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MONETARY POLICY UNCERTAINTY AND EXCHANGE RATE PASS-THROUGH: EVIDENCE FROM TÜRKİYE

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Abstract

In this study, the impacts of monetary policy uncertainty (MPU) on second and third-stage ERPT in Türkiye for the period June 2010–December 2023 are examined by using the Time-Varying Parameter VAR Model with Stochastic Volatility (TVP-VAR) developed by Nakajima (2011a, b). The findings of the study show that the time-varying ERPT coefficients increase in the first four periods after the MPU shock and then tend to decrease. The second-stage ERPT coefficients are greater than the third-stage ERPT coefficients over the whole period. The time-varying ERPT coefficients have increased rapidly since 2018. The second-stage ERPT coefficients respond to MPU shocks given at the dates when the CBRT Governors are dismissed before completing their terms of office by increasing more, while the third-stage ERPT coefficients respond by increasing permanently. Based on these findings, reducing monetary policy uncertainty by increasing the predictability of monetary policy decisions is recommended to reduce the ERPT.

Keywords: Monetary Policy Uncertainty, Exchange Rate Pass-Through, TVP-VAR

JEL Codes: E31, E52, E58

PARA POLİTİKASI BELİRSİZLİĞİ VE DÖVİZ KURUNDAN ENFLASYONA GEÇİŞ ETKİSİ: TÜRKİYE'DEN KANITLAR

Öz

Bu çalışmada, Nakajima (2011a, b) tarafından geliştirilen Stokastik Volatilite ile Zamanla Değişen Parametreli VAR Modeli (TVP-VAR) kullanılarak Haziran 2010-Aralık 2023 dönemi için Türkiye'de para politikası belirsizliğinin (MPU) döviz kurundan enflasyona geçiş etkisi (ERPT) üzerindeki etkileri incelenmektedir. Çalışmanın bulguları, zamanla değişen ERPT katsayılarının MPU şokunun ardından ilk dört dönem arttığını ve daha sonra bu artışın azalma eğiliminde olduğunu göstermektedir. İkinci aşama ERPT katsayıları, tüm dönem boyunca üçüncü aşama ERPT katsayılarından daha büyüktür. Zamanla değişen ERPT katsayıları 2018 yılından itibaren hızla artmıştır. TCMB Başkanlarının görev sürelerini tamamlamadan görevden alındıkları tarihlerde verilen MPU şoklarına ikinci aşama ERPT katsayıları daha fazla artarak tepki verirken, üçüncü aşama ERPT katsayıları ise kalıcı olarak artarak tepki vermektedir. Bu bulgulardan hareketle, para politikası kararlarının öngörülebilirliğini artırarak para politikası belirsizliğini azaltmak ERPT'yi düşürmek için önerilmektedir.

Anahtar Kelimeler: Para Politikası Belirsizliği, Döviz Kurundan Enflasyona Geçiş Etkisi, TVP-VAR

JEL Kodları: E31, E52, E58

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INTRODUCTION

The exchange rate pass-through (ERPT) is defined as a measure of the transmission mechanism of exchange rate movements on inflation rates. ERPT is measured for three different price indices: (i) the import price index (IPI), (ii) the producer price index (PPI), and (iii) the consumer price index (CPI) (Phuc and Duc, 2021). Within the framework of the original definition reflecting the first-stage ERPT, Goldberg and Knetter (1997) define ERPT as the effect of the nominal exchange rate on import prices in domestic currency. ERPT is expected to be the highest in the first stage. Later, the original definition is extended to capture the effects of a percentage change in the exchange rate on PPI and CPI inflation rates. These are called second- and third-stage ERPTs, respectively (Masha and Park, 2012).[4]

The exchange rate pass-through (ERPT) is crucial for inflation-targeting (IT)-central banks to pursue main monetary policy objectives such as price stability and financial stability (Anderl and Caporale, 2023). IT-central banks need to know the degree of ERPT when conducting monetary policy, as exchange rate fluctuations cause costs to rise and rising inflation expectations lead to inflationary pressure (Aron, Macdonald, and Muellbauer, 2014; Comunale and Kunovac, 2017; Forbes, Hjortsoe, and Nenova, 2018).

Country's experiences show that central banks are successful in reducing the degree of ERPT after the adoption of IT strategy (Gagnon and Ihrig, 2004; Campa and Goldberg, 2005; Choudhri and Hakura, 2006; Edwards, 2006; Gust, Leduc, and Vigfusson, 2006; Sekine, 2006). In IT strategy, the decline in ERPT is associated with switching to higher central bank credibility (Amato, Filardo, Galati, von Peter, & Zhu, 2005), and thus adopting IT strategy is considered an important step in itself to reduce the degree of ERPT thanks to increased credibility (Kara and Öğünç, 2008).[5] Taylor (2000), explaining this phenomenon with a model of a firm with a staggered price structure and operating under monopolistic market conditions, notes that ERPT decreases in environments where central bank credibility is high and the central bank conducts monetary policy independently.[6] This hypothesis of Taylor (2000) has been tested in numerous studies for the periods before and after the adoption of the IT strategy.[7] However, like these studies, even if switching to the floating exchange rate regime and IT strategy lends credibility to monetary policy and leads to a

[4] The analyses in this study provide evidence for the second- and third-stage ERPTs.
[5] Improving central bank credibility in IT strategy enhances the success of expectations management of monetary policy (Yuxiang and Chen, 2010; Montes, Oliveira, Curi, and Nicolay, 2016; De Mendonça, 2018; Aguir, 2018; Kurihara, 2019).
[6] In economies with a low inflation environment, ERPT decreases as firms consider that exchange rate fluctuations are temporary, but not for economies with a high inflation environment. In economies with high inflation and low central bank credibility, firms gradually pass on cost increases from exchange rate fluctuations to their prices, resulting in higher ERPT (Taylor, 2000).
[7] For time-varying evidence, see: (Reyes, 2007; Barhoumi, 2006; Holmes, 2009; María-Dolores, 2009; Ghosh and Rajan 2009a,b; Frankel, Parsley, and Wei, 2012; Mumtaz and Sunder-Plassman, 2013; Ozkan and Erden, 2015; Jooste and Jhaveri, 2014; López-Villavicencio and Mignon, 2017; Jašová, Moessner, and Takáts, 2019) for asymmetric and non-linearity evidence, see: (Nogueira Júnior and León-Ledesma 2011; Delatte and López-Villavicencio, 2012; Junttila and Korhonen, 2012; Lin and Wu, 2012; Shintani, Terada-Hagiwara, and Yabu, 2013; Kiliç, 2016; Cheikh and Rault, 2016, Baharumshah, Soon, and Wohar, 2017; Bhat and Bhat, 2022).

reduction in ERPT, some evidence, especially from developing countries, reveals that is not enough to keep ERPT low. Floating exchange rates may be vulnerable to destabilizing domestic shocks resulting from monetary policy uncertainty (MPU), which may increase ERPT (Devereux, 2002; 2010). In other words, uncertainty surrounding monetary policy decisions and implementations may end up with higher ERPT even if an IT strategy is conducted. Therefore, to keep ERPT low in the IT strategy, MPU needs to be low enough not to damage the credibility of the central bank (Dovern, Fritsche, and Slacalek, 2012; Kabundi and Mlachila, 2018). This is because the lower the MPU, the more the increase in the predictability of monetary policy will support the central bank credibility. Otherwise, as MPU increases, producers are more likely to prefer to price their goods and services in foreign currency (López-Villavicencio and Mignon, 2017), and the sensitivity of the exchange rate to economic news is high (Kurov and Stan, 2018). These may lead to a strengthening of the degree of ERPT.

These arguments for the relationship between MPU and ERPT have been the subject of few empirical studies. Some of these studies focus on the effects of MPU on exchange rate expectations (Beckmann and Czudaj, 2017), exchange rate volatility (Mueller, Tahbaz-Salehi, and Vedolin, 2017; Kuncoro, 2020; Park, Qureshi, Tian, and Villaruel, 2022), inflation expectations (Istrefi and Piloiu, 2014; Arce-Alfaro and Blagov, 2023), and financial and crude oil markets (Kurov and Stan, 2018; Bauer, Lakdawala, and Mueller, 2022). A limited number of studies analyze the effects of MPU on ERPT (López-Villavicencio and Mignon, 2017; Kabundi and Mlachila, 2018; López-Villavicencio and Pourroy, 2019). However, there are also studies in the literature that examine the impact of central bank credibility on ERPT and relate it to the effects of MPU. Devereux and Yetman (2010), Dovern et al. (2012), Ortega and Osbat (2020), following Taylor (2000), find that central banks need to have high credibility to lower ERPT. Aleem and Lahiani (2014), De Mendonça and Tostes (2015), Carrière-Swallow, Gruss, Magud, and Valencia (2016), De Mendonça and Tiberto (2017), Ndou, Gumata, and Tshuma (2019), Kabundi and Mlachila (2019), Cuitiño, Medina, and Zacheo (2021), and Kamal (2021) provide evidence that improving central bank credibility weakens ERPT by stabilizing the exchange rate. The findings of these studies suggest that the relationship between the rate of exchange rate change and inflation becomes stronger in an environment of low credibility caused by high MPU.

Analyzing the degree of ERPT and the reasons for changes in ERPT in the Turkish economy is important for understanding inflation dynamics. Early studies on ERPT reveal the degree of ERPT in the periods before and after the IT strategy and show that ERPT changes over time and decreases after the transition to the IT strategy. Their evidence also suggests that the decline in ERPT in a low-inflation environment is compatible with the Taylor's (2000) hypothesis (Kara, Küçük-Tuğer, Özlale, Tuğer, and

Yücel, 2007; Volkan, Saatçioğlu, and Korap, 2007; Kara and Öğünç, 2008; Yüncüler, 2011; Çatık and Güçlü, 2012; Arslaner, Karaman, Arslaner, and Kal, 2014; Dedeoğlu and Kaya, 2014; Çatık, Karaçuka, and Gök, 2016; Karahan, 2017). Subsequent studies focusing on the change in ERPT over time show the ERPT to remain relatively stable and also highlight that increasing exchange rate volatility leads to ERPT becoming stronger in some periods (Kal, Arslaner, and Arslaner, 2015; Kara, Öğünç, and Sarikaya, 2017; Kara and Sarıkaya, 2021; Bilgili, Ünlü, Gençoğlu, and Kuşkaya, 2022; Türel and Orhan, 2022). The other studies on ERPT try to explain how macroeconomic variables affect ERPT over time in Türkiye. These few studies reveal the effects of some macroeconomic variables such as aggregate demand conditions (Doğan, 2013), import price shocks (Çiftçi and Yılmaz, 2018), import-led intermediate goods production, dollarization and pricing behavior (Bari, 2020), foreign currency debt (Fendoğlu, Çolak, and Hacıhasanoğlu, 2020; Ertuğ, Özlü, and Yüncüler, 2020), central bank credibility and exchange rate uncertainty (Gayaker, Ağaslan, Alkan, and Çiçek, 2021), and supply and demand shocks (Ilhan, Akdeniz, and Özdemir, 2023) on ERPT over time.

This paper aims to examine the impact of MPU on ERPT using Türkiye's data for the period of June 2010–December 2023. The reason for selecting the Türkiye's data is that Türkiye is almost a laboratory feature for some monetary policy decisions and ERPT. This is because the MPU affects the CBRT's expectation management, and exchange rate movements are one of the main determinants of inflation.

Unlike the previous studies surveyed above, the main contribution of this paper is that it is the first study to examine the impact of MPU on ERPT by using a time-varying approach. ERPT is a time-varying relationship that varies over time across business cycles. Considering ERPT analysis as a time-varying approach for a specific period provides more accurate findings (Ndou et al., 2019; Chou, 2019). In this context, it would be more appropriate to use regime shifts, time-varying parameters, and/or nonlinear models for ERPT analysis. Thus, to examine the time-varying effect of MPU on ERPT, we use the Time-Varying Parameter VAR Model with Stochastic Volatility (shortly, TVP-VAR) developed by Nakajima (2011a, b), which takes into account time-varying coefficients. The structural changes in price movements in the Turkish economy suggest that ERPT analyses based on time-varying parameter assumptions would ensure more robust results. The reasons for using the TVP-VAR model in analyzing the ERPT are as follows: (i) The TVP-VAR model allows us to capture possible changes in the fundamental structure of the economy in a flexible and robust manner. (ii) The TVP-VAR model allows obtaining nonlinear findings for ERPT. (iii) Unlike other nonlinear models such as threshold-VAR, since the movement of the variables does not depend on the transition variable in the TVP-VAR model, changes in ERPT coefficients are gradually determined. The TVP-VAR model does not rely on any exogeneity assumption and models the variation in parameters

endogenously. (iv) The variance-covariance matrix in the model has a time-varying structure. The unanticipated effects of exogenous shocks in the model are captured by the time-varying variance-covariance matrix. This allows analyzing the time-varying effects of shocks on the relationship between variables (Cogley and Sargent, 2005; Primiceri, 2005; Nakajima, Kasuya, and Watanabe, 2011).

The evidence from the TVP-VAR model indicates that after a one-standard-deviation MPU shock, the time-varying ERPT coefficients increase over time, and the second-stage ERPT coefficients are greater than the third-stage ERPT coefficients over the whole period. The increase in time-varying ERPT coefficients following the MPU shock has accelerated since 2018 when central bank credibility declined and central bank independence was significantly damaged. The second-stage ERPT coefficients increase more and the third-stage ERPT coefficients increase permanently on the dates when the CBRT Governors are dismissed from office before the end of their term.

This paper is organized into five sections. Following the introduction, the second section explains the TVP-VAR model used in the study. The third section introduces the data set used in the study. The fourth section presents the empirical evidence. The conclusion summarizes the study.

METHOD

In this study, the TVP-VAR model developed by Nakajima (2011a, b) is used to estimate the effect of MPU on ERPT. This model is quite effective in examining the time-varying dynamic effects between variables compared to the VAR model. The VAR specification incorporates both temporary and permanent changes to the parameters by assuming that they follow a first-order random walk process. Because of the data-generating process of economic variables, they frequently exhibit drifting coefficients and stochastic volatility shocks. Therefore, using a time-varying parameter model with constant volatility may cause biased time-varying coefficient estimates because a potential volatility change in disturbances is overlooked. This misspecification is avoided by the TVP-VAR model with stochastic volatility, which captures the heteroscedasticity of the innovations and the simultaneous relationships between the model's variables (Primiceri, 2005). It is possible to estimate the model using Markov Chain Monte Carlo (MCMC) methods within the framework of Bayesian inference, despite the intractability of the likelihood function resulting from stochastic volatility. In accordance with Nakajima (2011a), the study estimates the TVP-VAR model with stochastic, as follows:

$$y_t = c_t + B_{1t}y_{t-1} + \cdots + B_{st}y_{t-s} + e_t, \quad e_t \sim N(0, \Omega_t), \tag{1}$$

where y_t is a $(kx1)$ variable vector, $B_{1t}y_{t-1} + \cdots + B_{st}y_{t-s}$, are (kxk) time-varying coefficient matrices, and Ω_t is (kxk) time-varying covariance matrix. $\Omega_t = A_t^{-1}\Sigma_t\Sigma_t{A_t}'^{-1}$decomposition implies a recursive identification system, where A_t is a matrix with lower triangles and diagonal components that equal one and $\Sigma_t = diag(\sigma_{1t},\ldots, \sigma_{kt})$. α_t is a stacked row vector of the free lower-triangular elements of A_t, β_t is the stacked row vector of $B_{1t}, \ldots, B_{st}$ and $h_t = (h_{1t}, \ldots, h_{kt})$ where $h_{jt} = log\sigma_{jt}^2$. It is assumed that the time-varying parameters follow a random walk process.

$$\begin{matrix} B_{t+1} = B_t + v_{Bt}, \\ a_{t+1} = a_t + v_{at}, \\ h_{t+1} = h_t + v_{ht}, \end{matrix} \quad \begin{pmatrix} \varepsilon_t \\ v_{Bt} \\ v_{at} \\ v_{ht} \end{pmatrix} \sim \mathrm{N}\left(0, \begin{pmatrix} I & 0 & 0 & 0 \\ 0 & \Sigma_B & 0 & 0 \\ 0 & 0 & \Sigma_a & 0 \\ 0 & 0 & 0 & \Sigma_h \end{pmatrix}\right),$$

for $t = s+1, \ldots, n$, with $e_t = A_t^{-1}\Sigma_t\varepsilon_t$ where Σ_a and Σ_h are diagonal, $\beta_{s+1}\sim N(\mu_{\beta 0}, \Sigma_{\beta 0}), a_{s+1}\sim N(\mu_{a0}, \Sigma_{a0})$, and $h_{s+1}\sim N(\mu_{h0}, \Sigma_{h0})$. By using MCMC techniques, Bayesian inference is utilized to estimate the TVP-VAR models. MCMC techniques aim to evaluate the joint posterior distributions of the parameters of interest under predefined prior probability densities. As in Nakajima (2011a), we make the following priors:

$$\Sigma_\beta \sim IW(25, 0.01I),$$

$$(\Sigma_a)_i^{-2} \sim G(4, 0.02),$$

$$(\Sigma_h)_i^{-2} \sim G(4, 0.02),$$

where $(\Sigma_a)_i^{-2}$and $(\Sigma_h)_i^{-2}$ are, respectively, the ith diagonal elements in Σ_a and Σ_h.

DATA

In this study, we analyze how a one-standard-deviation MPU shock affects second-stage and third-stage ERPTs. The study covers the period from June 2010 to December 2023, with monthly data. The data span is chosen by considering the data availability. Information on the data set is presented in Table 1.

Table 1: Data set

Variables	Transformation	Source
Monetary Policy Uncertainty	$MPU - Level -$	Electronic Data Delivery System
Exchange Rate	$dFX = Log(FX)_t - Log(FX)_{t-12}$	Electronic Data Delivery System
Economic Growth	$g = Log(IP)_t - Log(IP)_{t-12}$	Electronic Data Delivery System
PPI Inflation Rate	$\pi_{PPI} = Log(PPI)_t - Log(PPI)_{t-12}$	Electronic Data Delivery System
CPI Inflation Rate	$\pi_{CPI} = Log(CPI)_t - Log(CPI)_{t-12}$	Electronic Data Delivery System

MPU is measured by three different methods: market-based, survey-based, and news-based or Twitter-based.[8] The studies using the market-based method measure the MPU via implied volatilities of interest rate futures and options (Neely, 2005; Swanson, 2006; Bauer, 2012; Chang and Feunou, 2013). The survey-based method takes into account the predictability of interest rates and relies on information on interest rate expectations from central banks' monthly surveys of expectations. (Dahlhaus and Sekhposyan, 2018). The main survey-based MPU measures are the mean forecast errors, the standard deviations of interest rate expectations, and the absolute value of the difference between the highest and lowest interest rate forecasts among survey participants (Andrade, Crump, Eusepi, and Moench, 2014; Istrefi and Mouabbi, 2018). Studies focusing on the development of news-based or Twitter-based methods calculate the MPU as a sub-component of the economic policy uncertainty index (Baker, Bloom, and Davis, 2016; Husted, Rogers, and Sun, 2017; Arbatli, Davis, Ito, and Miake, 2022).

There are some studies to measure MPU for the CBRT using these methods. In the framework of the survey-based method, Bulut and Karasoy (2016) use the standard deviations of survey participants' expectations for the monetary policy interest rate and the absolute value of the difference between the highest and lowest interest rate forecasts among survey participants as a MPU measure. Ermişoğlu et al. (2013), Jirasavetakul and Spilimbergo (2018), Sahinoz and Cosar (2020), and Yeşiltaş, Şen, Arslan, and Altuğ (2022) develop MPU indices as a sub-component of a news-based and/or Twitter-based economic policy uncertainty index for the Turkish economy. Unlike these studies, Cevik and Erduman (2020) develop MPU indices by using survey-based and news-based methods.

The high correlation between different methods of measuring MPU demonstrates the consistency of these methods. Although news-based MPU measures are more comprehensive than the other methods, they require updating the survey questions due to changing economic conditions. Moreover, each MPU index varies according to the questions weighted by the researcher and cannot be directly compared with each

[8] For detailed information, see (Cevik and Erduman, 2020).

other because of subjectivity. Therefore, in this study, we calculate MPU within the framework of the survey-based method to capture the level of disagreement among participants to the CBRT's monthly Survey of Expectations. Thus, in this study, we use the standard deviation of market participants' expectations for the CBRT's one-week repo rate for MPU.

The transformations of other variables are as follows: For the annual rate of change of the exchange rate, the logarithmic twelve-month difference of the USD/TRY exchange rate is used $[dFX = Log(FX)_t - Log(FX)_{t-12}]$. The annual economic growth is calculated by seasonally adjusting the logarithmic industrial price index using the Census X-13 method and then taking the twelve-month difference of this series $[g = Log(IP)_t - Log(IP)_{t-12}]$. The annual inflation rate for the producer price index (PPI) is calculated by seasonally adjusting the logarithmic price index using the Census X-13 method and then taking the twelve-month difference of this series $[\pi_{PPI} = Log(PPI)_t - Log(PPI)_{t-12}]$. The same method is also used for the annual inflation rate for the consumer price index $[\pi_{CPI} = Log(CPI)_t - Log(CPI)_{t-12}]$. All variables are gathered from the CBRT's Electronic Data Delivery System (EDDS).

The stationarity of the variables is tested before estimating the TVP-VAR model. The results of the ADF and PP unit root tests of the transformed variables are presented in Table 2. The null hypothesis of a unit root is rejected for MPU and g [I(0)] but not for dFX, π_{PPI} and π_{CPI} [I(1)]. However, they do not include unit root at first difference. VAR analysis allows the use of non-stationary series to avoid information loss when variables are cointegrated (see: Sims, 1980; Tiao and Box, 1981; Tiao and Tsay, 1983; Cooley and Leroy, 1985; Litterman, 1986; Doan, 1992; 2010). The existence of a cointegration relationship among the variables of our model allows the analysis without requiring the first differences of non-stationary series to be taken.[9]

[9] Since the variables used in the study are not stationary at the same degree and are not I(2), the existence of a cointegration relationship among the variables is examined by Autoregressive Distributed Lag (ARDL) model bounds test. The optimal lag lengths are automatically selected according to the Akaike Information Criterion (AIC) for the F-statistic in the model: 1 for MPU, 3 for dFX, 0 for g, 2 for π_{PPI} and 3 for π_{CPI} [ARDL(1, 3, 0, 2, 3)]. The calculated F-statistic is 15.71. Since the calculated F-statistic is greater than the upper bound critical values for 1%, 5%, and 10% significance levels, the null hypothesis that there is no cointegration is rejected.

Table 2: Unit root tests

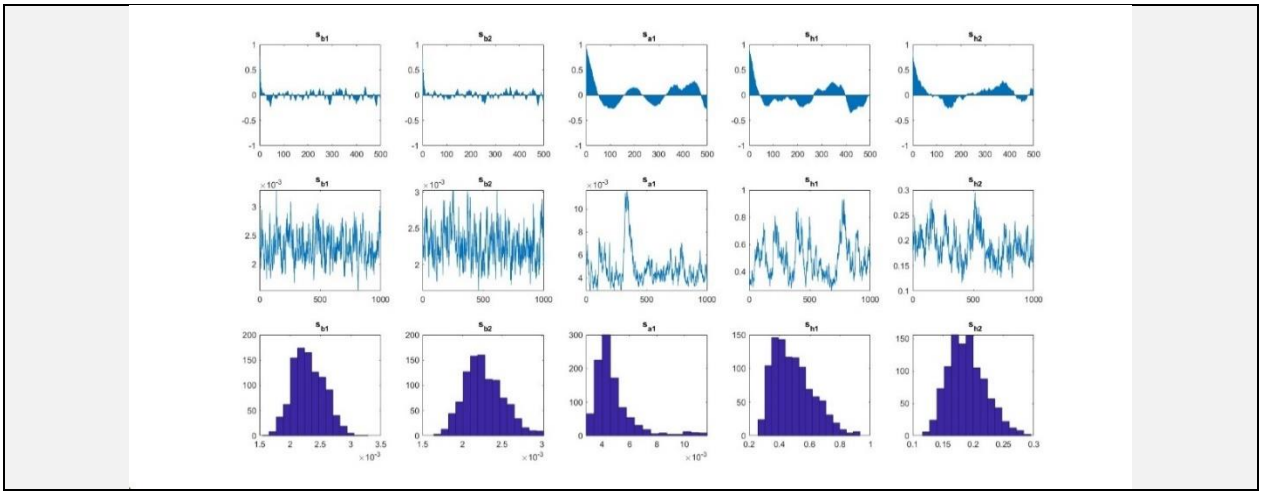
Variables		ADF		PP	
		Constant	Trend & Constant	Constant	Trend & Constant
MPU	Level	-4.860*** (0.000)	-9.557*** (0.000)	-9.670*** (0.000)	-9.963*** (0.000)
	1 st. dif.	-----	-----	-----	-----
dFX	Level	-1.710 (0.423)	-3.025 (0.128)	-2.482 (0.121)	-2.828 (0.189)
	1 st. dif.	-5.904*** (0.000)	-5.890*** (0.000)	-7.526*** (0.000)	-7.492*** (0.000)
g	Level	-3.312** (0.016)	-3.300* (0.070)	-4.791*** (0.000)	-4.907*** (0.000)
	1 st. dif.	-----	-----	-----	-----
π_{PPI}	Level	-2.083 (0.251)	-3.121 (0.105)	-1.696 (0.431)	-2.427 (0.363)
	1 st. dif.	-3.047** (0.032)	-5.042*** (0.001)	-5.906*** (0.000)	-5.890*** (0.000)
π_{CPI}	Level	-1.300 (0.628)	-2.311 (0.425)	-0.628 (0.859)	-1.966 (0.614)
	1 st. dif.	-3.403** (0.012)	-3.523** (0.040)	-6.923*** (0.000)	-6.983*** (0.000)

Note: ***, **, * are statistically significant at 1%, 5%, and 10% levels, respectively. The brackets indicate the probability. Akaike Information Criterion (AIC) is used in unit root tests, and the maximum lag length is automatically selected. The Barlett-Kernel Method is used in the PP Test. Bandwidth Width is determined by the Newey-West method.

EMPIRICAL EVIDENCE

In this study, the impact of a one-standard-deviation MPU shock on the second and third-stage ERPTs is presented for Türkiye with time-varying impulse-response functions using the TVP-VAR model developed by Nakajima (2011a, b). To estimate the TVP-VAR model, the MCMC estimation method is used with 1000 iterations to calculate the joint posterior distributions of the parameters. Using the Akaike Information Criterion (AIC), we choose the number of lags as 2. Since Cholesky decomposition is used to identify the responses to MPU shocks, the results are sensitive to the order of the variables in the model. All variables are contemporaneously affected by the preceding variables, but not by the latter variables contemporaneously, and all the variables affect each other with a lag. Accordingly, the model includes a one-standard-deviation shock to MPU and presents the responses of the rate of change of the exchange rate (dFX), economic growth (g), producer price inflation rate (π_{PPI}), and consumer price index inflation rate (π_{CPI}), respectively.

Figure 1: Sample autocorrelation, sample path and posterior densities for selected parameters



Note: Sample autocorrelations are in top, sample paths are in middle) and posterior densities are in bottom).

The sample autocorrelation function, the sample paths, and the posterior densities for selected parameters are shown in Figure 1, respectively. The sample autocorrelations decrease stably, and the sample paths are stable. In other words, the MCMC estimation leads to stable and uncorrelated samples.

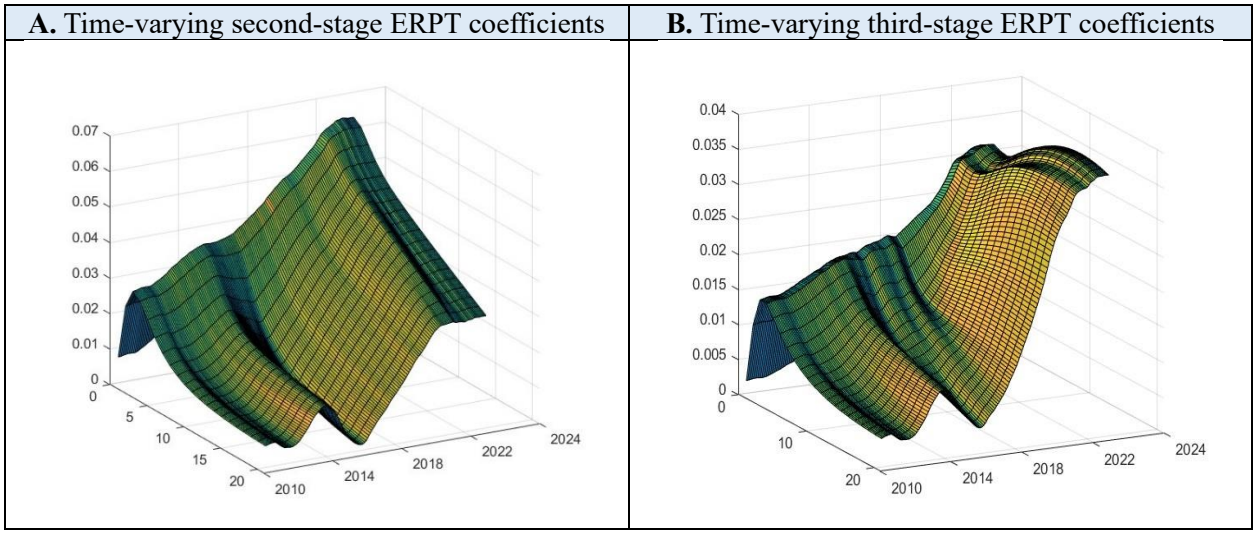
In order to determine the appropriation of our analysis, we examine the stability of the selected parameters. The estimates for posterior means, standard deviations, the 95% confidence intervals, Geweke's (1992) CD test and inefficiency factors are shown in Table 3. The first posterior mean of the estimated parameters remains within the upper and lower 95% confidence bands. The CD test is low and statistically significant at the 5% level. Therefore, the burn-in period required for the convergence of the Markov chain appears to be sufficient. The inefficiency factors are not rejected for all parameters. Thus, the very low inefficiency factors indicate efficient sampling for the parameters in our model.

Table 3: Estimation results of selected parameters of the TVP-VAR model

Parameter	Mean	Std. Dev.	95% Interval	CD	Inefficieny
sb1	0.0023	0.0003	[0.0018, 0.0028]	0.056	1.72
sb2	0.0023	0.0002	[0.0018, 0.0028]	0.000	7.22
sa1	0.0048	0.0015	[0.0033, 0.0101]	0.052	20.65
sh1	0.4912	0.1312	[0.3045, 0.7772]	0.119	7.75
sh2	0.1897	0.0309	[0.1387, 0.2573]	0.057	23.77

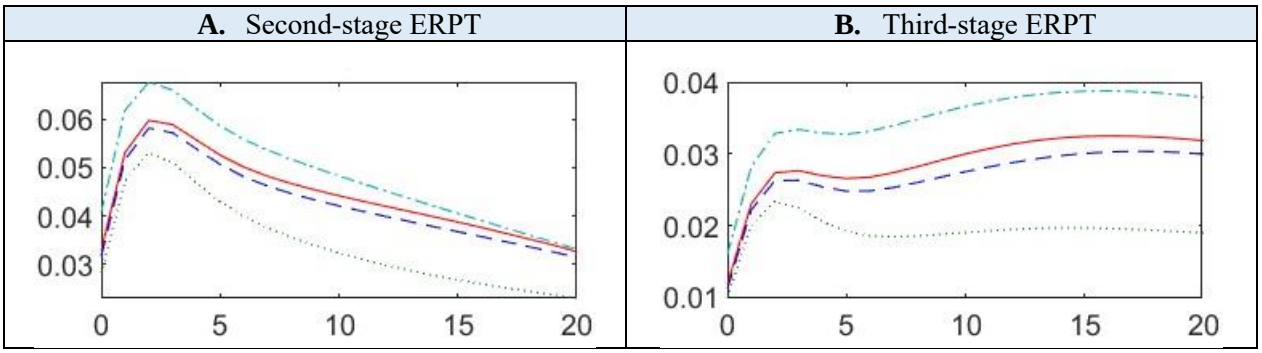
After estimating the TVP-VAR model, time-varying impulse-response functions are calculated from the variance-covariance matrix. The time-varying ERPT coefficients following a one-standard-deviation MPU shock are shown in Panels A and B of Figure 2 with three-dimensional graphs where one of the horizontal axes represents time and the other horizontal axis represents the period after the shock, where $h = 0,1,2,\ldots,20$. Following a positive MPU shock, the time-varying ERPT coefficients increase in the first four periods after the shock and then tend to decline. The degree of the second-stage ERPT coefficients is greater than the third-stage ERPT coefficients over the whole period.[10] The time-varying ERPT coefficients increased moderately in the 2010–2014 period and then started to decline. The second-stage ERPT coefficients have increased rapidly beginning from the second half of 2017 and reached the highest degree with 0.065 in July 2021, and have begun to slow down since then. Similarly, the third-stage ERPT coefficients have increased rapidly beginning from 2018 and have continued to increase moderately, reaching 0.033 in December 2023.[11]

Figure 2: Time-varying ERPT coefficients



[10] For similar results, see (Yüncüler, 2011; Özer and Kutlu, 2022).
[11] The CBRT (2023) argues that this rise in ERPT is driven by the cost channel, the balance sheet channel, and the expectations channel.

Figure 3: Linear responses to a one-standard-deviation MPU shock for selected dates



Note: The dates of the one-standard-deviation MPU shock are shown as follows: July 2019 is the green dotted line, November 2020 is the blue dashed line, March 2021 is the red line, and June 2023 is the green dashed dotted line.

As seen in Figure 2, the increase in time-varying ERPT coefficients following MPU shock has accelerated since 2018, when central bank credibility declined (see: Çakmaklı ve Demiralp, 2020; Bulut, 2020; Varlık and Dağlaroğlu, 2021) and central bank independence was significantly damaged (see: Demiralp and Demiralp, 2019; Vasicek, Uhrova, Dimitriou, Wroblowsky, and Navratil, 2023). From this point of view, the impact of the MPU shock on ERPT is analyzed by taking into account the dates when the CBRT Governors were dismissed before completing their term in office, and the results are reported in Figure 3. These dates are July 2019, November 2020, March 2021 and June 2023. The findings suggest that for these dates, the second- and third-stage ERPTs respond to the MPU shock by increasing and the second-stage ERPT increases more, while the third-stage ERPT increases permanently. Thus, these findings imply that developments in the institutional structure of monetary policy that undermine central bank independence have long-term and permanent effects on ERPT.

CONCLUSION

The degree of ERPT is crucial for developing countries like Türkiye implementing IT strategy in terms of maintaining price stability and financial stability. Even if adopting IT strategy is an important step in itself to reduce the degree of ERPT thanks to higher central bank credibility, IT strategy requires MPU to be low enough not to damage central bank credibility to keep ERPT low. Otherwise, an increase in MPU reduces the predictability of monetary policy, leading to a strengthening of the degree of ERPT.

This paper, unlike the previous studies, examines the impact of MPU on ERPT for the period June 2010–December 2023 using data from Türkiye, which is almost a laboratory feature for some monetary policy decisions and ERPT and where exchange rate movements are one of the main determinants of

inflation. Following Nakajima (2011a, b), using the TVP-VAR model, we provide time-varying impulse-response evidence of second-stage and third-stage ERPTs to a one standard deviation MPU shock.

Overall, our findings suggest that the time-varying ERPT coefficients increase over time when increase in MPU. The three-dimensional impulse-response graphs show that a one-standard deviation MPU shock increases the coefficients of the second- and third-stage ERPTs in the first four periods, after which they tend to decline. Considering that changes in producer prices affect consumer prices with a lag, the second-stage ERPT coefficients are expected to be greater than the third-stage ERPT coefficients over the whole period. The time-varying ERPT coefficients are seen to have increased rapidly for the last five years. The second- and third-stage ERPT coefficients reached the highest degree with 0.065 in July 2021 and 0.033 in December 2023, respectively. It is noteworthy that the increase in time-varying ERPT coefficients following the MPU shock has accelerated since 2018, when central bank credibility declined and central bank independence was significantly damaged. We find that the second-stage ERPT coefficients increase more and the third-stage ERPT coefficients increase permanently when a one standard deviation MPU shock is given on the dates when the CBRT Governors are dismissed from office before the end of their term.

Consequently, our findings imply that an increase in MPU increases time-varying ERPT coefficients over time and that this is also observed in periods of reduced central bank independence. These findings highlight the importance of increasing the predictability and credibility of monetary policy and preserving central bank independence to keep the ERPT low. From these findings, reducing monetary policy uncertainty by increasing the predictability of monetary policy decisions through transparent communication, implementing a forward guidance policy that enhances central bank credibility, and strengthening the legal framework that ensures central bank independence can be put forward as policy recommendations to reduce ERPT.

AUTHOR STATEMENT / YAZAR BEYANI

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