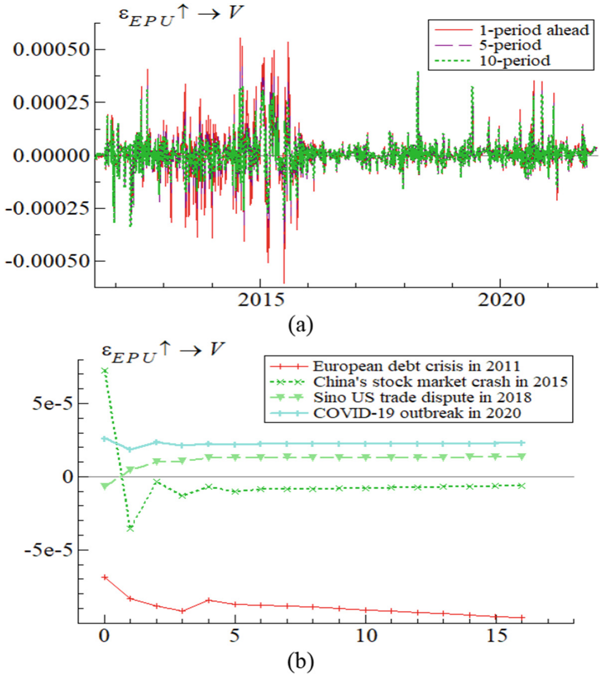


Fig. 2. Dynamic effects of EPU on volatility

4 Conclusions and Implications

Using the time-varying impulse response function of TVP-SV-VAR model, this paper makes an empirical study on the impacts of EPU on China's education market from Aug 4, 2011 to Jun 17, 2022. First, the shock effects of EPU shocks on China's education market return are dynamic and quite different at different time horizons, which are most significant in the short term. Second, according to the volatility analysis, the effect of uncertainty shocks is stronger at the mid-to long-term horizons, suggesting that uncertainty shocks have additive effects on education market volatility. Third, the four serious risk events have significantly dynamic and lagging effects on education markets, and the Sino-US trade dispute and COVID-19 shocks give the most contribution to market fluctuations.

Based on the conclusions above, some important policy recommendations can be drawn as follows: First, since the EPU have a significant time-varying impact on education market, the stakeholders organizations and policy makers should cooperate and establish an emergency mechanism for stability and reduced the sharp market fluctuations. It is necessary for analysts and investors to track major events. Second, Education market is a good safe-haven to hedge against the uncertainty of economic policy. For this reason, the inclusion of education stock in investment portfolio and hedge management helps to lower the systematic risk of returns. Third, considering the importance of EPU in explaining education market volatility, education practitioners should think about the future trend and potential risks of the education industry from a macroeconomic level perspective.

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