6. EFFECTS OF GLOBAL ECONOMIC, POLITICAL AND GEOPOLITICAL UNCERTAINTIES ON THE TURKISH ECONOMY: A SVAR ANALYSIS

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Abstract

This study empirically examines for the first time the simultaneous effects of global economic, political and geopolitical uncertainties (GEPGU) on the Turkish economy over the period from 1992:Q1 to 2018:Q3, in a structural vector autoregressive analysis. The evidence from this study indicates that GEPGU has negative and quantitatively meaningful effects on the main macroeconomic indicators (inflation rate, interest rate, unemployment rate, exchange rate, current account balance and economic growth) of the Turkish economy in the short and/or long run. These findings point towards the fact that GEPGU is a potentially important external factor that may undermine the recovery process of the Turkish economy. Therefore, along with proactive and moderate foreign policies, the Turkish policy makers should expand or redesign the traditional fiscal and monetary policies in order to respond to the external instability elements immediately and to reduce the pre-existing GEPGU to which the economy has to be exposed.

Keywords: economic uncertainty, policy uncertainty, geopolitical uncertainty, Turkish economy, SVAR analysis, Principal Component Analysis

JEL Classification: C22, D81, E60, O50

1. Introduction

The global economic growth, which reveals a slower pace than its potential since the 2008 financial crisis and the subsequent recession period, has entered a new recovery process since 2017. The reconstruction process is expected to be largely completed by the end of 2019 in a conjuncture in which the extraordinary expansion steps taken by the central banks of the developed countries have been replaced by normalisation. These expectations are supported by the fact that the growth rates increase in most of the developed countries,

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especially in the United States and the European Union (EU) countries, that inflation showed a moderate upward trend and that the unemployment rate dropped to its lowest levels after the global crisis (TMB, 2018a: 1-2). The expectations of organisations such as the International Monetary Fund (IMF) and the Organisation for Economic Co-operation and Development (OECD) that the global growth rate, which reached 3.6% in 2017, will increase steadily to 3.9% by 2019 indicate that the recovery of the global economy will continue (IMF, 2018a: 1; OECD, 2018: 2-3). Although these growth rates remain below the pre-crisis potential of 4%–4.5%, their upward revisions at systematic intervals in almost all the developed countries that were mostly affected by the global crisis, such as the United States and the EU countries, reinforce the positive expectations about the future of the global economy's recovery (TÜSİAD, 2018: 3).

Despite this positive outlook, there are several economic, political and geopolitical (EPG) risks that are expected to be decisive in the future of the global economic conjuncture. Whether or not the monetary normalisation steps taken by the central banks in the developed countries, such as the Federal Reserve System (FED) and the European Central Bank (ECB), will be in accordance with the expectations, the possible effects of these steps on the global capital flows may be considered a major part of such risks. Indeed, the tightening of monetary policies of the central banks may be achieved faster than anticipated, and the fragilities in the global financial markets may increase if the US tax reform suppresses the public budget deficits (TCMB, 2018: 11). The possibility of an upsurge in the global inflation due to the increase in commodity prices, including oil prices, and the pressure of decreasing unemployment rates on wages are among such risks (IMF, 2018b: 2). These economically viable risks are also accompanied by political and geopolitical risks, some of which have been carried over from the previous periods, such as the following: the inability of the United Kingdom to clearly reveal its programme for the Brexit process; the ongoing discussions on Brexit and the increase in the importance of inward-oriented policies in the EU countries; the unpredictability of the US policies led by Donald Trump; Russian Federation's quest for a position of power in the new world order and the uncertainty of its possible effects on the global economic order; the emergence of implementation of populist and protectionist policies; and the unresolved tensions originating in the Middle East, with a progressively expanding sphere of influence (TCMB, 2017: 9; GBPC, 2018: 6-7).

All these indicate that the developments creating global uncertainty in terms of EPG stand as a major risk factor for the economic recovery, because heightened uncertainty has some negative effects on the demand and supply sides of the economy. These negative effects occur through three different channels, depending on the behaviours of the economic units. The first channel is related to the household sector. A jump in uncertainty induces households to postpone consumption decisions and save more to ensure themselves against the negative shocks to income; this is called the precautionary savings motive (Caroll, 1996). This motive may harm economic growth by slacking the domestic demand, which puts downward pressure on inflation, whereas uncertainty does not affect the supply side of the economy (Haddow *et al*., 2013). The second channel is related to firms. During periods of heightened uncertainty, firms may postpone investment with the 'wait-and-see' effect and hiring decisions (Dixit and Pindyck, 1994; Bloom, 2009) and become more reluctant to enter new markets (Haddow *et al*., 2013). These behaviours are likely to produce a rapid decrease in output and employment and reduce supply, which puts upward pressure on inflation in contrast to the slacking demand. The third channel is related to the financial sector. Elevated uncertainty can reduce asset prices and make them more volatile. This situation leads the investors that hold assets to require more compensation that may increase risk premium, which can discourage investment as the cost of credit has a negative effect on the financial wealth of investors (Haddow *et al*., 2013, Şahinöz and Coşar, 2018). In addition, higher uncertainty may restrict the bank loans for other sectors. Thus, it may lead to a sharp and persistent widening of credit spreads, which restricts capital expenditures (Gilchrist *et al*., 2014). In addition, heightened uncertainty can reverse capital flows by increasing fluctuations in the financial markets, increase the opportunity cost of financial investments by restricting access opportunities to both domestic and external financial sources and limit investment decisions by reducing the risk appetite of the financial actors. In this context, by settling on a normal growth and inflation trend after a long stagnation period, the global economy enters a new process in which recovery is considered the strongest scenario, and the global EPG risk factors are closely monitored (TMB, 2017b: 1). In this process, the possibility of a reduction in global liquidity, together with high capital volatility and low risk appetite, further increases the risks in the developing countries, although a significant portion of the uncertainties that constitute the downside risks to the global economic outlook originates from the developed countries (TÜSİAD, 2018: 4). Thus, the possibility of a change in the capital flows from the developing to the developed countries causes the pressures to be felt relatively heavier on the economic growth outlook of the developing countries, particularly the countries where the level of domestic savings is low, the sustainability of current account deficits is weak, the cost of accessing foreign financing sources is high and the national currencies are depreciated against foreign currencies (TMB, 2017a: 6). This condition indicates that a possible deterioration in the recovery process of the global economy may be caused mostly by the developing countries.

During such a period, Turkey, given its position on the global economic platform in terms of EPG, is among the developing countries that are most likely to be affected by these developments that constitute uncertainty and cause a global risk. Indeed, the Turkish economy enters the global economic conjuncture by experiencing the effects of a series of global-scale EPG uncertainty factors, which stem from both the current and the previous periods, in its macroeconomic indicators. The EPG uncertainties, which showed initial effects on the financial markets during the previous periods, caused Turkey to deviate towards the negative direction as opposed to other developing countries by increasing the Turkish lira's value losses against the foreign currencies (TCMB, 2017: 2). As the value losses in the lira continue, the Turkish economy enters the current period of global conjuncture with an outlook in which the volatility in the financial markets and the cost of accessing external funding sources are increasing; the public budget balance is deteriorating; the current account deficits are increasing and financing is becoming more difficult; the inflation, interest and unemployment rates are increasing; and the fiscal pressures on the economic growth rates are also increasing (TMB, 2018b: 13-15). This outlook raises some concerns, such as how the deteriorating macroeconomic indicators of the Turkish economy will be affected by the EPG uncertainties that are expected to be decisive in the current economic conjuncture, and whether the economic growth rate in the past few years will become sustainable. As its first contribution to the existing literature, this study provides empirical evidence that sheds light on the solution to these concerns and offers insightful suggestions to policy makers to reduce the negative effects of these uncertainties on the Turkish economy. The second contribution is that we use a single variable that can measure the simultaneous effects of the global economic, political and geopolitical uncertainties (GEPGU) on the macroeconomic variables of an emerging country, Turkey, although many studies mainly conducted on developed countries have considered only the importance of the economic policy uncertainty (EPU) or the geopolitical uncertainty (GPU).

The rest of the study is organised as follows. The second section explains the literature with an emphasis on the relationship between uncertainty and the macroeconomic variables and on the approaches to measuring the EPU and the global economic policy uncertainty (GEPU). The third section introduces the scope and dataset of the study. The fourth section examines the effects of the GEPGU on the macroeconomic indicators of the Turkish economy in the period from 1992:Q1 to 2018: Q3 through the structural vector autoregressive (SVAR) methodology. The fifth section discusses the research findings and policy implications.

2. Literature Review

Studies investigating the effects of EPU on economies using the EPU index developed by Baker *et al*. (2013) for the USA have progressed only in the past few years, and they generally focus on the effects of EPU and not so much on the simultaneous effects of the GEPGU. The EPU index[3], which reflects the frequency of articles in leading newspapers containing some keywords pertaining to the economy, policy and uncertainty, may simultaneously measure the effects of developments that cause economic and political uncertainty (Baker *et al*., 2015: 1-7). The economic and political uncertainty level of the global economy can also be measured through the GEPU index, which is constructed by the gross domestic product (GDP)-weighted average of the national EPU indices (Davis, 2016: 3). Following Baker *et al*. (2013), a large number of empirical studies investigated the simultaneous effects of economic and political uncertainties on various countries and country groups. A significant part of these studies conducted for countries that have their own EPU indices has examined the 'direct effects' of EPU on economic activity (Baker *et al*., 2013; Lovato, 2013; Bhagat *et al*., 2013; Baker *et al*., 2015; Lee, 2015; Zalla, 2017; Ferrara and Guérin, 2016; Čižmešija *et al*., 2017; Dima *et al*., 2017; Soric and Lolic, 2017; Dai *et al*., 2017; Arbatli *et al*., 2017; Yalçınkaya and Aydın, 2017; Charles *et al*., 2018; Hardouvelis *et al*., 2018; Cerda *et al*., 2018; Rice *et al*., 2018, Jiang *et al*., 2018; Handley and Li, 2018). Some other studies have mentioned the 'reflection effects' of the EPU index values and the 'indirect effects' of these uncertainties originating from the United States (Stockhammar and Österholm, 2014; Luk *et al*., 2017; Nowzohour and Stracca, 2017; Stockhammar and Österholm, 2017; Nyawo and Van Wyk, 2018; Fontaine *et al*., 2018) and the EU (Manteu and Serra, 2017) on developed and developing countries. Moreover, some studies have examined the effects of uncertainty on the behaviours of firms and individuals. For example, Masayuki (2017) analysed the effect of policy uncertainty on the saving and consumption behaviours of households using the original survey data of 10,000 individuals and found that policy uncertainty leads individuals to save more through the precautionary saving motive. Gu *et al*. (2018) studied the effects of EPU on the corporate investments of 671 Chinese firms and concluded that EPU has a more obvious effect on firms with a low external demand than on firms with a high external demand. Ghosal and Ye (2019) examined how uncertainty might influence the number of businesses and whether firm size had an important role in the magnitude of such an effect. The study concluded that higher uncertainty had a significantly negative effect on the number of businesses and that relatively smaller businesses were more vulnerable to these effects.

[3] *For more detailed information on the countries within the scope of the GEPU index and the method of constructing the GEPU index, see Davis (2016: 1-13).*

Without any exception, all these studies conclude that the economic policy uncertainties have significant and mainly adverse effects on the economic variables in the short and/or long run. The ability to measure the EPU extends the scope of the literature. As a reflection of this situation, the geopolitical uncertainties in parallel with the recent developments in the global economy may also be defined and measured with the same methodology. Caldara and Iacoviello (2018) developed the GPU index to measure the effects of geopolitical uncertainty in the global economy. In other words, the GPU index is calculated to measure the effects of geopolitical events that cause uncertainty with wars, terrorist actions and interstate tensions in the global economy by considering the power struggle over territories that cannot be solved peacefully. Generally, the GPU index[4] is measured on the basis of the articles published in the United States, the United Kingdom and Canada's leading international newspapers containing geopolitical events that are of global interest (Caldara and Iacoviello, 2018: 2-3). In the study of Caldara and Iacoviello (2018), the simultaneous effects of the GPU on the US economy for the period of 1985–2016 were investigated by employing the GPU index, and the GPU uncertainties were found to have a significant and generally adverse effect on macroeconomic indicators such as employment and trade. Consequently, the empirical studies on the relationship between the economic, political and/or geopolitical uncertainties and the macroeconomic indicators started to be conducted with the ability to measure normatively the effects of the events that created uncertainty in the EPG in the global economy by employing the EPU and GPU indices. All such studies that were mostly conducted on the advanced countries, especially the United States, found that the developments creating global uncertainty in terms of EPG had adverse effects on the macroeconomic indicators. However, the current study differs from the recent studies in that it constructs a single variable obtained by the principal component analysis (PCA), which reflects the simultaneous effects of the GEPGU on the macroeconomic indicators of the Turkish economy. From this view, the methodology and findings of this study are considered to contribute to the development of the existing literature.

3. Data and Scope of the Study

This study uses the quarterly variables for the period 1992:Q1–2018:Q3. The reason for using this period is that the time series data may be obtained from various databases without interruption. Table 1 shows these variables and the data sources.

Table 1

Definitions and Sources of Data

Abbreviations	Definitions	Units	Sources
GEPGU	Global Economic, Political and Geopolitical Uncertainties	Index	http://www.policyuncertainty.com/. Authors' calculations based on the GEPU and GPU indices.
INR	Inflation Rate (CPI, 2015=100)	Index	OECD-Stat (Organization for Economic Cooperation and Development Statistics-2018).
RGDP	Reel Gross Domestic Product	USD-PPP (base=2015)	

[4] *For more detailed information on the GPU index and its measurement method, see Caldara and Iacoviello (2018: 1-64).*

Abbreviations	Definitions	Units	Sources
CAB	Current Account Balance	USD ($)	
MIR	Money Market Interest Rates	Percentage (%)	
UNR	Unemployment Rate	Percentage (%)	TÜİK (Turkish Statistical Institute-2018).
NER	Nominal Effective Exchange Rate	Special Drawing Right (SDR)	IMF-MFS (International Monetary Fund-Monetary and Financial Statistics-2018).

We establish the data on the GEPGU variable to measure the global EPG uncertainties simultaneously by using the data on the GEPU and GPU indices sourced from related databases. Here, the GEPU index values are sourced from available data on the GDP-weighted values (in USD and PPP) of the monthly EPU index values calculated for 20 countries (the United States, Germany, Australia, Brazil, China, France, South Korea, India, the Netherlands, the United Kingdom, Italy, Spain, Sweden, Ireland, Japan, Canada, Mexico, Russian Federation, Chile, and Greece) that have the power to represent the global economy. The GPU index values are also sourced from available data on the monthly GPU index values of the global economy. In deriving the GEPGU variable, we first calculate the quarterly GEPU and GPU index values for the period 1992–2018 by averaging the quarterly arithmetic means of these values. As the data on the GEPU index are available from 1997 in the related database, the quarterly values of this index for 1992–1996 are derived by taking the arithmetic means of the EPU index values of the mentioned countries. Then, we derive the index values of the GEPGU variable by employing the PCA after taking the logarithm of the GEPU and GPU index values for the period1992–2018. The PCA allows for obtaining a new variable that is reduced from the linear components of the variables to reflect the structure explained by the number of correlated variables and their observed variances (Hotelling, 1933: 417-41). Therefore, the simultaneous effects of strongly correlated global EPG uncertainties can be measured by a single variable. In addition, the RGDP variable is sourced from the related database as a seasonally adjusted available series, and the other variables are seasonally adjusted by Census X-13 methodology to obtain more consistent results.

This study uses the natural logarithmic values of the indices and monetary indicators (GEPGU, INR, RGDP, CAB, and NER), except for the rational variables (MIR and UNR). As the CAB variable has negative values for a large part of the period from 1992:Q1 to 2018:Q3, we take the natural logarithm of the absolute values of this variable and eliminate the negative effects of this process on the real values of the CAB variable by multiplying the natural logarithmic values for the periods when the variable takes negative values by negative ones. In the empirical analyses of this study, we use the EViews 10.0 and Gauss 10.0 packages.

4. Methodology and Findings

In this section, the effects of the GEPGU on the major macroeconomic indicators of the Turkish economy are investigated using the SVAR approach during the 1992:Q1–2018Q:3 period. In a time-series analysis, the stability of the variables is crucial because biased test statistic values and the spurious regression phenomenon can arise when dealing with non-stationary variables. In addition, when investigating the stationarity in a time series analysis, disregarding the effects of structural changes and determining them incompetently may also cause unit root tests to give biased results (Yılancı and Öztürk, 2011: 265). To solve these problems and to achieve reliable results, the stationarity of the variables in the defined models in this study is investigated by using the KPT unit root test developed by Kapetanios (2005), which may analyse stability by including the effects of multiple structural changes during the observed period. Based on the assumption that the number and the date of structural breaks are unknown, the KPT unit root test allows for a maximum of five internally determined structural breaks. The stability of a time series in the KPT unit root test as (y_t) is examined on the basis of the following regression:

$$y_t = \mu_0 + \mu_1 t + \alpha y_{t-1} + \sum_{i=1}^{k} \gamma_i \, \Delta y_{t-i} + \sum_{i=1}^{m} \theta_i \, DU_{i,t} + \sum_{i=1}^{m} \varphi_i \, DT_{i,t} + \varepsilon_i \, . \quad (1)$$

The terms $DT_{i,t}$ and $DU_{i,t}$ denote the trend and the intercept break dummy variables defined as

$$DT_{i,t} = 1(t > T_{b,i})(t - T_{b,i}), \;\; DU_{i,t} = 1(t > T_{b,i}) \quad (2)$$

$$DT_{i,t} = \begin{cases} t > T_{b,i} & \Rightarrow \;\; t - T_{b,i} \\ Otherwise & \Rightarrow \;\; 0 \end{cases}, \qquad DU_{i,t} = \begin{cases} t > T_{b,i} & \Rightarrow \;\; 1 \\ Otherwise & \Rightarrow \;\; 0 \end{cases} \quad (3)$$

where: the $T_{b,i}$ +1 is the date of the *i*th structural break (i=1,2,…,m), and $(\sum_{i=1}^{k} \gamma_i \, \Delta y_{t-i})$ is the difference value of the (y_t) series added to the right side of Equation (1) to eliminate the possible autocorrelation problem. In Equation (1), as $\varphi_1 = \varphi_2 = \cdots = \varphi_m = 0$, Model A, which allows for structural breaks only in the fixed term, is valid. As $\theta_1 = \theta_2 = \cdots = \theta_m = 0$, Model B, which allows for structural breaks only in the trend, is valid. In case that these restrictions are not valid, Model C, which allows for structural breaks both in the fixed term and in the trend, is valid. In the KPT unit root test, the numbers and dates of the structural breaks in the series are detected by Bai and Perron's (1998) algorithm. As it maintains the structural break dates determined in the previous stage as fixed in every stage, this method mainly consists of two stages. In the first stage, each date in the research period is estimated as a possible date of the structural breaks, and the error sum of squares (SSE) of the model is obtained. Then, the unit root test statistics are calculated for one structural break date by considering the dummy variables in the model at which the SSE is at a minimum. In the second stage, the unit root test statistics are recalculated by considering all the possible structural break dates and by adding dummy variables to the model to give the second structural break date. The calculated test statistics after the determination of the structural break dates are compared with the critical table values in Kapetanios' (2005) study, and the hypotheses are tested for stability. Here, if the calculated test statistics are higher in absolute value than the critical table values, the null hypothesis 'the series includes unit root with structural breaks' is rejected, and the series is stationary with structural breaks (Kapetanios, 2005: 124-128). The results of the KPT unit root test (Table 2) show that all the variables are stationary in their levels.

The results in Table 2 also indicate that all the variables are subjected to structural breaks at various dates during the research period. These breaks, which have short-term effects on the variables, do not affect the stability of the degrees of the variables.

Table 2

Results of the KPT Unit Root Test with Multiple Structural Breaks

	Variables	KPT Test Statistic	Critical Table Values		NB	BD
			1%	5%		
Model A	GEPGU	-7.07*	-6.99	-6.53	3	2003:Q1-2015:Q2-2017:Q1
	RGDP	-8.81*	-8.25	-7.64	4	1994:Q1-1995:Q2-1996:Q3-1998:Q3
	UNR	-6.05**	-6.16	-5.68	2	1995:Q2-2001:Q3
	NNER	-6.45*	-6.16	-5.68	2	2001:Q4-2003:Q1
	MIR	-10.48*	-8.25	-7.64	4	2002:Q2-2004:Q1-2005:Q2-2007:Q3
	INR	-8.88*	-8.25	-7.64	4	2002:Q1-2003:Q2-2005:Q3-2007:Q3
	CAB	-8.42*	-8.25	-7.64	4	2003:Q3-2004:Q4-2009:Q3-2010:Q4
Model B	GEPGU	-8.19*	-6.86	-6.31	4	2002:Q3-2013:Q4-2015:Q1-2017:Q1
	RGDP	-6.33**	-6.86	-6.31	4	2001:Q2-2008:Q1-2010:Q1-2012:Q4
	UNR	-4.91**	-5.01	-4.49	1	2009:Q1
	NER	-5.80**	-6.29	-5.73	3	1994:Q2-1995:Q4-1999:Q3
	MIR	-10.14*	-5.62	-5.09	2	2010:Q2-2015:Q2
	INR	-10.51*	-7.40	-6.71	4	1999:Q4-2001:Q1-2002:Q3-2010:Q2
	CAB	-8.22*	-7.40	-6.72	4	1993:Q1-1994:Q2-2011:Q4-2015:Q2
Model C	GEPGU	-6.39**	-6.59	-6.11	2	2003:Q1-2014:Q2
	RGDP	-7.76**	-8.24	-7.73	4	1993:Q1-1994:Q2-2000:Q1-2001:Q4
	UNR	-6.31**	-6.59	-6.11	2	1997:Q2-2001:Q2
	NER	-7.88**	-8.24	-7.74	4	2001:Q4-2010:Q4-2013:Q1-2016:Q1
	MIR	-10.49*	-9.04	-8.34	4	1994:Q1-2003:Q1-2004:Q4-2006:Q1
	INR	-12.03*	-9.04	-8.34	4	1994:Q1-1995:Q2-1997:Q3-1999:Q4
	CAB	-9.80*	-9.04	-8.34	4	2003:Q3-2004:Q4-2006:Q2-2008:Q1

Note: '' and '**' indicate that the related series are stationary at 1% and 5% significance levels, respectively. The 'NB' and 'BD' columns show the numbers and the dates of the structural breaks, respectively, determined according to the minimum test statistics using the Akaike information criterion in the research period.*

To investigate the direction and size of the relationships between the EPG uncertainties and the macroeconomic variables, this study employs the SVAR model using the level values of the variables. The SVAR model, developed by Sims (1986), Bernanke (1986) and Shapiro and Watson (1988), removes the uncertain constraints on the parameters and estimation results varying in the sequence of the variables. The SVAR model, which was developed as an alternative to overcome the deficiencies in the standard VAR model, aims to structurally determine the error terms and the parameters (a linear composition of external shocks) by imposing short- and long-term restrictions on the variables consistent with economic theory (Fry and Pagan, 2011: 938). The SVAR model, in which a standard VAR model is transformed into a structural equation system using the economic theory, enables the development of propositions on the effects of significant changes in the economy or the effects of certain policies (Narayan *et al*., 2008: 2765).

Based on the following structural equation system, a SVAR(p) model can be written as follows:

$$AZ_t = A_0 + C(L)Z_{t-1} + B\varepsilon_t \,, \tag{4}$$

where: (A) is the $(k \times k)$ dimensional matrix of the structural coefficients, (Z_t) is the $(k \times 1)$ dimensional vector of the endogenous variables (GEPGU, NER, MIR, INR, CAB, RGDP, and UNR) at time (t), (A_0) is the $(k \times 1)$ dimensional vector of constant terms, $(C(L))$ is the $(k \times k)$ dimensional matrix of lag length L and (Z_{t-1}) is the $(k \times 1)$ dimensional vector of the lagged endogenous variables in the model. (B) is the $(k \times k)$ dimensional matrix that indicates the linear relations between the structural shocks (changes) and their reduced forms, and (ε_t) is the $(k \times 1)$ dimensional vector of non-relational and normally distributed structural shocks (Lütkepohl, 2005: 13-14). When Equation (4) is multiplied by (A^{-1}), the reduced-form VAR model can be rewritten as follows:

$$Z_t = v + D(L)Z_{t-1} + \mu_t, \tag{5}$$

where: $(v = A^{-1}A_0)$, $(D(L) = A^{-1}C(L))$ and $(\mu_t = A^{-1}B\varepsilon_t)$, (μ_t) is the $(k \times (1))$ dimensional vector of shocks in the reduced form that can be simultaneously correlated with each other but is serially uncorrelated and normally distributed. The relations between (μ_t) (reduced-form shocks) and (ε_t) (structural shocks) are expressed as follows:

$$Au_t = B_{\varepsilon t}, \tag{6}$$

where: (A) and (B) are the square matrices describing the instant relations between the variables and the linear relations between the reduced-form shocks, respectively. As the reduced-form shock, (μ_t), is a linear combination of structural shocks, it cannot be interpreted in an economic sense, whereas an unobserved structural-form shock, (ε_t), can be interpreted in an economic sense (Onafowora and Owoye, 2017). In this context, it is necessary to estimate the reduced VAR model in Equation (5) by converting it into the SVAR model and determining the structural shocks obtained from the variance–covariance matrix of the residuals in the reduced form with economically appropriate restrictions on the A and B matrices. Regarding the $(Au_t = B_{\varepsilon t})$ relationship, the covariance matrix of the structural shocks consisting of restrictions as $((n^2 - n)/2))$ on the A and B matrices should be equal to the multiplication of the restriction matrix by the covariance matrix of the residuals of the reduced VAR model. Here, (n) indicates the number of endogenous variables in the reduced VAR model.

According to the restrictions imposed on the A and/or B matrices, the SVAR model is based on the detection system, which is generally grouped into three forms, namely, the A, B, and AB models. Model A, in which the autoregressive coefficients are emphasised, is developed to investigate the direct observable instant relations between the variables. Model B, in which the structural shocks are obtained from the reduced form of the residuals, is developed to investigate the effects of the structural shocks on the variables. Model B is a unit matrix, with $((n^2 - n)/2)$ number of restrictions imposed on model A. Similarly, model A is a unit matrix, with $((n^2 - n)/2)$ number of restrictions imposed on model B. In model AB, which deals with the effects of both the instant relations between variables and the reduced form of the structural shocks, $((n^2 - n)/2)$ is the number of restrictions imposed on models A and B (Lütkepohl, 2005: 358-368). As this study aims to explore the effects of both the instant relations between the GEPGU and the macroeconomic indicators of the Turkish economy and the reduced form of the structural shocks, the SVAR(p) model, which is estimated to detect the dynamic interactions between the variables, is based on the model AB detection system. The model AB detection system, which was developed by Amisano and Giannini (1997) and Blanchard and Perotti (2002), is based on the assumption that the endogenous variables in model A are not simultaneously affected by the structural shocks in model B, and it allows the separation of the effects of the instant structural shocks on the variables in the endogenous model during the examination period.

In this direction, by assuming that the macroeconomic indicators of the Turkish economy are simultaneously affected by the changes (structural shocks) in the GEPGU and that the GEPGU is affected by the changes in these indicators with a lag, the endogenous variables are included in the A matrix in the following order: GEPGU, NER, MIR, INR, CAB, RGDP, and UNR. With this order, the A and B matrices turn into a diagonal structure. To show the instant relations among the structural shocks and their reduced forms, the A and B matrices can be written as follows:

$$\begin{bmatrix} 1 & 0 & \dots & \dots & \dots & \dots & 0 \\ \alpha_{21} & 1 & \ddots & \dots & \dots & \dots & \vdots \\ \alpha_{31} & \alpha_{32} & 1 & \ddots & \dots & \dots & \vdots \\ \alpha_{41} & \alpha_{42} & \alpha_{43} & 1 & \ddots & \dots & \vdots \\ \alpha_{51} & \alpha_{52} & \alpha_{53} & \alpha_{54} & 1 & \ddots & \vdots \\ \alpha_{61} & \alpha_{62} & \alpha_{63} & \alpha_{64} & \alpha_{65} & 1 & 0 \\ \alpha_{71} & \alpha_{72} & \alpha_{73} & \alpha_{74} & \alpha_{75} & \alpha_{76} & 1 \end{bmatrix} \begin{bmatrix} \mu_t^{GEPGU} \\ \mu_t^{NER} \\ \mu_t^{MIR} \\ \mu_t^{INR} \\ \mu_t^{CAB} \\ \mu_t^{RGDP} \\ \mu_t^{UNR} \end{bmatrix} = \begin{bmatrix} \beta_{11} & 0 & \dots & \dots & \dots & \dots & 0 \\ 0 & \beta_{22} & \ddots & \dots & \dots & \dots & \vdots \\ \vdots & \ddots & \beta_{33} & \ddots & \dots & \dots & \vdots \\ \vdots & \dots & \ddots & \beta_{44} & \ddots & \dots & \vdots \\ \vdots & \dots & \dots & \ddots & \beta_{55} & \ddots & \vdots \\ \vdots & \dots & \dots & \dots & \ddots & \beta_{66} & 0 \\ 0 & \dots & \dots & \dots & \dots & 0 & \beta_{77} \end{bmatrix} \begin{bmatrix} \varepsilon_t^{GEPGU} \\ \varepsilon_t^{NER} \\ \varepsilon_t^{MIR} \\ \varepsilon_t^{INR} \\ \varepsilon_t^{CAB} \\ \varepsilon_t^{RGDP} \\ \varepsilon_t^{UNR} \end{bmatrix} \quad (7)$$

Here, (α_n) and (β_n) are the structural restrictions imposed on the endogenous variables in the A and B matrices, consistent with the economic theory; (μ_t^n) is the shocks in the variables obtained from the residuals of the reduced form of the VAR model; and (ε_t^n) is the structural shocks in the variables obtained by multiplying the restriction matrix and the reduced form of the shocks by the covariance matrix. With this order, the AB matrix in Equation (7) shows that the variables (NER, MIR, INR, CAB, RGDP, and UNR) are simultaneously affected by the structural shocks (ε_t^{GEPGU}) in the GEPGU variable and that the GEPGU variable is affected by the changes in the macroeconomic variables only with a lag. This condition is also valid in terms of other macroeconomic variables in accordance with their order in the AB matrix.

By determining the structural coefficients (α_n) and (β_n) of all the endogenous variables in the AB matrix through the estimation of the SVAR(p) model, the dynamic interactions between the macroeconomic variables of Turkey and the global EPG uncertainties can be detected using the impulse-response functions and the variance decomposition analyses. The impulse-response functions investigating the dynamic interactions between the variables show the effects of a one-standard-deviation change (structural shock) in the endogenous variables on the present and future values of other variables. The variance decomposition examining the sources of structural shocks in the variables indicates how much of the variation in the endogenous variables is due to their own shocks and to the shocks in other variables in the system (Lütkepohl, 2005: 51-66). To estimate the SVAR(p) model, which is identified on the basis of the AB detection system, determining the optimal lag length that resolves the autocorrelation in the residuals of the VAR model is necessary. After estimating the reduced VAR model by the ordinary least square methodology, the model should pass the structural consistency tests such as heteroscedasticity, autocorrelation and normality, among others (Damane, 2018: 806-807).

In this study, the optimal lag length for the SVAR(p) model is determined as 3 according to the Akaike information criterion and the Schwarz information criterion. At this optimal lag length, the residuals are found to not be related to each other using the Lagrange multiplier (LM) autocorrelation test, as the probability values of the LM test statistics of the SVAR(3) model in Table 3 are higher than 0.05. Therefore, the corresponding null hypothesis 'the residuals in the model are unrelated' cannot be rejected. In addition, as confirmed by the inverse roots of the AR characteristic polynomial situated in the unit circle, the SVAR(3) model is steady and satisfies the stationary conditions. The residuals in the SVAR(3) model are normally distributed, and the variance of the residuals is fixed for all of the observations using the normality and White's heteroskedasticity tests (WHT), as the probability values of the test statistics of Jarque–Bera and WHT (chi-square) are higher than 0.05. Therefore, the corresponding null hypothesis 'the variance of the residuals in the model is fixed' and 'the residuals in the model are normally distributed' cannot be rejected. These findings confirm that the SVAR(3) model is steady and does not have a structural issue. Table 3 presents the results of the multiplier matrix of the SVAR(3) model.

To determine the consistency of the findings obtained from the SVAR(3) AB model, the effect of the structural shocks in the GEPGU on the macroeconomic indicators of the Turkish economy is also analysed by the SVAR(3) B model, which is based on the imposing restrictions only on the B model[5]. Consistent with the results of the SVAR(3) AB model, the findings obtained from the impulse-response functions and the variance decomposition analysis of the SVAR(3) B model, which is estimated by following the econometric methodology applied for the SVAR(3) AB model and tested for structural consistency, are presented in the Appendix.

Table 3

Results of the Multiplier Matrix of the SVAR Model

Structural Coefficients					
Matrix A	Coefficients	STE.	Matrix B	Coefficients	STE.
(α_{21})	-0.0348**	0.0152[0.022]	(β_{22})	0.0589*	0.0041[0.000]
(α_{31})	-0.1756**	0.0729[0.016]	(β_{33})	31.975*	2.2278[0.000]
(α_{41})	0.0027	0.0041[0.516]	(β_{44})	0.0192*	0.0013[0.000]
(α_{51})	0.5205	0.8326[0.532]	(β_{55})	3.7636*	0.2622[0.000]
(α_{61})	-0.0068**	0.0028[0.045]	(β_{66})	0.0179*	0.0012[0.000]
(α_{71})	-0.0474**	0.0213[0.026]	(β_{77})	0.9774*	0.0681[0.000]
Diagnostic Tests					
LM	58.49 [0.166]				
Estimated from SVAR (Jarque-Bera)	2.001 [0.367]				
WHT (Chi-Square)	5380.50 [0.495]				

Note: ''and '**' indicate that the Z-statistics of the coefficients are significant at the 1% and 5% significance levels; STE shows the standard errors of the coefficients; and '[ ]' indicates the value of probabilities.*

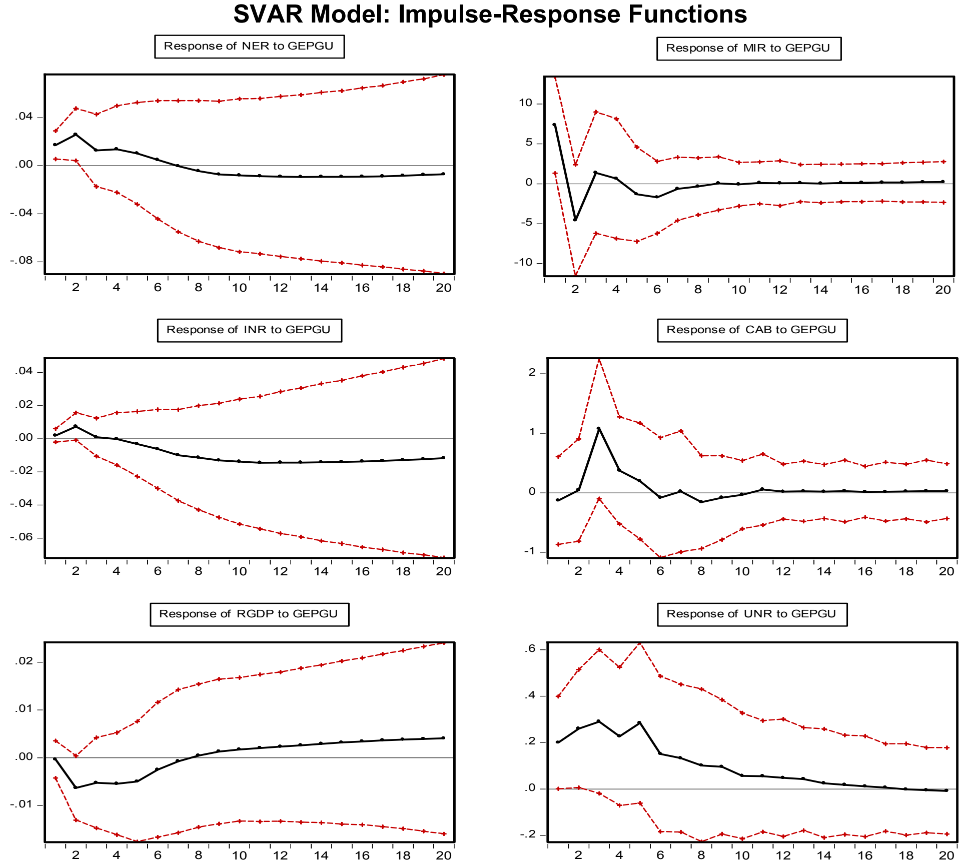
[5] *For further information on the restrictions imposed on the B model and the detection system including the endogenous variables in SVAR(3) model in the A matrix (*e.g. *GEPGU, NER, MIR, INR, CAP, RGDP and UNR), see Lüthkepol (2005: 358-368).*

Here, (α_n) represents the structural coefficients (restrictions) in matrix A and indicates the effects of the structural shocks of the GEPGU on the macroeconomic indicators, such as NER, MIR, INR, CAB, RGDP, and UNR, respectively. (β_n) indicates the structural coefficients in the B matrix and shows the lagged effects of the structural shocks in the NER, MIR, INR, CAB, RGDP, and UNR variables on the GEPGU.

Along with the absence of a consistent estimation of the objective coefficients, the signs and significance levels of the coefficients of the multiplier matrix give prior knowledge about the effects of the structural shocks of the GEPGU. As shown in the findings in Table 3, the structural shocks of the GEPGU have statistically significant effects on NER, MIR, RGDP and UNR and statistically insignificant effects on the other variables. The results of the impulse-response function analyses of the SVAR(3) model are presented in Figure 1.

Figure 1

SVAR Model: Impulse-Response Functions



Note: Graphs indicate responses of the variables to one standard deviation change in global economic, political and geopolitical uncertainties within the confidence interval of ± 2.

As Figure 1 shows, the NER, MIR, INR, CAB, RGDP, and UNR variables respond to the one-standard-deviation structural shocks in the GEPGU at different levels and lags. The initial response of NER to the one-standard-deviation structural shocks in the GEPGU is positive and appears to have a continuously increasing trend up to the third period. This positive directional response decreases continuously from the third period to the eighth period, becomes negative from the ninth period and then gradually loses its influence with the passing of time. The initial response of MIR to the GEPGU in the first period is positive, and the degree of this positive directional response decreases continuously up to the second period. In the second period, it turns negative and then fluctuates positively or negatively until the eighth period. The initial response of INR to the GEPGU in the first period is positive, and this positive directional response declines continuously up to the fifth period. Following the fifth period, it turns negative and lasts during the entire period.

Figure 1 shows that the response of CAB to the GEPGU has a negative sign in the first period, returns to positive in the second period and takes to its maximum level until the sixth period. It returns to negative in the seventh period and then follows a fluctuating course. It generally maintains its negative sign, but gradually loses its influence with the passing of time.

The initial response of RGDP to the GEPGU in the first period has a negative sign, and this negative directional response persists up to the eighth period. Following the eighth period, it turns positive, and the degree of the response declines during the process. The initial response of UNR to the GEPGU in the first period has a positive sign, and this positive directional response seems to have an upward trend, although not always, until the sixth period. The degree of the positive directional response declines continuously from the sixth period and gradually loses its influence with the passing of time.

The results of the variance decomposition analysis of the SVAR(3) model, which explores the dynamic interactions between the structural shocks of the GEPGU and the macroeconomic indicators of the Turkish economy, are presented in Table 4.

As shown in Table 4, approximately 92% of the variation of NER in the first sampling period is due to its own structural shocks, and GEPGU accounts for about 8%. After the first period, the role of NER in explaining its own variations with its internal dynamics declines continuously, and the significance of the external dynamics (GEPGU) increases up to the second period, gradually declining but maintaining its effect during the entire period. Approximately 91% of the variation of MIR in the first sampling period is due to its own structural shocks, and GEPGU accounts for about 5%. After the first period, the role of MIR in explaining its own variations with its internal dynamics declines continuously, and the significance of the GEPGU increases in the second period, maintaining its effect during the entire period. Approximately 75% of the variation of INR in the first sampling period is due to its own structural shocks, and the GEPGU accounts for 0.82%. After the first period, the role of INR in explaining its own variations with its internal dynamics declines continuously, and the importance of the GEPGU increases significantly, although it is discrete. Approximately 97% of the variation of CAB in the first sampling period is due to its own structural shocks, and the GEPGU accounts for 1%. Following the first period, the role of CAB in explaining its own variations with its internal dynamics declines continuously, and the significance of the GEPGU in explaining the variations in CAB increases significantly, although it is discrete. Approximately 83% of the variation of RGDP in the first sampling period is due to its own structural shocks, and the GEPGU accounts for hardly any. After the first period, the role of RGDP in explaining its own variations with its internal dynamics declines continuously, and the significance of the GEPGU increases continuously from the second period to the fourth period before gradually decreasing. Approximately 91% of the variation of RGDP in the first sampling period is due to its own structural shocks, and the

GEPGU accounts for 4%. After the first period, the role of UNR in explaining its own variations declines continuously, and the importance of GEPGU increases significantly.

Table 4

SVAR Model: Variance Decomposition Analysis

	NER			MIR			INR		
Period	STE.	ε_t^{GEPGU}	ε_t^{NER}	STE.	ε_t^{GEPGU}	ε_t^{MIR}	STE.	ε_t^{GEPGU}	ε_t^{INR}
1	0.061	7.86	92.14	33.57	4.82	90.74	0.022	0.82	75.35
2	0.111	7.93	67.72	34.24	6.41	87.21	0.040	3.71	41.63
3	0.142	5.63	60.10	34.81	6.37	84.95	0.056	1.90	34.64
4	0.167	4.71	57.27	35.12	6.29	83.43	0.069	1.25	29.42
6	0.205	3.44	57.86	35.34	6.58	82.43	0.096	1.16	24.03
8	0.238	2.68	57.88	35.43	6.59	82.09	0.120	2.35	20.86
10	0.258	2.39	57.57	35.48	6.57	81.95	0.142	3.48	18.72
12	0.279	2.24	57.06	35.51	6.56	81.84	0.162	4.26	17.06
16	0.312	2.13	56.15	35.53	6.56	81.74	0.197	4.93	14.58
20	0.337	2.05	55.35	35.54	6.56	81.70	0.223	5.02	12.71
	CAB			RGDP			UNR		
Period	STE.	ε_t^{GEPGU}	ε_t^{CAB}	STE.	ε_t^{GEPGU}	ε_t^{RGDP}	STE.	ε_t^{GEPGU}	ε_t^{UNR}
1	3.825	0.12	96.79	0.019	0.03	83.10	1.026	3.79	90.75
2	4.190	0.11	80.97	0.035	3.18	48.59	1.187	7.64	83.42
3	4.651	5.45	65.82	0.045	3.28	44.08	1.404	9.74	60.81
4	5.015	5.24	58.48	0.052	3.52	44.58	1.484	11.06	56.15
6	5.137	5.16	56.88	0.062	3.30	46.27	1.589	13.76	55.09
8	5.181	5.17	56.45	0.068	2.77	47.44	1.632	14.08	52.58
10	5.204	5.15	56.00	0.074	2.46	48.23	1.648	14.27	52.39
12	5.223	5.13	55.65	0.079	2.30	48.73	1.657	14.31	51.93
16	5.243	5.10	55.32	0.088	2.31	49.79	1.664	14.30	51.67
20	5.252	5.09	55.17	0.098	2.52	50.94	1.667	14.25	51.50

Note: 'ε_t^n' indicates the structural changes in the related variables, and 'STE' indicates the standard errors.

5. Conclusion

This study employs the SVAR analysis to investigate the simultaneous effects of uncertainties stemming from the EPG developments in the global economy on the macroeconomic variables of the Turkish economy using a single variable as the GEPGU index. The empirical findings are summarised as follows.

The responses of the macroeconomic indicators to the one-standard-deviation structural shocks in the GEPGU vary from period to period. In the short run, the impulse-response functions indicate that the GEPGU produces enhancing effects on the nominal effective exchange rates. Consistent with the argument suggesting that uncertainty may reverse the capital flows and limit investment decisions by reducing the risk appetite of the external financial actors, GEPGU then leads to the depreciation of the Turkish lira as investors need higher risk premiums, which should be the reason for the heightened cost-push inflation and money market inflation rates in the Turkish economy. The GEPGU produces considerably contractionary pressures on the economic growth performance of the Turkish economy and enhancing effects on the unemployment rate. These findings are also consistent with the suggestion that a jump in uncertainty induces the households to postpone consumption decisions and the firms to postpone investment, hiring and entering new markets, especially export markets, which are likely to produce a rapid decrease in output and employment and a detractive effect on the current account balance with the decline in exports. Conversely, the first significant changes in these macroeconomic indicators become reversed or normalised or lose their validity with the changing effects of these shocks in the long run. According to the results of the variance decomposition analysis, the structural shocks in the GEPGU have a more significant influence on the nominal effective exchange rates, money market interest rates and economic growth in the short run and this effect continues albeit at a diminishing pace. Moreover, the shocks in the GEPGU are significantly effective in the current account balance, inflation and unemployment rates both in the long and short run and the effect continues increasingly in the long run.

Consistent with the expectations, these results show that the shocks in the GEPGU produce significantly negative effects on the macroeconomic indicators of the Turkish economy in the short and/or long run. In this context, traditional monetary and fiscal policies should be redesigned by policy makers in a way that may reduce the adverse effects of the GEPGU on the Turkish economy. For this purpose, these policies should be expanded by policy implications that can respond to external instability factors immediately, increasing the flexibility and diversity in the economy. These economic policy measures in this direction should be assisted by proactive foreign policies to resolve the pre-existing GEPGU. In this way, reducing the relatively negative effects of such uncertainties on the macroeconomic indicators and maintaining the stability of these indicators may be possible.

This study contributes to the current economic literature by analysing the simultaneous effects of the GEPGU that are expected to be decisive on the current economic conjuncture on the main macroeconomic indicators of a developing country, that is, Turkey. Moreover, this study provides significant policy implications to reduce the negative effects of these uncertainties on the Turkish economy. The main limitation of this study is that an EPU index for the Turkish context has not been published yet, and this restricted the comparison of the effects of the global and the national uncertainties on the Turkish economy. Therefore, in future studies, developing a national economic, political and geopolitical uncertainty index for Turkey would be interesting. Moreover, research on the effects of the GEPGU on both developing and developed country groups using panel data analysis may contribute to the development of the existing literature.

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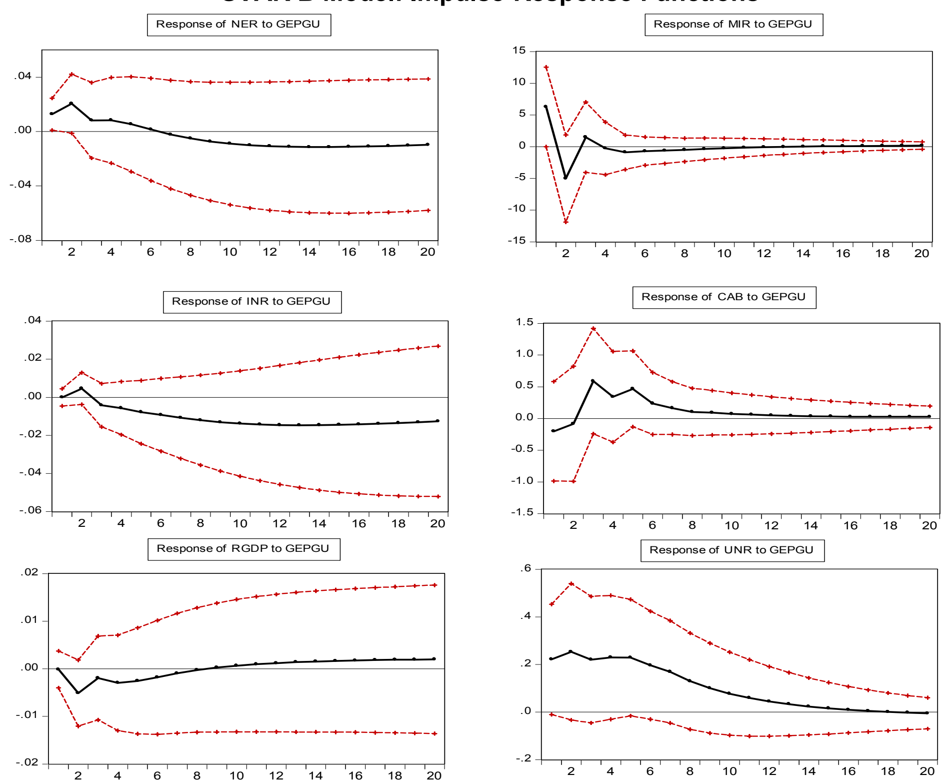
Appendix

SVAR B Model: Impulse-Response Functions



Note: Graphs indicate responses of the variables to one standard-deviation change in global economic, political and geopolitical uncertainties within the confidence interval of ± 2.

SVAR B Model: Variance Decomposition Analysis

	NER			MIR			INR		
Period	STE.	ε_t^{GEPGU}	ε_t^{NER}	STE.	ε_t^{GEPGU}	ε_t^{MIR}	STE.	ε_t^{GEPGU}	ε_t^{INR}
1	0.060	4.45	95.55	32.32	3.77	91.17	0.023	1.38	77.55
2	0.109	4.89	70.43	331.1	5.89	86.91	0.042	1.19	45.61
3	0.142	3.21	63.47	33.63	5.9	84.70	0.058	1.13	36.35
4	0.166	2.61	62.15	33.84	5.84	83.66	0.072	1.33	30.07
6	0.202	1.83	61.16	34.04	5.88	82.73	0.099	2.16	22.48
8	0.233	1.44	60.23	34.18	5.89	82.10	0.125	3.03	17.48
10	0.260	1.35	59.39	34.27	5.87	81.72	0.149	3.74	13.74
12	0.284	1.39	58.59	34.31	5.86	81.51	0.172	4.19	11.01
16	0.325	1.54	57.17	34.35	5.85	81.33	0.215	4.51	75.37
20	0.357	1.61	55.87	34.37	5.85	81.27	0.251	4.41	55.82
	CAB			RGDP			UNR		
Period	STE.	ε_t^{GEPGU}	ε_t^{CAB}	STE.	ε_t^{GEPGU}	ε_t^{RGDP}	STE.	ε_t^{GEPGU}	ε_t^{UNR}
1	3.998	0.25	94.37	0.019	0.01	83.41	1.193	3.43	94.18
2	4.394	0.24	78.63	0.034	2.16	50.07	1.407	5.70	87.95
3	4.790	1.72	66.29	0.045	1.46	44.61	1.511	7.06	81.30
4	4.865	2.16	64.86	0.052	1.38	43.68	1.563	8.75	77.33
6	4.940	3.22	63.10	0.064	1.18	44.65	1.644	1.12	71.36
8	4.989	3.31	61.99	0.073	0.93	45.55	1.684	1.23	68.28
10	5.025	3.32	61.27	0.080	0.76	46.34	1.705	1.25	66.79
12	5.050	3.31	60.81	0.087	0.68	47.12	1.716	1.26	66.00
16	5.079	3.29	60.31	0.100	0.61	48.59	1.725	1.25	65.30
20	5.092	3.29	60.10	0.111	0.61	49.94	1.729	1.24	65.00

Note: 'ε_t^n' indicates the structural changes in the related variables, and 'STE' indicates the standard errors.