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How Does Economic Policy Uncertainty Respond to Permanent and Transitory Shocks?

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Abstract

A popular economic policy uncertainty index is based on the count of the words in newspaper reports and could be subject to the inclinations of media coverage. This study empirically explores the response of the economic policy uncertainty index to permanent and transitory shocks, which are identified using standard structural vector autoregression approaches. We find an overreaction of the economic policy uncertainty index to a permanent shock, implying the temporary overeagerness of media reporting. Specifically, we demonstrate that the index responds negatively and transiently to a permanent shock, followed by reversal and prolonged responses. By contrast, the negative and transient effects of a transitory shock on the index are shown to be less pronounced than those of a permanent shock.

Keywords: Economic policy uncertainty index, Media, Overreaction, Permanent shocks, Transitory shocks, Structural vector autoregression

JEL classification: E21, E66

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1 Introduction

The influential paper of Bloom (2009) has spurred much research on the impact of uncertainty shocks; as a result, there is a large amount of evidence that the effects of uncertainty shocks on macroeconomies are non-negligible, as shown by Carriero *et al.* (2015), Cesa-Bianchi and Fernandez-Corugedo (2018), and Alessandri and Mumtaz (2019), among others. In particular, since the economic policy uncertainty (EPU) index was developed by Baker *et al.* (2016), it has been used by dozens of works to empirically claim that EPU has significant effects on key macroeconomic variables (e.g., Stockhammar and Österholm, 2016; Bartsch, 2019; Nilavongse *et al.*, 2020).[1]

However, despite its popularity, the features of the EPU index *per se* are less well understood. Specifically, what changes and characterizes the EPU index is not sufficiently studied. Importantly, given that the index is constructed on the basis of the archives for newspapers and the count of words pertaining to economic and policy uncertainty, the index is highly likely to be fundamentally influenced by the inclination of the media coverage on macroeconomic phenomena. Indeed, recently, Duca and Saving (2018) point out that media fragmentation is one of the determinants of EPU in European countries and the United States. However, how does the EPU index respond to fundamental macroeconomic shocks? To which shocks does the EPU index tend to react? The dominant patterns remain largely unknown.

To better understand the dominant patterns, this study investigates how the EPU index responds to permanent and transitory shocks. The causal responses to these two shocks are of interest because the media, whose behavior determines the EPU index, comprises different optimizing agents than consumers. In other words, while an optimizing consumer's response is widely recognized as being predominant only to a permanent shock, the EPU responses might vary. For example, in contrast to the widely held view of consumption, the EPU responses could be sensitive to transitory as well as permanent shocks. In addition, although a permanent shock has a persistent effect on consumption, the extent to which EPU responds persistently to this shock is an open question, and it could behave quite differently.

Our empirical methodology relies on simple and standard structural vector autoregres-

[1] See also Bloom (2014), who argues that policy-related uncertainty is harmful to economic growth in the United States.

sion (VAR) approaches. We identify permanent and transitory shocks following Cochrane (1994), who considers a structural VAR model with consumption and income in line with the permanent income model of consumption. Retaining Cochrane's (1994) recursive identification of structural shocks, we incorporate the EPU into the VAR system. While U.S. quarterly observations are used as in Cochrane (1994), a historical news-based policy index for more than half a century is used to enlarge the sample size. Moreover, as a by-product of the present VAR framework, we evaluate the effect of EPU shocks on consumption and income. The EPU shock is separated from permanent and transitory shocks. Specifically, it is not explained by permanent and transitory shocks, and is considered as an exogenous EPU shock.

In contrast to most previous studies, which focus on the effects of EPU, we provide the following insights into the features of the popular EPU index. First, there is a stark difference in EPU responses to permanent and transitory shocks. While the responses of EPU to both shocks are transient and negative, the degree is larger for permanent shocks than for transitory shocks. These different responses reflect the ability of the media to recognize both shocks, and suggest that the media thinks that permanent shocks are more noteworthy than transitory shocks.

Second, and most notably, our results reveal the characteristic inclinations in the responses of the EPU index to permanent shocks. That is, we find that the EPU index overreacts to permanent shocks in the sense that the transient negative responses are followed by reversal and prolonged responses. This overreaction stems from the temporary overeagerness of the media to report the outcome of macroeconomic trends. The finding of such an overreaction is novel and striking in that it might sound a note of caution on the use of this popular index as a proxy for pure EPU. Incidentally, a rise in EPU has negative and persistent effects on consumption and income. Regarding consumption, this suggests precautionary saving by force of the EPU.

The remaining sections of this paper are organized as follows. In Section 2, we present our empirical framework. Specifically, we explain the VAR model and the identification scheme and describe in detail the features of the data used in the analysis. The main results of the VAR analyses are provided in Section 3. In Section 4, we check the robustness of the results by using other specifications. Section 5 concludes the paper and refers to remaining future issues.

2 Empirical framework

We conduct a standard VAR analysis to examine the causal responses of EPU to macroeconomic permanent and transitory shocks. To this end, we need to infer a true model from preliminary tests. For example, unit root tests could help us specify whether a VAR model in levels or in differences is used depending on the existence of a unit root. In addition, if unit roots exist, we need to select either a VAR model in differences or a vector error correction model (VECM) depending on the results of cointegration tests on the relationships between the variables.

However, preliminary tests such as unit root tests are widely known to have low power, and accordingly, the true model is difficult to specify accurately. For this reason, many researchers in empirical macroeconomics consider a VAR model in levels owing to its asymptotical validity—even if unit roots and cointegration relationships exist. Moreover, this approach is validated by Gospodinov *et al.* (2013), who point out that a VAR model in levels is likely to provide more accurate estimates than selected models using preliminary tests. As such, we consider a VAR model in levels in the benchmark analysis, while the selected models are also adopted as robustness checks.

2.1 VAR and identification

Our VAR framework is an extension of Cochrane (1994), who assumes a permanent income hypothesis and considers a bivariate VAR model with real consumption and income. We extend the bivariate model to a trivariate model including EPU. Let c_t, y_t, and u_t denote the natural logarithm of real consumption, real income, and EPU at time t, respectively. The structural VAR representation is of the form

$$\boldsymbol{B}(L)\boldsymbol{x}_t \;=\; \boldsymbol{\varepsilon}_t, \tag{1}$$

where $\boldsymbol{B}(L)$ is the autoregressive lag polynomial such that $\boldsymbol{B}(L) = \boldsymbol{B}_0 - \boldsymbol{B}_1 L - \boldsymbol{B}_2 L^2 - \cdots - \boldsymbol{B}_p L^p$, L is the lag operator, $\boldsymbol{x}_t = [c_t, y_t, u_t]'$, and $\boldsymbol{\varepsilon}_t = [\varepsilon_t^c, \varepsilon_t^y, \varepsilon_t^u]'$ is the vector of serially and mutually uncorrelated structural shocks. We omit all deterministic regressors to simplify the notation. The reduced form is represented as

$$\boldsymbol{A}(L)\boldsymbol{x}_t \;=\; \boldsymbol{\upsilon}_t, \tag{2}$$

where $\boldsymbol{A}(L) = \boldsymbol{I}_3 - \boldsymbol{A}_1 L - \boldsymbol{A}_2 L^2 - \cdots - \boldsymbol{A}_p L^p$ is the autoregressive lag polynomial, $\boldsymbol{I}_3$ is the 3×3 identity matrix, $\boldsymbol{A}_i = \boldsymbol{B}_0^{-1}\boldsymbol{B}_i$ for $i = 1, 2, \cdots, p$, and $\boldsymbol{\upsilon}_t = [\upsilon_t^c, \upsilon_t^y, \upsilon_t^u]'$ is the reduced-form shocks. Without loss of generality, each reduced-form shock can be written as a weighted average of structural shocks:

$$\upsilon_t^c = b_{11}\varepsilon_t^c + b_{12}\varepsilon_t^y + b_{13}\varepsilon_t^u \tag{3}$$

$$\upsilon_t^y = b_{21}\varepsilon_t^c + b_{22}\varepsilon_t^y + b_{23}\varepsilon_t^u \tag{4}$$

$$\upsilon_t^u = b_{31}\varepsilon_t^c + b_{32}\varepsilon_t^y + b_{33}\varepsilon_t^u \tag{5}$$

Turning to our identification scheme, we adopt basic consumption theories in the literature: the permanent income hypothesis and precautionary saving. Our identifying restrictions are based on Cochrane (1994), who supposes the recursive model of c_t and y_t and identifies permanent and transitory shocks. Retaining Cochrane's (1994) identification strategy, we impose restrictions such that $b_{12} = b_{13} = b_{23} = 0$; as a result, the lower-triangular Cholesky decomposition is used to identify structural shocks $\boldsymbol{\varepsilon}_t$, and accordingly, $\boldsymbol{B}_0$ has a recursive structure and is a lower-triangular matrix.

Given this restriction, structural shocks can be interpreted as economically meaningful shocks as follows. As in Cochrane (1994), the first two structural shocks have meanings in line with the permanent income hypothesis, that is, ε_t^c is the permanent shock and ε_t^y is the transitory shock, because ε_t^c affects consumption and income, whereas ε_t^y affects income only. The last structural shock ε_t^u is interpreted as an exogenous EPU shock that deviates from permanent and transitory income movements.

2.2 Data

We estimate the VAR model using U.S. quarterly observations from 1947:Q1 to 2014:Q4. The consumption and income data are obtained from the St. Louis Fed FRED website.[2] Following Cochrane (1994), consumption per capita is the sum of non-durable goods (A796RX0Q048SBEA) and services (A797RX0Q048SBEA). As a proxy for real income, real gross domestic product (GDP) per capita (A939RX0Q048SBEA) is used. The EPU series is the historical news-based policy index retrieved from the website of Economic Policy Uncertainty.[3] All the data are transformed into a natural logarithmic form.

[2] `https://fred.stlouisfed.org`.

[3] `https://www.policyuncertainty.com`.

Incidentally, the start of the sample period is selected because of the availability of consumption and income data and the end is chosen because of the availability of historical EPU data.

[Insert Figure 1]

Figure 1 plots the data on our three variables: consumption (c), income (y), and EPU (u). As is well-known, real income is more volatile than real consumption in the short run, whereas both exhibit similar behavior in the long run. Income severely diminishes in recessions (e.g., the 1973 oil crisis and the Great Recession in the late 2000s), whereas such decreases in consumption are less pronounced. These visual observations are consistent with the permanent income hypothesis under which consumers respond to an income shock more keenly if such a shock is permanent rather than transitory.

Figure 1 shows that EPU has risen substantially over the past half century.[4] EPU appears to be volatile in the short run. Large positive spikes are observed during significant incidents such as Black Monday in the fourth quarter of 1987, the Russian crisis in the third quarter of 1998, the September 11 attacks in the third quarter of 2001, the invasion of Iraq in the first quarter of 2003, and the bankruptcy of Lehman Brothers in the third quarter of 2008.

3 Empirical results

Having identified the structural shocks and described the data, we now examine their effects on our three endogenous variables. While we present the results in this section including only a deterministic constant, they are hardly affected by the additional inclusion of a deterministic linear trend. Based on the Schwarz information criterion, the lag length is chosen to be two. In the figures to follow, we report the estimated impulse responses up to 40 quarters; the solid line indicates the median response and the shaded areas show the 68% and 95% bootstrapped confidence intervals.

[4]Baker *et al.* (2014) claim that the substantial rise in U.S. EPU is due to two factors: "growth in government spending, taxes, and regulation" and "increased political polarization and its implications for the policymaking process and policy choices."

3.1 Permanent and transitory shocks

We begin by presenting the impulse response functions (IRFs) to the permanent and transitory shocks that are identified following Cochrane (1994). Although our focus here is on the responses of EPU, it is also important to check whether these shocks are well identified in light of the permanent income hypothesis compared with Cochrane (1994).

Figure 2 shows the IRFs to a permanent shock ε_t^c. By definition, the responses of consumption and income are similar to those shown by Cochrane (1994).[5] An unanticipated permanent shock causes an immediate increase in consumption, the peak of which occurs after about five quarters. The shape of the IRF is almost flat and the effect is highly significant. At the same time, the GDP exhibits a clear hump-shaped response to this shock. The peak level of the GDP response is larger than that of the consumption response and the eventual response is the same as that of consumption.

[Insert Figure 2]

It is noteworthy that this shock also causes an immediate and temporary decline in EPU followed by long-lasting increases. Specifically, the temporary decline immediately peaks within several quarters and becomes almost zero after 10 quarters; thereafter, the response becomes positive and persistent (albeit quantitatively not large). Such responses can be interpreted as an overreaction of EPU to an unexpected permanent shock. This could be due to the inclination that the media reports on macroeconomic trends are prone to be easily warmed up but just as easily cooled down.

[Insert Figure 3]

Figure 3 plots the IRFs to a transitory shock ε_t^y. As before, the responses of consumption and income are very similar to those presented by Cochrane (1994), and they are consistent with the view of the permanent income hypothesis. The effect of transitory disturbances on consumption is vanishingly small at any horizon, although the disturbances slightly raise consumption only in several quarters. By contrast, the unexpected transitory shock rapidly increases the GDP; however, the effects are only transient. In

[5] Our data sample differs from that of Cochrane (1994), whose sample period runs from 1947:Ql to 1989:Q3 and is thus shorter than ours.

other words, such increases in GDP disappear almost completely after approximately 20 quarters.

The transitory shock causes a transient decline in EPU as in the case of a permanent shock, but the degree is less pronounced than for a permanent shock. Furthermore, in contrast to a permanent shock, the response of EPU to a transitory shock is rapidly mean-reverting without an overreaction. Thus, the difference in the responses of EPU to permanent and transitory shocks is striking. This could imply that the media identifies both shocks and places less emphasis on a transitory shock.

3.2 EPU shocks

The set of topics that we explore in this empirical framework also include the effects of an EPU shock. In particular, our trivariate VAR system can also answer whether EPU shocks cause precautionary saving. Under economic uncertainty, there has been much interest in the theory of private consumption that accounts for the greatest proportion of GDP. Since the 1980s, the mainstream consumption theory under uncertainty is precautionary saving or buffer-stock saving in the train of the random walk model of consumption (Hall, 1978) and the permanent income hypothesis (Friedman, 1957); accordingly, there is vast literature on precautionary saving.[6]

However, we are unaware of a direct answer to this fundamental question. On one hand, a branch of the empirical literature examines the existence of precautionary saving for uncertainty (e.g., Carroll and Samwick, 1998), but EPU is overlooked. On the other hand, as already mentioned, another branch of empirical studies evaluates the effects of EPU on key macroeconomic variables, but precautionary saving attracts less attention. As such, few previous studies have analyzed how EPU affects consumption–saving decision-making.[7]

[Insert Figure 4]

To bridge the important gap at the crossroads of these two branches of literature, Figure 4 explores the IRFs to an EPU shock ε_t^u. Overall, we find that increases in EPU have

[6]See Kimball (1990) and Carroll (1992, 1997), among others.

[7]An important exception is Kim (2019), who finds that government spending policy uncertainty causes precautionary saving, although specific policy uncertainty is the focus unlike aggregate EPU.

negative and persistent effects on both consumption and GDP. Both responses take time to build, while their shapes are in a somewhat different form. Consumption responds slowly and exhibits the largest response after approximately 20 quarters; thereafter, the response remains at the peak level. The reductions in private consumption can be attributed to the precautionary saving motive. GDP declines more rapidly than consumption and the largest decline is observed after approximately 10 quarters, followed by a partial reversal of that decline; as a result, the response of GDP appears to be inverted hump-shaped. EPU is rapidly influenced by its own exogeneous shocks and the effects disappear after about 20 quarters.

4 Robustness

Thus far, we have used a VAR model in levels for the analysis, as in much of the applied macroeconometrics literature. While recognizing that it is difficult to correctly specify the model because of the limitations of preliminary tests, it nonetheless seems important to examine the sensitivity of the results to possible alternative specifications.

[Insert Table 1]

To specify the model, we first perform the unit root tests proposed by Dickey and Fuller (1979) and Elliot *et al.* (1996). We include the lag whose lengths are chosen based on the Schwarz information criterion. Table 1 reports the results. Panel A of Table 1 presents the results in levels, showing that strong rejections of the null hypothesis cannot be confirmed from both tests for all the variables. On the contrary, as shown in Panel B of Table 1 in which the variables are taken in first differences, both tests strongly reject the null for all the variables. Thus, it is reasonable that each of the variables is considered to be integrated of order one.

[Insert Table 2]

In the next step, we examine the existence of a cointegration relationship in the trivariate system. The cointegrating rank (denoted by r) of the trivariate system is investigated by performing Johansen's (1988) and Johansen and Juselius' (1990) maximum eigenvalue tests. The lag order in levels is two, as before, based on the Schwarz information criterion.

Table 2 reports the results. Panel A shows the results for the model in which the trends in cointegrating vectors are not included and Panel B shows the results for the model in which the trends in cointegrating vectors are included. Both cases indicate that the cointegrating rank is two, $r = 2$. Thus, the preliminary tests suggest that the preferred dynamic system is the VECM with two cointegrating equations.

[Insert Figure 5]

Given the above, Figure 5 presents the estimated impulse responses from the suggested VECM, where the recursive identification procedure is used to disentangle the structural shocks from the reduced-form shocks as before. The solid line depicts the IRFs of VECM 1 in which the trends in the cointegrating vectors are not included and the dashed line depicts those of VECM 2 in which the trends in the cointegrating vectors are included.

Importantly, both responses are mirrored by the preceding results depicted in Figures 2–4, and for the most part, these reinforce the above conclusions. The impulse responses to a permanent shock shown in the first column of Figure 5 indicate that VECM 1 and VECM 2 partly yield quantitatively different results; that is, compared with VECM 1, VECM 2 generates a more pronounced hump-shaped response of GDP and a more notable overreaction of EPU. However, we confirm that all the impulse responses to a transitory shock displayed in the second column of Figure 5 are hardly affected by the choice of being either VECM 1 or VECM 2. In the impulse responses to an EPU shock in the third column of Figure 5, the response of GDP in VECM 2 is smaller than that in VECM 1. In summary, while the results of the selected VECMs differ quantitatively and slightly from those of the preceding VAR model in levels, the qualitative results are unaffected by which specification we select.

5 Conclusion

Motivated by the fact that the popular EPU index is constructed by counting words in newspapers and could fluctuate under the influence of the special nature of media reporting, this study investigated how the index is prone to respond to two types of fundamental macroeconomic shocks, permanent and transitory shocks. We used the structural VAR approach presented by Cochrane (1994) to identify permanent and transitory shocks and

to evaluate their effects on the index. Our analyses verify the significance of the permanent shock effect on the index and reveal the striking inclination of the index to overreact to a permanent shock. On the contrary, the index is shown to be unresponsive to a transitory shock.

These results may be driven by the attributes of media reporting. Specifically, for permanent shocks, the media is easily warmed up but just as easily cooled down, meaning that overreaction is observed. By contrast, the media is less interested in transitory shocks. These suggestions have relevance in the discussions on the popular EPU index. For example, if such overreactions do not reflect uncertainty correctly, the results might sound a note of caution on the use of the popular news-based policy index as a proxy for pure EPU. When using the popular EPU index, analysts might at least need to bear in mind these possible inclinations of media reporting.

Although this study is viewed as the first attempt to uncover the characteristic features of the popular EPU index, it could be extended in a number of directions. First, in the present analysis, we were only able to examine the U.S. economy because of limited data on historical EPU. It is thus important to conduct similar analyses using data from other countries if historical data become available. Second, although we focus on transitory and permanent shocks, the effect of more specific and deeper shocks (e.g., technology shocks and various policy shocks) on EPU is an open question that should be pursued in future research. Finally, another important area of interest is research using the categorical EPU index, unlike this study that used the overall index.

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Table 1: Unit root test results

	Variables	Dickey and Fuller (1979)	Elliot *et al.* (1996)
A. Detrended test			
	c	$-0.21(2)$	$-0.80(2)$
	y	$-2.51(2)$	$-2.46(2)$
	u	$-3.53(3)^{\dagger}$	$-1.56(3)$
B. Demeaned test			
	Δc	$-8.12(1)^{*}$	$-3.87(2)^{*}$
	Δy	$-11.36(0)^{*}$	$-4.73(1)^{*}$
	Δu	$-14.73(2)^{*}$	$-2.44(5)^{\dagger}$

Notes: Panel A shows the results for the variables in levels, including a constant and a linear trend (detrended tests). Panel B shows the results for the variables in first differences, including a constant only (demeaned test). The lag lengths are chosen based on the Schwarz information criterion (up to six lags) and shown in parentheses. † and * represent the rejection of the null hypothesis at the 5% and 1% significance levels, respectively.

Table 2: Cointegration test results

	Null hypothesis	Maximum eigenvalue statistics
A. No trend		
	$r = 0$	38.61^{*}
	$r \leq 1$	20.65^{*}
	$r \leq 2$	2.77
B. Trend		
	$r = 0$	50.17^{*}
	$r \leq 1$	$22.75^{\dagger}$
	$r \leq 2$	2.81

Notes: The statistics are from Johansen's maximal eigenvalue test (Johansen, 1988; Johansen and Juselius, 1990). Panel A shows the results for the model in which the trends in cointegrating vectors are not included. Panel B shows the results for the model in which the trends in cointegrating vectors are included. † and * represent the rejection of the null hypothesis at the 5% and 1% significance levels, respectively.

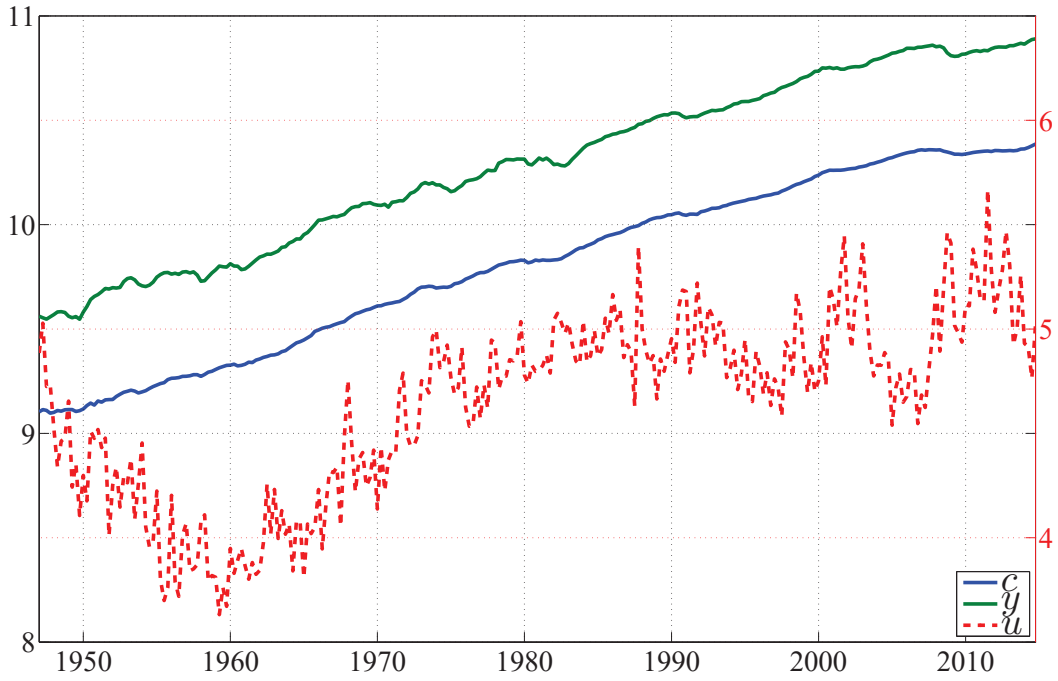

Figure 1: Data

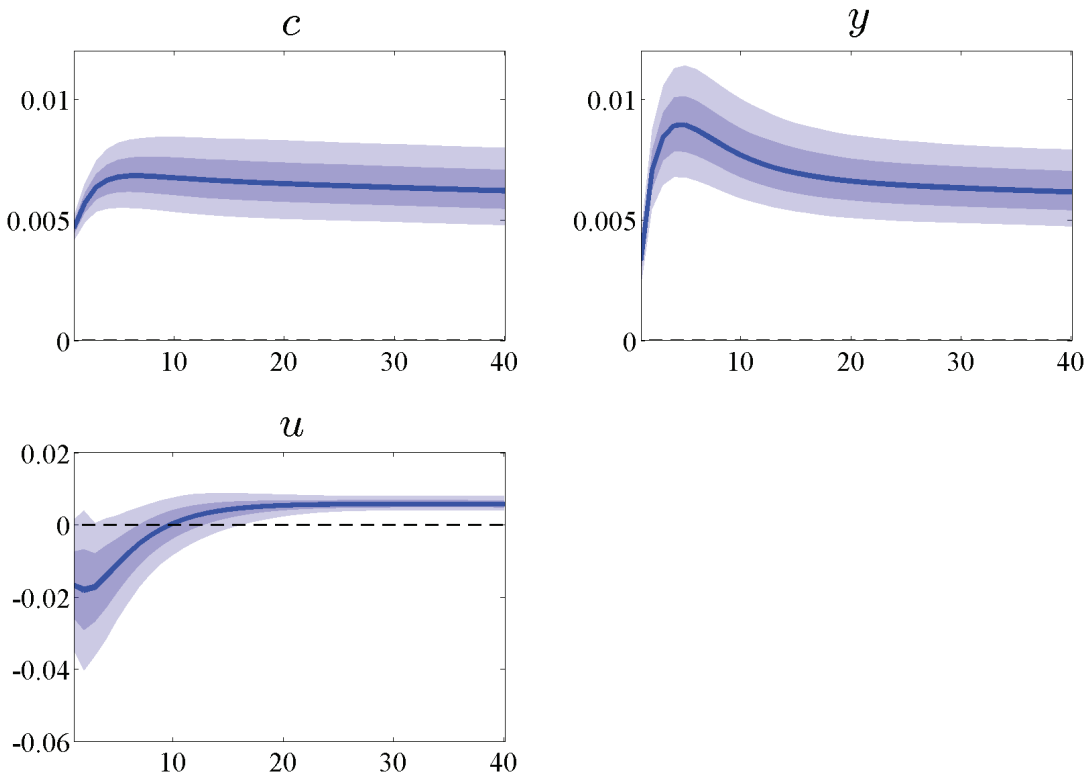

Figure 2: IRFs to a permanent shock

Notes: The solid line depicts the median and the shaded areas show the 68% and 95% bootstrapped confidence intervals.

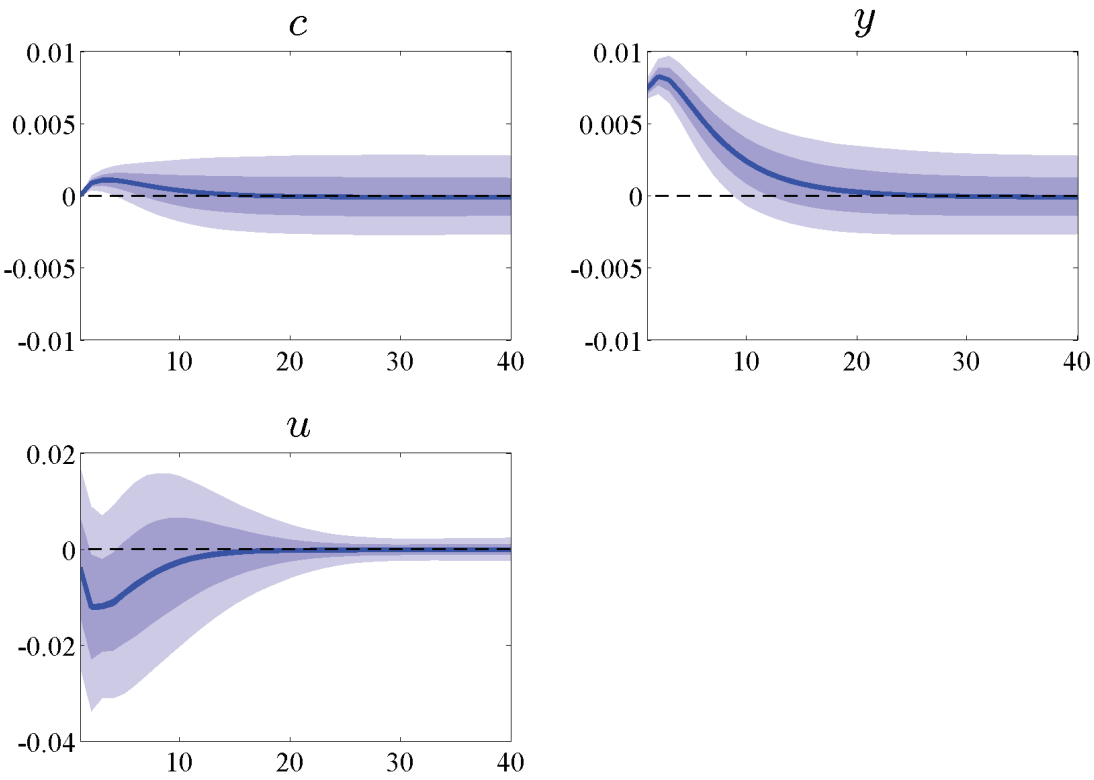

Figure 3: IRFs to a transitory shock

Notes: The solid line depicts the median and the shaded areas show the 68% and 95% bootstrapped confidence intervals.

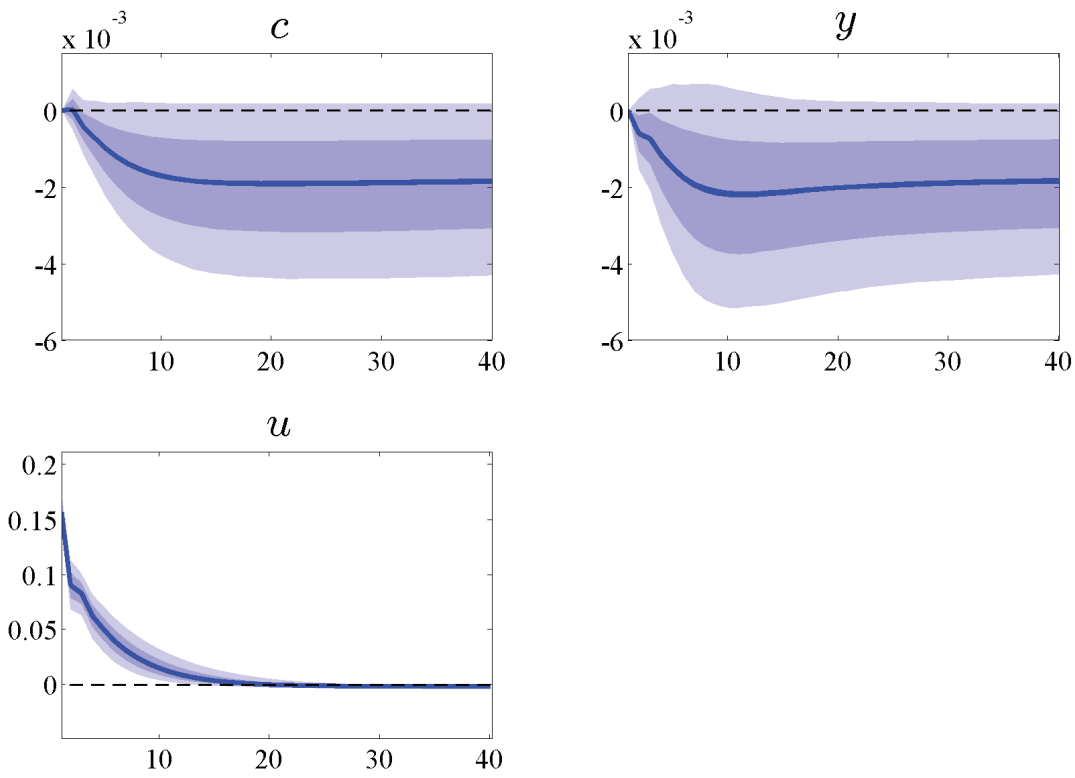

Figure 4: IRFs to an EPU shock

Notes: The solid line depicts the median and the shaded areas show the 68% and 95% bootstrapped confidence intervals.

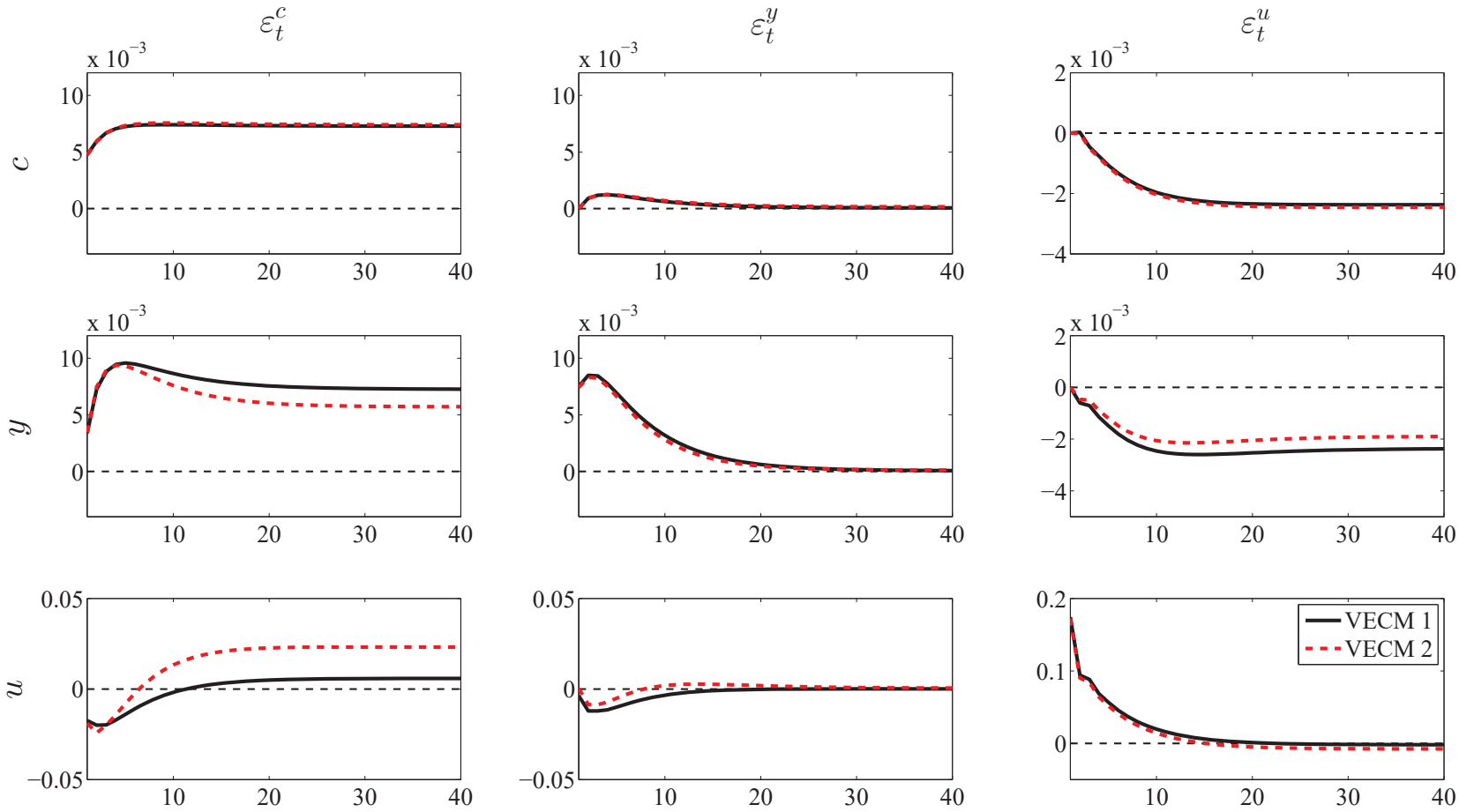

Figure 5: IRFs of VECMs

Notes: The solid line depicts the IRFs of VECM 1 in which the trends in the cointegrating vectors are not included. The dashed line depicts those of VECM 2 in which the trends in the cointegrating vectors are included.