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Financial Fragility in Developing Countries: An Analysis in the Context of Monetary Policy and Central Bank Independence[1]

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Abstract: This study aims to examine the effects of monetary policies implemented by developed countries and central bank independence of developing countries on the financial fragility of developing countries. According to the findings, it was seen that the contractionary monetary policies implemented by the central banks of developed countries increase the financial fragility for both groups of countries, as do the change of central bank governors. However, the change in governors strengthens positive effects of contractionary monetary policies on the financial fragility.

Key words: Financial Fragility, International Monetary Policy, Central Bank Independence, System GMM.

JEL Code: C33, E52, E58, F42, G00

Introduction

With the globalization process, there has been an increase in the commercial, financial and other economic relations of countries with each other, and capital flows accelerated with the liberalization of capital movements. With the accel-

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eration of capital flows, access to financial markets has become easier, without the need for any intermediary person or institution. However, this situation has brought some negative effects, especially for developing countries. Thus, shocks that especially occur in the economies of developing countries have become able to affect the economic indicators of other countries through various channels. In this context it has been observed that the monetary policy practices of developed countries especially during and after the 2008 crisis, have an impact on the financial fragility of developing countries through capital movements. The reduction of interest rates by the central banks of developed countries causes a high amount of liquidity to be injected into the global economy. On the other hand, since the interest rates in developing countries are relatively higher, these countries attract a significant amount of foreign capital. However, the fact that capital flows to developing countries are mostly short-term creates significant risks for emerging markets. The increase in capital flows causes these economies to become more sensitive to capital flows by increasing the current account deficit, overvaluing the national currency, and increasing the tendency of domestic and foreign borrowing. On the other hand, the contractionary policies of the central banks of developed countries lead to a decrease in capital flows to developing countries, significant capital outflows, and the depreciation of the currencies of the developing countries. This situation makes it difficult for developing countries to access foreign capital they depend on and causes them to become more fragile.

The fragility of developing countries can be affected by domestic factors as well as external factors. One of the main characteristics of the monetary authority is its independence. In cases where necessary precautions cannot be taken regarding the problems that arise in the economy, stability may deteriorate. In terms of the success of monetary policy, especially in the last 30 years, it has been widely accepted that the independence of monetary authorities is one of the basic conditions of stability. In this context, it can be said that central bank independence is one of the main factors affecting the economic risks and thus financial fragility of developing countries:

- In the context of financial fragility, central banks stand out with their characteristics such as being the only liquidity provider, their impact on the efficiency of the banking system, and the impact of the monetary policy to be implemented on the real economy through transmission channels. (Padoa-Schioppa, 2003; Schinasi, 2003; Selgin, 2010).
- Central banks ensure that the implemented monetary policy has an impact on the real economy through monetary transmission channels. However, any problem that may occur in the economic system may prevent central banks from providing the needed liquidity to the markets and implement-

ing an effective monetary policy. Nevertheless, it can be said that the independence of central banks can provide positive contributions in terms of practices aimed at reducing financial fragility and ensuring stability. Independence not only enables central banks to play an active role without any restrictions in preventing financial instability but also helps them to intervene effectively, decisively, and quickly in case of a possible shock.

This study provides empirical evidence on the effects of central bank independence of developing countries and the monetary policies implemented by developed countries on the financial fragility of selected developing countries. In the study, the relationship between the variables was estimated using the System Generalized Moments Method (System GMM) from 2001 to 2019 for 23 upper-middle-income and 25 lower-middle income countries. In line with this purpose, answers to the following questions are sought in this study.

- How do the central bank decisions of developed countries affect the financial fragility of developing countries?
- How does independence of monetary authorities in developing countries affect financial fragility of these countries?
- Does independence of central banks in developing countries change the degree of impact of international monetary policies on financial fragility of these countries?

Within the framework of these research questions, the study is expected to make the following contributions to the literature: The first in this study, unlike other studies, a "Financial Fragility Index" was developed to represent the financial fragility of developing countries by using the indicators suggested by the Federal Reserve Board (Fed, 2014). When the relevant literature is examined, it is seen that one or more of the indicators discussed by the Fed are widely used in studies. But it is noteworthy that the number of studies in which all of them are used together is limited. Also, in the mentioned studies, it is seen that fragility is analyzed on the scale of individual indicators. In this study, an index was created by considering all possible fragility indicators, and the analysis was carried out with the calculated fragility index. In addition, no studies have been found in the literature that deal with the effects of international monetary policy decisions and central bank independence on financial fragility. Therefore, as far as we know, this is the first study to examine the relationship between these variables.

The rest of the paper is organized as follows: The literature review section briefly covers the studies on financial fragility, international monetary policy, and central bank independence. The data and methodology section describes the dataset and methodology. The estimation results and findings section describes the re-

sults of the empirical models. The conclusions and discussion are presented in the final section, together with suggestions for future works.

Financial Fragility, International Monetary Policy, and Central Bank Independence: A Literature Review

Studies on financial fragility have increased significantly since the 1990s. Various indicators have been used in the relevant studies to represent financial fragility. Ahumada and Budnevich (2001) used the share of non-performing loans in total loans and the interbank spread to represent financial fragility in their study, and they concluded that the increase in capital level and high liquidity reduce financial fragility. Iftikhar (2015) used the ratio of impaired loans to gross loans to represent financial fragility and the findings revealed that the effect of financial reforms and financial liberalization on financial fragility is positive whilst the effect of strong banking regulation and supervision policies is negative. In Demirgüç-Kunt and Detragiache (1999) and Ruiz-Porras (2008), fragility was represented by banking crises, and it was suggested in both studies that crises originating from the banking sector could have an increasing effect on fragility. Kaplan and Yapraklı (2014) and Bayraktar and Elüstü (2016) used the variables suggested by the Fed (2014) as an indicator of financial fragility. Karakurt, Şentürk & Mehmet (2015) and Akın (2017) discussed fragility with the following indicators: current account deficit/GDP, foreign exchange reserve/GDP, budget balance/GDP, public debt/GDP, domestic credit growth, loans/deposits, real effective exchange rate. In addition, there are also studies in which various indices are calculated to represent financial fragility. Based on Kibritçioğlu (2002, 2003), Feridun (2009) and Singh (2010) calculated the banking sector fragility index using indicators related to banks' liquidity risk, credit risk, and currency risk. While Ferrari-Filho, Terra & Conceição (2010) calculate a financial fragility index that includes government revenues, current expenditures, and financial expenses, Tymoigne (2011) created the financial fragility index to cover three sectors: households, financial firms, and non-financial firms. Kuek, Puah & Arip (2020) calculate a financial vulnerability index for Malaysia using 10 variables consisting of the real sector, external sector, financial sector and capital account through a dynamic approximate factor model. Also, Al-Rjoub (2021) construct a Financial Stability Index for Jordan using indicators such as Non-Performing Loans/Total Loans, Coverage Ratio, Leverage Ratio, Net Profits Before Taxes Liquidity Ratio, Growth Rate of Total Assets.

While the main determinant of financial fragility is national factors, central banks of developed countries such as the Fed and the European Central Bank (ECB),

which have the ability to control reserve currencies, can have a significant impact on global markets, especially the emerging economies. There are many studies examining the international effects of the policies implemented by the central banks of developed countries. It is noteworthy that the number of these studies increased especially after the 2008 global financial crisis. In the studies, the effect of the monetary policy practices of the Fed and ECB on the developing countries is mostly examined within the scope of financial and macroeconomic indicators such as bond spreads, equity prices, price levels, exchange rates, interest rates, real output (Arora & Cerisola, 2000; Georgiadis & Gräb, 2016; Maćkowiak, 2007; Dajčman, Kavkler, Merzlyakov, Pekarski & Romih, 2022). In addition to estimation methods such as GMM and Vector Autoregression (VAR) analysis (Bulut, Demirel & Akar, 2017; Erer, Erer, Çayır & Altay, 2016; Ho, Zhang & Zhou, 2018), the event study method (Chen, Filardo, He & Zhu, 2012; Neely, 2015; Rosa, 2011) is frequently used in econometric analysis in these studies.

It is seen that the independence of central banks, which is another dimension of the subject, has been discussed in many studies and the research of the relationship between central bank independence and inflation has come to the fore. In addition, there are studies examining the relationship between central bank independence and indicators such as financial development, growth, and budget balance. In the studies, indices and the rate of turnover of the central bank governors are used to represent the central bank's independence. In this context, the main studies that calculate the index representing the independence of the central bank will be explained. Then, studies examining the effects of central bank independence will be included. Bade and Parkin (1988) analyzed central bank independence for 12 developed countries and the 1972-1986 period under two headings: financial independence and political independence. While measuring financial and political independence, indices developed based on different criteria were calculated:

Financial independence:

- Whether the central bank has budgetary independence;
- Whether the salaries of bank members are determined by the central bank;
- Whether the allocation of profits is determined by the central bank.

Political independence:

- Whether the central bank is the highest monetary policy authority;
- Whether there is a member of the government in the central bank council;
- Whether a certain number of central bank council members are appointed independently of the government.

Alesina (1988) developed the index of political independence using the criteria of Bade and Parkin (1988) and including four more countries. Grilli, Masciandaro & Tabellini (1991) examined and calculated central bank independence under two headings: economic and political independence. Cukierman, Webb & Neyapti (1992) investigated central bank independence from different perspectives, including legal independence, the frequency of change of central bank governors, and surveys answered by experts. However, the fact that a central bank is legally independent does not necessarily mean that it is independent. This situation increases the importance of de facto independence. For this reason, it is thought that it would be more realistic to focus on the frequency of change of central bank governors in developing countries. An increase in the frequency of change of central bank governors indicates a decrease in central bank independence. Finally, a new central bank independence index was calculated for developed and developing countries by Garriga (2016) using the Cukierman et al. (1992) index.

When examining the relevant studies we could not find a study that directly examines the effects of Fed and ECB policies and central bank independence on financial fragility. However, the view that countries with a more fragile structure are more affected by international policies comes to the fore in the relevant studies (Bhattarai, Chatterjee & Park, 2018; Bowman, Londono & Sapriza, 2015). In some studies, there is evidence that the effects of Fed and ECB policies may not be valid for all developing countries, and the direction and significance of the effects may change depending on the financial development conditions of the countries (Berument, Ceylan & Olgun, 2007). In addition, some studies examining the effects of Fed and ECB policies together (Fratzscher, Duca & Straub, 2016; Göcen, 2017) suggest that the Fed decisions have more significant effects on developing countries than those of the ECB. Based on these results, it is expected that the relationship between the interest rate policies implemented by the Fed and ECB and financial fragility will be positive in our study. Similarly, the effect of central bank independence has been discussed within the framework of indicators related to financial fragility. Since it is one of the components of the financial fragility index calculated in the study, the relationship between central bank independence and price stability is important in terms of the relationship between central bank independence and financial fragility. In addition, financial instability refers to a process that develops in line with financial fragility. Therefore, the relationship between central bank independence and financial stability and financial development is important in terms of the relationship between central bank independence and financial fragility. In the literature, there is a negative relationship between central bank independence and inflation (Demirgil, 2011; Garriga & Rodriguez, 2020) and a positive relationship between financial stability. In the literature (Agoba, Abor, Osei & Sa-Aadu, 2020; Garriga & Rodriguez,

2020; Aftab & Mehmood, 2023), it is widely argued that there is a negative relationship between central bank independence and inflation, and a positive relationship between central bank independence and financial stability. In addition, in countries where the institutional structure is strong, institutional indicators and the level of democracy more support the effect of independence on reducing inflation and increasing financial stability (Agoba et al., 2020; Garriga & Rodriguez, 2020). Based on these results, it is possible that there is a negative relationship between central bank independence and financial fragility.

In the following part of the study, the abovementioned relations will be empirically examined for developing countries.

Data and methodology

The data used in the estimation part of the paper cover two country groups and 19 years: 23 upper-middle income and 25 lower-middle income countries[2] and the 2001-2019 period. This selection was made to create a balanced panel data set based on the World Bank's classification updated in June 2020.

We basically estimate the impact of Fed's and ECB's interest rate policies and central bank independence of developing countries on financial fragility of developing countries. In order to reveal the effect of central bank independence, the effect of the interest rates on fragility was examined first, without taking into account central bank independence, and then an estimation was made by adding the independence effect. The models estimated in the study and created in logarithmic form are as follows:

$$frag_{it} = a_1 frag_{it-1} + a_2 fed_{jt} + a_3 sp500_{jt} + a_4 usd_{it} + e_{it} \quad (1)$$

$$frag_{it} = a_1 frag_{it-1} + a_2 fed_{jt} + a_3 cbi_{it} + a_4 sp500_{jt} + a_5 usd_{it} + e_{it} \quad (2)$$

$$frag_{it} = \beta_1 frag_{it-1} + \beta_2 ecb_{jt} + \beta_3 dax30_{jt} + \beta_4 euro_{it} + u_{it} \quad (3)$$

$$frag_{it} = \beta_1 frag_{it-1} + \beta_2 ecb_{jt} + \beta_3 cbi_{it} + \beta_4 \mathrm{dax30}_{jt} + \beta_5 euro_{it} + u_{it} \quad (4)$$

In the equations, *j* shows unit invariant[3], *i* and *t* show unit and time dimensions, respectively; $frag_{it}$, shows the financial fragility index; $frag_{it-1}$, shows the lag of fi-

[2] The countries included in the analysis are presented in Appendix 1.

[3] In the equations while the variables *fed, ecb, sp500* and *dax30* vary according to time, they do not vary according to the unit. In other words, these variables are included in the model as unit invariants. Therefore, these variables are shown with the *j* subscript in the model instead of the *i* subscript, which indicates the units.

nancial fragility index; fed_{jt} and ecb_{jt} show Fed's and ECB's discount rates, respectively; cbi_{it}, represents the central bank independence; $sp500_{jt}$ and $dax30_{jt}$ show stock indices used to represent US and Europe stock markets, respectively; usd_{it} and $euro_{it}$ show the US dollar and Euro exchange rates, respectively; e_{it} and u_{it} represent the error term.

The variables used in the models and their sources are presented in Table 1.

Table 1: Variables used in the models and their sources

Variables	Definition of variable	Source
frag	Financial Fragility Index (FFI) created with the indicators expressed by the FED (2014)	World Bank Database World Development Indicators (WDI)
fed	FED's discount rate	International Monetary Fund International Financial Statistics
ecb	ECB's discount rate	European Central Bank
cbi	Dummy variable representing central bank independence	It is derived from the data on the official websites of the central banks of the countries covered by the analysis.
usd	The value of national currencies against the US dollar	World Bank Data
euro	The value of national currencies against the Euro	Eurostat
sp500	S&P500 Index	Yahoo Finance
dax30	DAX30 Index	Investing.com

Source: Authors

The descriptive statistics of the variables are presented in Appendix 2 and Appendix 3. The dependent variable of the study is the Financial Fragility Index (FFI) calculated by the authors. The purpose of calculating the FFI is to create a composite indicator of the course of the fragility by using the variables representing financial fragility. While creating the composite indicator, we used the Handbook on Constructing Composite Indicators-Methodology and User Guide, which was developed in collaboration with the Organisation for Economic Cooperation and Development (OECD) and the European Commission Joint Research Center (JCR) (OECD & JRC European Commission, 2008). Accordingly, selecting variables, normalization, weighting and aggregation steps were used while calculating the index.

Selecting variables: Choosing the right variables while creating a composite indicator is important in terms of determining the strengths and weaknesses of the indicator. There are some indicators in the reports of institutions such as

Moody's, the IMF, and the Fed to represent financial fragility. Since this study aims to examine the effects of contractionary interest policies of developed countries' central banks on financial fragility of developing countries, it has been decided to use the indicators suggested by the Fed (2014) to represent financial fragility: *Current account balance/GDP, gross government debt/GDP, average annual inflation over the past three years, the change over the past five years of bank credit to private sector/ GDP, total external debt/ exports, foreign exchange reserves/GDP.*

Normalization: For the purpose of comparison, the variables were normalized. It is seen that methods such as "scale transformation", "standardization", "minimum-maximum", "distance to a reference" are used during normalizing. In the study, the "minimum-maximum method", which is one of the most frequently used methods in the literature, was used. In this method, the variables are converted to take values between 0 and 1. This conversion was calculated separately for each year and the conversion process was applied as given in Equation (5).

$$\gamma_{n,i} = \frac{x_{n,i} - \text{minimum}(x_n)}{\text{maximum}(x_n) - \text{minimum}(x_n)} \tag{5}$$

For each year; *n*, shows the fragility indicator (n=1, 2, …, 6); i, shows the country; $x_{n,i}$, shows the value of the variable in the relevant country; maximum(x_n) ve minimum(x_n) show the maximum and minimum values of the variable in the relevant year, respectively; $\gamma_{n,i}$ represents the normalized indicator of financial fragility.

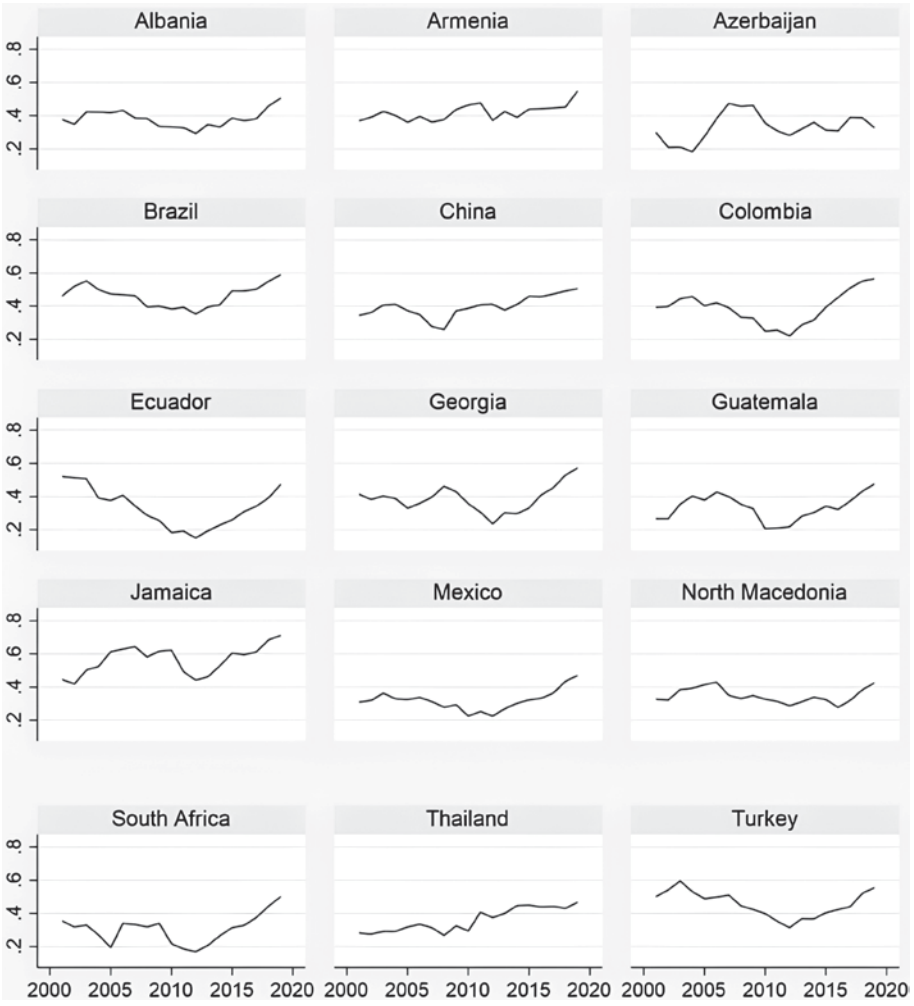
Weighting and Aggregation: While determining the weights of the variables in the index, various methods are used such as "data envelopment analysis", "equal weighting", "principal components analysis", and "conjoint analysis". The equal weighting method is one of the most used methods in studies because it is easy to apply (Balakrishnan, Danninger, Elekdag & Tytell, 2011). In the equal weighting method, the variables are weighted equally after normalization; in other words, the arithmetic mean of the variables is taken. Thus, each variable is included in the index with equal importance and it is assumed that each indicator contributes equally to the index.[4] Combining the variables into a single indicator using the equal weighting method is presented in Equation (6):

[4] The principal component analysis method was also used while determining the weights in the study. It was decided to use the equal weighting method in the study because of the limitation of the data period and the fact that the results support the findings obtained as a result of equal weighting.

$$FFI_t = \sum_{n=1}^{k} \frac{\gamma_{n,i}}{k}$$

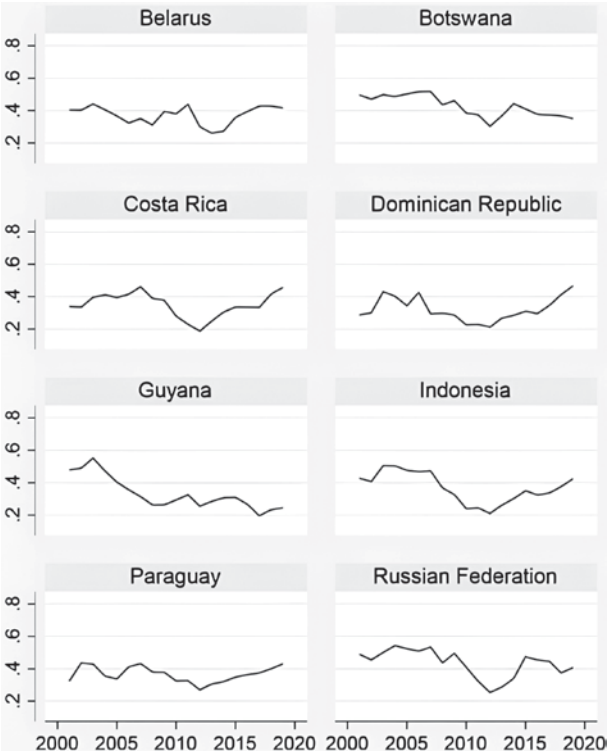
The time-dependent change of FFI for countries in the upper-middle and lower-middle income groups is presented graphically in Figure 1 and Figure 2.

Figure 1: The Course of the Financial Fragility Index in Upper-Middle Income Countries



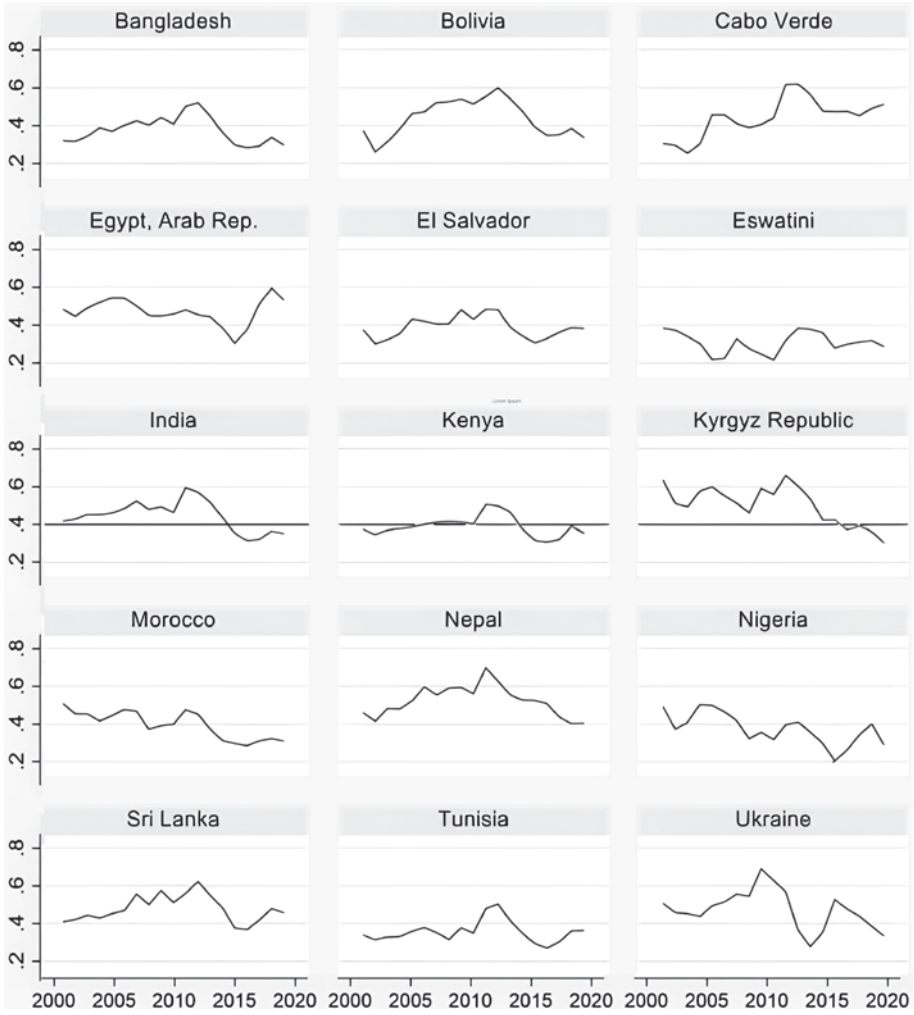
Source: Authors

Figure 1: The Course of the Financial Fragility Index in Upper-Middle Income Countries - continued



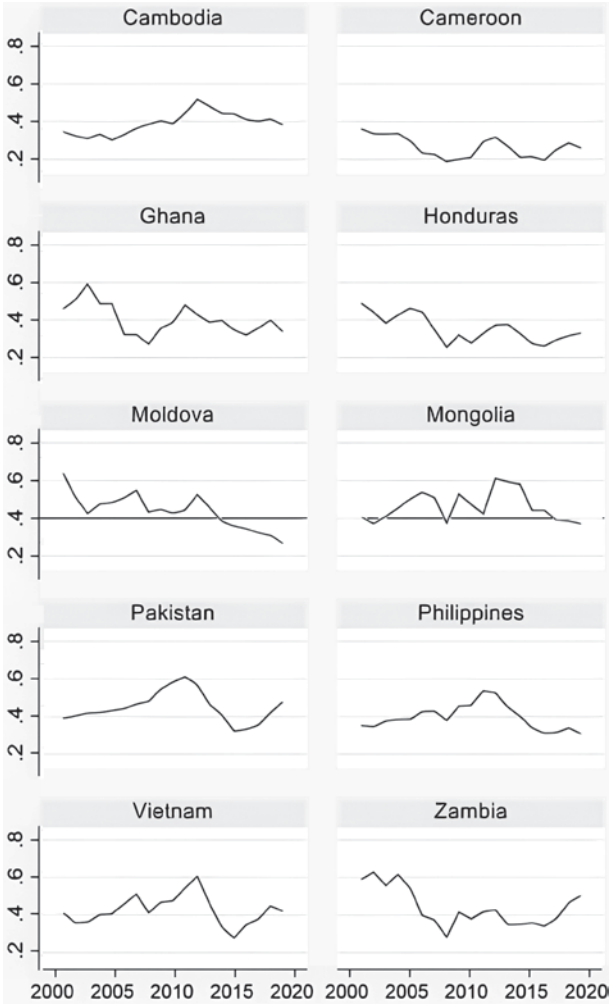
Source: Authors

Figure 2: The Course of the Financial Fragility Index in Lower-Middle Income Countries



Source: Authors

Figure 2: The Course of the Financial Fragility Index in Lower-Middle Income Countries - continued



Source: Authors

Graphs of the financial fragility index in the Figure 1 and Figure 2 showed that the index was not effective in predicting the 2008 global crisis. However, it is thought that this is due to the fact that the effects of the 2008 global crisis in developing countries were more limited than in developed countries. On the other hand, these graphs clearly showed the impact of expansionary and contraction-

ary interest rate policies implemented after the crisis on financial fragility of developing countries.

The first of the independent variables are the indicators related to monetary policy. Since the discount rates represent the direct control power of the central banks (Lopes, 2014), monetary policies implemented by the Fed and the ECB are shown with the mentioned interest rates.

The second independent variable is the dummy variable created to represent the central bank independence. In the studies on independence, indices are often used to represent independence. However, it is emphasized in various studies that focus on the rate of turnover of central bank governors gives more effective results when considering central bank independence in terms of developing countries (Cukierman et al., 1992). The ratio is calculated as: $number\ of\ governors_{it}\ /\ t$. Accordingly, as the number of governors changed during the term, in other words, as the frequency of change increases, the independence will decrease. In this case, only an increase in the frequency of change of governors is considered. However, in some countries, it can be seen that central bank governors serve for quite long periods. If an example is given over the data set of the study: There are countries that have changed their governor only once or twice in 19 years. This implies that the frequent changes of the governors, as well as the occasional changes, can be a sign of dependency. The rate of turnover does not take into account this situation. Therefore, in this study, central bank independence was used as a dummy variable which equals one if the governors changed in that year. Thus, it is aimed to make more rational interpretations in terms of financial fragility.

Stock market indices are included in the models in order to consider the distribution of global liquidity between developed countries and the stock markets of developing countries. For this purpose, the S&P500 index, which includes the 500 largest companies operating in the prominent sectors of the US economy, and the DAX30 index, which includes the 30 largest German companies traded on the Frankfurt stock exchange, representing the European Union stock market index, were used.

Finally, the exchange rates (US Dollar and Euro) were added to the models, as they affect the variables in the financial fragility index.

In this research, the models are analyzed using the System GMM, which is one of the dynamic panel data models developed by Arellano and Bover (1995). In the System GMM, data loss is minimized by taking the difference of the average of all possible future values of the variable. Blundell and Bond (1998) found that the

System GMM approach has higher predictive power in cases where the number of parameters is higher than the number of observations (N > T).

Estimation results and findings

Determining the cross-sectional dependence in panel data analysis is important in terms of deciding on pre-tests and estimation methods. In this study, cross-sectional dependence was investigated using the Pesaran (2004) Cross-Section Dependence (CD) test and the Pesaran, Ullah & Yamagata (2008) Bias-Adjusted Lagrange Multiplier (LM_{adj}) test. CD and LM_{adj} test results are presented in Appendix 4. According to the test results, there is a cross-sectional dependence in both the variables and the models. These results showed that tests which consider cross-sectional dependence must be used in unit root analysis. For this reason, Cross-sectionally Augmented Dickey-Fuller (CADF) test developed by Pesaran (2007), which is one of the second-generation unit root tests was used in the study. The unit root test results of the variables are given in Appendix 5. CIPS statistics show that the *ecb, usd*, and *euro* variables in the upper-middle income group become stationary at the first differences, while all other variables are stationary at the level values in both country groups. The *ecb*, *usd*, and *euro* variables were included in the upper-middle income group models by taking their first difference.

In this study, it was decided to use dynamic models, as financial fragility may be affected by its own lagged values. The lagged value of the dependent variable included in the model as an independent variable causes the endogeneity problem. Arellano and Bover (1995) and Blundell and Bond (1998) System GMM estimator, which can produce effective and consistent results in the presence of endogeneity, autocorrelation, and heteroscedasticity, was used in the estimations. The lagged values of the dependent and independent variables were added to the models as instrumental variables.

The System GMM estimation results obtained for the countries in the upper-middle income group are presented in Table 2.

Table 2. System GMM results for upper-middle income group

	Model 1	Model 2	Model 3	Model 4
Dependent variable: frag	Coefficient	Coefficient	Coefficient	Coefficient
frag(-1)	0.823*** (0.000)	0.848*** (0.000)	0.903*** (0.000)	0.861*** (0.000)
fed	0.052*** (0.000)	0.057*** (0.000)		
Δecb			0.015*** (0.010)	0.051* (0.083)
cbi		0.151*** (0.000)		0.519*** (0.000)
Δusd	0.745*** (0.000)	0.774*** (0.000)		
Δeuro			0.730*** (0.000)	0.680*** (0.000)
sp500	0.058*** (0.000)	0.061*** (0.000)		
dax30			0.102*** (0.000)	0.118*** (0.000)
Constant	-0.634*** (0.000)	-0.661*** (0.000)	-1.023*** (0.000)	-1.280*** (0.000)
Number of inst./Number of groups	21/23	21/23	22/23	20/23
Observations	414	414	414	414
Wald Chi2	25194.31*** (0.000)	52578.30*** (0.000)	18071.14*** (0.000)	55440.58*** (0.000)
AR(1) test	-4.06*** (0.000)	-4.00*** (0.000)	-3.92*** (0.000)	-3.83*** (0.000)
AR(2) test	-1.08 (0.282)	-0.19 (0.852)	-1.16 (0.244)	0.75 (0.453)
Hansen test	22.22 (0.136)	21.71 (0.116)	22.74 (0.158)	18.02 (0.206)

Note: *** and * denote significance at the 1% and 10% significance level, respectively.
Source: Authors

When the model results are evaluated as a whole, it has been determined that the necessary conditions for the System GMM estimator to be effective and the models estimated for the upper-middle income group are valid. It is seen that fragility is also significantly and positively affected by its own lagged values in all models. According to Model 1 results, the effect of the *fed*, *usd*, and *sp500* variables on financial fragility is positive and statistically significant. According to Model 2 results, the dummy variable used to represent the central bank independence, together with all variables, increases financial fragility. This result shows that financial fragility is greater in years when the central bank governor changes than in years when the governor does not change. In addition, when independence of the central bank is included, it is striking that the positive effect

of an increase in the Fed's interest rate on fragility increases. Similarly, according to the findings obtained from Model 3, the effect of *ecb*, *euro* and *dax30* variables on financial fragility is positive and statistically significant. Also, according to Model 4 results, the dummy variable used to represent the central bank independence, together with all variables, increases financial fragility. In addition, governor changes increase the positive effect of an increase in the ECB's interest rate on fragility. On the other hand, it is understood that the interest rate policy implemented by the Fed is more effective on the fragility of countries in terms of coefficient compared to the interest policy implemented by the ECB.

In Table 3, the System GMM estimation results obtained for countries in the lower-middle income group are presented.

Table 3. System GMM results for lower-middle income group

	Model 1	Model 2	Model 3	Model 4
Dependent variable: frag	Coefficient	Coefficient	Coefficient	Coefficient
frag(-1)	0.614*** (0.000)	0.749*** (0.000)	0.787*** (0.000)	0.759*** (0.000)
fed	0.045*** (0.000)	0.047*** (0.000)		
ecb			0.019*** (0.000)	0.029*** (0.037)
cbi		0.300*** (0.000)		0.168*** (0.000)
usd	0.313*** (0.000)	0.312*** (0.000)		
euro			0.002** (0.020)	0.004*** (0.005)
sp500	-0.274*** (0.000)	-0.278*** (0.000)		
dax30			-0.010* (0.072)	0.003 (0.980)
Constant	0.497*** (0.000)	0.539*** (0.000)	-0.120** (0.065)	-0.278** (0.036)
Number of inst./Number of groups	21/25	21/25	22/25	23/25
Observations	450	450	450	450
Wald Chi2 (prob)	1210.57*** (0.000)	1003.22*** (0.000)	298501.07*** (0.000)	50234.87*** (0.000)
AR(1) test	-3.52*** (0.000)	-3.32*** (0.001)	-3.60*** (0.000)	-4.00*** (0.000)
AR(2) test	-0.51 (0.613)	0.43 (0.664)	0.45 (0.650)	1.07 (0.286)
Hansen test	23.42 (0.103)	21.87 (0.111)	23.44 (0.135)	24.00 (0.119)

Note: *** and ** denote significance at the 1% and 5% significance level, respectively.

Source: Authors

When the model results are evaluated as a whole, it has been determined that the necessary conditions for the System GMM estimator to be effective and the models estimated for the lower-middle income group are valid. As in the upper-middle income group, it is seen that fragility is also significantly and positively affected by its own lagged values in all models. According to Model 1 results, the effect of *fed* and *usd* variables on financial fragility is positive and statistically significant. On the other hand, the ISP500 index negatively affects financial fragility. According to the results of Model 2, it is understood that the dummy variable used to represent central bank independence, together with the *fed* and *usd* variables, increases financial fragility. The *sp500* index negatively affects fragility again. When the independence of the central bank is included, as in the upper-middle income group, the positive effect of an increase in the Fed's interest rate on fragility increases. According to the findings from Model 3, the effect of the ecb and euro variables on financial fragility is positive and statistically significant. On the other hand, the *dax30* index negatively affects financial fragility. According to the results of Model 4, it is understood that the cbi variable, together with the ecb and euro variables increases financial fragility. But the effect of the dax on financial fragility is insignificant. In addition, the governor changes increase the positive effect of an increase in the ECB's interest rate on fragility. On the other hand, as in the upper-middle income group models, it is understood that the interest rate policy applied by the Fed is more effective on the fragility of countries in terms of coefficient compared to the interest policy implemented by the ECB.

Conclusion and Discussion

In this study, which emerged from the importance of financial fragility in the context of monetary policy, the relationship between financial fragility, monetary policies, and the central bank independence was investigated in terms of developing countries. The financial fragility index was calculated using the financial fragility variables suggested by the Fed (2014). The study was conducted within the scope of 23 countries in the upper-middle income group and 25 countries in the lower-middle income group, using the data from the 2001-2019 period.

According to the findings, the effect of the discount rate implemented by the Fed on financial fragility is similar for country groups. In the models created for the upper-middle and lower-middle income groups, this effect is positive and statistically significant. However, the effect of the Fed's interest rate policy in the upper-middle income group model is more effective compared to the lower-middle income group model in terms of coefficients. The effect of the ECB's interest rate

policies on fragility is positive and statistically significant. On the other hand, the effect of the ECB's interest rate policies in the upper-middle income group model is more effective compared to the lower-middle income group model in terms of coefficients. The effect of the interest rate policies implemented by the Fed and the ECB differs in terms of country groups. It is thought that this situation arises from the financial development conditions of countries in the lower-middle income group, similar to Berument et al. (2007). In addition, according to the results, the Fed's interest rate policies are more effective compared to the ECB's interest policies in terms of coefficient for both country groups.

The effect of the dummy variable, which is used as the indicator of central bank independence, on fragility is positive and statistically significant in all models. In addition, with the inclusion of governor changes, the positive effect of interest rate policies implemented by the Fed and the ECB on fragility increases for both groups of countries. Therefore, the findings show that financial fragility increases in years when the central bank governor changes and change of the governor increases the effect of external factors. This situation also reveals why monetary stability is not provided in countries where central bank management is subject to arbitrary changes by government officials.

As a result of the study examining the monetary policy-related factors that affect financial fragility in developing countries, it has been seen that central bank practices of developed countries and the central bank independence of developing countries are determinant factors on the fragility of countries.

The financial fragility in developing countries is affected by the policies implemented by international central banks, but this effect is at a higher level in terms of Fed's interest policies, similar to Fratzscher et al. (2016) and Göcen (2017). This has shown that the Fed plays a greater role in guiding global financial markets. It is possible that this effect is due to the use of the US dollar as the most common reserve currency. Especially in the post-crisis period, the fact that the issuance of dollar-denominated bonds by the Fed is higher than the issuance of Euro-denominated bonds by the ECB can be shown among the reasons leading to this situation. Therefore, the policies implemented and announced by the Fed will contribute to the effectiveness of policies to be developed to reduce financial fragility. In addition, the degree of sensitivity of developing countries to the policies implemented by developed countries` central banks is largely determined by internal factors (Bhattarai et al., 2018; Bowman et al., 2015). If the economic and social structure is based on sound footing, as countries will be less affected by external shocks, the sensitivity of financial fragility to external shocks will decrease.

The effect of central bank governor changes in developing countries shows that financial fragility in developing countries is one of the issues that should be discussed as a priority in terms of domestic dynamics. Findings that deal with the independence of central banks on the axis of the appointment and dismissal of governors have shown that the practices aimed at ensuring independence will significantly reduce fragility. Therefore, practices that increase central bank independence will have an effect on reducing fragility. However, central bank independence is also indirectly related to the institutional structure of the country. Effective rules will not be formed in governments that incorporate legislative, executive, and judicial organs. However, since the existing rules are often not followed, arbitrary dismissals of monetary policy managers, appointments not based on merit, and practices that take away the policy freedom of the bank may also occur. In countries where the legislature that determines the rules and the judiciary that controls whether the rules are obeyed does not function effectively, the financial fragility will constantly increase, as independence and transparency cannot be achieved in monetary policy, as in all other fundamental rights. The findings are consistent with theoretical and empirical studies examining central bank independence (Agoba et al., 2020; Garriga & Rodriguez, 2020; Klomp & De Haan, 2009).

The present study, which examines the internal and external factors that affect financial fragility of developing countries, differs from the existing studies in terms of the calculated financial fragility index and the way it is calculated as well as the variables used. However, there is a possibility that the findings may differ in terms of the period, units, variables, and methods. For this reason, studies to be developed within the scope of different periods, countries, and variables will contribute to the formation of a theoretical and empirical approach to this topic. In future studies, evaluating international monetary policies on the axis of different central banks and using different indicators that deal with central bank independence on the axis of transparency and accountability criteria will contribute to addressing the effects of international monetary policies and central bank independence from different perspectives.

References

1. Aftab, M.and Mehmood, A. (2023). Does Central bank transparency deter the exchange rate volatility? New evidence from Asian emerging markets. *Journal of Central Banking Theory and Practice*, 12(2), 133-163. https://doi.org/10.2478/jcbtp-2023-0017
2. Agoba, A. M., Abor, J. Y., Osei, K. A., & Sa-Aadu, J. (2020). The independence of central banks, political institutional quality and financial sector development in africa. *Journal of Emerging Market Finance*, 19(2), 154-188. https://doi.org/10.1177/097265271987747
3. Ahumada, A., & Budnevich, C. (2001). Some measures of financial fragility in the Chilean banking system: An early warning indicators application. Central Bank of Chile, Working Papers Central Bank of Chile 117. Available at: https://ideas.repec.org/p/chb/bcchwp/117.html
4. Akın, F. (2017). Türkiye ve Seçilmiş Balkan Ülkelerinde Makroekonomik Kırılganlık: Karşılaştırmalı Bir Analiz (Macroeconomic Fragility in Turkey and Selected Balkan Countries: A Comparative Analysis). *Balkan and Near Eastern Journal of Social Sciences*, 3(4), 88-96. Available at: https://www.ibaness.org/bnejss/2017_03_04/09_Akin.pdf
5. Alesina, A. (1988). Macroeconomics and politics. *NBER macroeconomics annual*, 3, 13-62. Available at: http://www.nber.org/books/fisc88-1
6. Al-Rjoub, S. A. (2021). A financial stability index for Jordan. *Journal of Central Banking Theory and Practice*, 10(2), 157-178. https://doi.org/10.2478/jcbtp-2021-0018
7. Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of econometrics*, 68(1), 29-51. https://doi.org/10.1016/0304-4076(94)01642-D
8. Arora, M. V. B., & Cerisola, M. M. D. (2000). How does US monetary policy influence economic conditions in emerging markets? IMF, Working Paper WP/00/148. Available at: https://www.imf.org/external/pubs/ft/wp/2000/wp00148.pdf
9. Bade, R., & Parkin, M. (1988). Central bank laws and monetary policy. Department of Economics, University of Western Ontario London, University of Western Ontario, Departmental Research Report Series No 7804. Available at: https://economics.uwo.ca/people/parkin_docs/CentralBankLaws.pdf
10. Balakrishnan, R., Danninger, S., Elekdag, S., & Tytell, I. (2011). The transmission of financial stress from advanced to emerging economies. *Emerging Markets Finance and Trade*, 47(sup2), 40-68. https://doi.org/10.2753/REE1540-496X4703S203

11. Bayraktar, Y., & Elüstü, S. (2016). Makroekonomik Kırılganlığın Ölçülmesi: Yükselen Piyasalar ve Türkiye için Karşılaştırmalı Bir Analiz (Measuring Macroeconomic Vulnerability: Comparative Analysis of the Emerging Markets and Turkey). *Hak İş Uluslararası Emek ve Toplum Dergisi*, 5(12), 8-29. Available at: https://dergipark.org.tr/tr/download/article-file/263269
12. Berument, H., Ceylan, N. B., & Olgun, H. (2007). The effects of changes in the anticipated and unanticipated Fed funds target rate on financial indicators: The case of an emerging market country-Turkey. *International Research Journal of Finance and Economics,* (7), 40-47. Available at: http://berument.bilkent.edu.tr/irjfe01.pdf
13. Bhattarai, S., Chatterjee, A., & Park, W. Y. (2018). Effects of US quantitative easing on emerging market economies. *Journal of Economic Dynamics and Control*, 122, 1-22. https://doi.org/10.1016/j.jedc.2020.104031
14. Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of econometrics*, 87(1), 115-143. https://doi.org/10.1016/S0304-4076(98)00009-8
15. Bowman, D., Londono, J. M., & Sapriza, H. (2015). US unconventional monetary policy and transmission to emerging market economies. *Journal of International Money and Finance*, 55, 27-59. https://doi.org/10.1016/j.jimonfin.2015.02.016
16. Bulut, E., Demirel, B., & Akar, N. Ç. (2017). 2008 Krizi Sonrası FED'in Faiz Artırımının Yükselen Piyasa Ekonomilerindeki Portföy Yatırımları Üzerine Etkileri (Impacts Of Fed's Hiking Interest Rates On Portfolio Investments in Emerging Markets Economies After the 2008 Crisis). *Gazi İktisat ve İşletme Dergisi*, 3(1), 35-58. Available at: https://dergipark.org.tr/tr/download/article-file/271556
17. Chen, Q., Filardo, A. J., He, D., & Zhu, F. (2012). International spillovers of central bank balance sheet policies. In: Are central bank balance sheets in Asia too large?, ed. Bank for International Settlements, 66, 220-264.
18. Cukierman, A., Webb, S. B., & Neyapti, B. (1992). Measuring the independence of central banks and its effect on policy outcomes. *The world bank economic review*, 6(3), 353-398. Available at: http://www.jstor.org/stable/3989977
19. Dajčman, S., Kavkler, A., Merzlyakov, S., Pekarski, S. E., & Romih, D. (2022). International Transmission of Conventional and Unconventional Monetary Policy and Financial Stress Shocks from the Euro Area to Russia. *Journal of Central Banking Theory and Practice*, 11(1), 227-247. https://doi.org/10.2478/jcbtp-2022-0010
20. Demirgil, H. (2011). Merkez Bankası bağımsızlığı ve makroekonomik performans: TCMB Örneği (Central Bank Independence and Macroeconomic Performance: The Case of CBRT). *Sosyoekonomi*, 16(16),

113-136. Available at: https://dergipark.org.tr/tr/pub/sosyoekonomi/issue/21076/226913
21. Demirgüç-Kunt, A., & Detragiache, E. (1999). Financial Liberalization and Financial Fragility. Annual World Bank Conference on Development Economics. World Bank, World Bank Policy Research Working Papers No: 1917. https://doi.org/10.1596/1813-9450-1917
22. Erer, E., Erer, D., Çayır, M., & Altay, N. O. (2016). TCMB, FED ve ECB Para Politikalarının Türkiye Ekonomisi Üzerindeki Etkileri: 1994-2014 Dönemi Analizi(The Effects of Monetary Policies by CBRT, FED and ECB on Turkish Economy: An Analysis for 1994-2014 Period). *Sosyoekonomi*, 24(29), 285-305. https://doi.org/10.17233/se.2016.07.004
23. Fed. (2014). Monetary Policy Report, February 11, 2014. Board of Governors of the Federal Reserve System. Available at: https://www.federalreserve.gov/monetarypolicy/files/20140211_mprfullreport.pdf
24. Feridun, M. (2009). Determinants of exchange market pressure in Turkey: an econometric investigation. *Emerging Markets Finance and Trade*, 45(2), 65-81. https://doi.org/10.2753/REE1540-496X450204
25. Ferrari-Filho, F., Terra, F. H. B., & Conceição, O. A. (2010). The financial fragility hypothesis applied to the public sector: an analysis for Brazil's economy from 2000 to 2008. *Journal of Post Keynesian Economics*, 33(1), 151-168. https://doi.org/10.2307/20798385
26. Fratzscher, M., Duca, M. L., & Straub, R. (2016). ECB unconventional monetary policy: Market impact and international spillovers. *IMF Economic Review*, 64(1), 36-74.
27. Garriga, A. C. (2016). Central bank independence in the world: A new data set. *International Interactions*, 42(5), 849-868. https://doi.org/10.1080/03050629.2016.1188813
28. Garriga, A. C., & Rodriguez, C. M. (2020). More effective than we thought: Central bank independence and inflation in developing countries. *Economic Modelling*, 85, 87-105. https://doi.org/10.1016/j.econmod.2019.05.009
29. Göcen, S. (2017). *Global Para Politikalarının Açık Ekonomilerdeki İş Çevrimleri Üzerine Etkisi: Türkiye Örneği*. Anadolu International Conference in Economics V, May 11-13, 2017, Eskişehir, Turkey.
30. Georgiadis, G., & Gräb, J. (2016). Global financial market impact of the announcement of the ECB's extended asset purchase programme. *Journal of Financial Stability*, 26, 257-265. https://doi.org/10.1016/j.jfs.2016.07.009
31. Grilli, V., Masciandaro, D., & Tabellini, G. (1991). Political and Monetary Institutions and Public Financial Policies in The Industrial Countries. *Economic Policy*, 6(13), 341-392. https://doi.org/10.2307/1344630

32. Ho, S. W., Zhang, J., & Zhou, H. (2018). Hot money and quantitative easing: The spillover effects of US monetary policy on Chinese Housing, equity and loan markets. *Social Science Electronic*, 3, 1-48. https://doi.org/10.1111/jmcb.12501
33. Iftikhar, S. (2015). Financial reforms and financial fragility: A panel data analysis. *International Journal of Financial Studies*, 3(2), 84-101. https://doi.org/10.3390/ijfs3020084
34. Kaplan, F., & Yapraklı, S. (2014). Ekonomik Kırılganlık Endeksi Göstergelerinin Döviz Kuru Üzerindeki Etkileri: Kırılgan 12 Ülke Üzerine Panel Veri Analizi (The Effects of The Economic Fragility Index Indicators on Exchange Rate Effects: Panel Data Analysis on Fragile 12 Country). *Uluslararası Alanya İşletme Fakültesi Dergisi*, 6(3), 111-121.
35. Karakurt, B., Şentürk, S. H., & Mehmet, E. (2015). Makroekonomik Kırılganlık: Türkiye VE Şangay Beşlisi Karşılaştırması (Macroeconomic Vulnerability: A Comparison Between Turkey and Shanghai Five). *Yönetim ve Ekonomi Araştırmaları Dergisi*, 13(1), 283-307. http://dx.doi.org/10.11611/JMER563
36. Kibritçioğlu, A. (2002). Excessive risk-taking, banking sector fragility, and banking crises. U of Illinois, Commerce and Bus. Admin., Working Paper No: 02-0114.
37. Kibritçioğlu, A. (2003). Monitoring banking sector fragility. *The Arab Bank Review*, 5(2), 51-66. Available at: https://core.ac.uk/download/pdf/9313839.pdf
38. Klomp, J., & De Haan, J. (2009). Central bank independence and financial instability. *Journal of Financial Stability*, 5(4), 321-338. https://doi.org/10.1016/j.jfs.2008.10.001
39. Lopes, L. T. (2014). Institutional development and monetary policy transmission. Georgia State University Economic Dissertations, Georgia/USA.
40. Kuek, T. H., Puah, C. H., & Arip, M. A. (2020). Financial vulnerability and economic dynamics in Malaysia. *Journal of Central Banking Theory and Practice*, 9(s1), 55-73. https://doi.org/ 10.2478/jcbtp-2020-0023
41. Maćkowiak, B. (2007). External shocks, US monetary policy and macroeconomic fluctuations in emerging markets. *Journal of monetary economics*, 54(8), 2512-2520. https://doi.org/10.1016/j.jmoneco.2007.06.021
42. Neely, C. J. (2015). Unconventional monetary policy had large international effects. *Journal of Banking & Finance*, 52, 101-111. https://doi.org/10.1016/j.jbankfin.2014.11.019

43. OECD, & JRC European Comission (2008). Handbook on constructing composite indicators: methodology and user guide. OECD Publishing.
44. Padoa-Schioppa, T. (2003). Central banks and financial stability: exploring the land in between. *The transformation of the European financial system*, 25, 269-310.
45. Pesaran, M. H. (2004). General diagnostic tests for cross-sectional dependence in panels. Empirical Economics, 1-38. https://doi.org/10.1007/s00181-020-01875-7
46. Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. *Journal of applied econometrics*, 22(2), 265-312. https://doi.org/10.1002/jae.951
47. Pesaran, M. H., Ullah, A., & Yamagata, T. (2008). A bias-adjusted LM test of error cross-section independence. *The Econometrics Journal*, 11(1), 105-127. https://doi.org/10.1111/j.1368-423X.2007.00227.x
48. Rosa, C. (2011). The Validity of the Event-study Approach: Evidence from the Impact of the Fed's Monetary Policy on US and Foreign Asset Prices. Economica, 78(311), 429-439. http://dx.doi.org/10.1111/j.1468-0335.2009.00828.x
49. Ruiz-Porras, A. (2008). Banking competition and financial fragility: Evidence from panel-data. *Estudios Económicos*, 23(1), 49-87. Available at: https://www.jstor.org/stable/40311538#metadata_info_tab_contents
50. Schinasi, M. G. J. (2003). Responsibility of central banks for stability in financial markets. International Monetary Fund, Working Paper No. 2003/121. Available at: https://www.imf.org/en/Publications/WP/Issues/2016/12/30/Responsibility-of-Central-Banks-for-Stability-in-Financial-Markets-16526
51. Selgin, G. (2010). Central banks as sources of financial instability. *The Independent Review*, 14(4), 485-496. Available at: https://www.independent.org/pdf/tir/tir_14_04_01_selgin.pdf
52. Singh, T. R. (2010). An ordered probit model of an early warning system for predicting financial crisis in India. IFC Bulletins chapters, In: Bank for International Settlements (ed.), Proceedings of the IFC Conference on "Initiatives to address data gaps revealed by the financial crisis", Basel, 25-26 August 2010, 34, 185-201.
53. Tymoigne, É. (2011). Measuring macroprudential risk: Financial fragility indexes. Levy Economics Institute of Bard College, Working Paper No: 654.

Appendices

Appendix 1. Countries used in the analysis

Upper-Middle Income	Lower-Middle Income
Albania	Bangladesh
Armenia	Bolivia
Azerbaijan	Cabo Verde
Belarus	Cambodia
Botswana	Cameroon
Brazil	Egypt, Arab Rep.
China	El Salvador
Colombia	Eswatini
Costa Rica	Ghana
Dominican Republic	Honduras
Ecuador	India
Georgia	Kenya
Guatemala	Kyrgyz Republic
Guyana	Moldova
Indonesia	Mongolia
Jamaica	Morocco
Mexico	Nepal
North Macedonia	Nigeria
Paraguay	Pakistan
Russian Federation	Philippines
South Africa	Sri Lanka
Thailand	Tunisia
Turkey	Ukraine
	Vietnam
	Zambia
Total 23	25

Appendix 2. Descriptive statistics for upper-middle income group

Variables	Obs.	Mean	St. Deviation	Minimum	Maximum
frag	437	-0.996	0.259	-1.888	0.339
fed	437	0.364	0.789	-0.693	1.832
ecb	437	0.221	1.137	-1.386	1.609
usd	437	3.447	2.743	-1.973	9.563
euro	437	3.642	2.744	-2.083	9.729
sp500	437	7.305	0.347	6.861	7.985
dax30	437	8.843	0.399	8.072	9.428

Appendix 3. Descriptive statistics for lower-middle income group

Variables	Obs.	Mean	St. Deviation	Minimum	Maximum
frag	475	-0.905	0.238	-1.672	0.361
fed	475	0.364	0.789	-0.693	1.832
ecb	475	0.221	1.137	-1.386	1.609
usd	475	3.771	2.356	-0.333	10.045
euro	475	3.965	2.357	-0.443	10.259
sp500	475	7.305	0.347	6.861	7.985
dax30	475	8.843	0.399	8.072	9.428

Appendix 4. CD and LMadj tests results

Variables	Upper-middle income group				Lower-middle income group			
	CD	Prob.	LM_{adj}	Prob.	CD	Prob.	LM_{adj}	Prob.,
frag	27.622***	0.000	53.128***	0.000	23.872***	0.000	43.610***	0.000
fed	69.332***	0.000	201.811***	0.000	75.498***	0.000	219.759***	0.000
ecb	69.332***	0.000	201.811***	0.000	75.498***	0.000	219.759***	0.000
usd	19.131***	0.000	56.631***	0.000	34.301***	0.000	90.761***	0.000
euro	26.314***	0.000	57.374***	0.000	41.837***	0.000	93.795***	0.000
sp500	69.332***	0.000	201.811***	0.000	75.498***	0.000	219.759***	0.000
dax30	69.332***	0.000	201.811***	0.000	75.498***	0.000	219.759***	0.000
Model 1	41.570***	0.000	138.100***	0.000	22.010***	0.000	37.790***	0.000
Model 2	37.490***	0.000	105.200***	0.000	19.970***	0.000	26.030***	0.000
Model 3	40.450***	0.000	120.000***	0.000	25.360***	0.000	52.770***	0.000
Model 4	36.060***	0.000	87.840***	0.000	23.650***	0.000	42.380***	0.000

Note: ***, denotes significance at the 1% significance level.

Appendix 5. CADF test results

Variables	Upper-middle income group		Lower-middle income group
	CIPS Stat.		CIPS Stat.
	Level	First difference	Level
frag	-3.247***		-3.829***
fed	-3.750***		-3.792***
ecb	-2.069	-3.102***	-2.553***
usd	-1.918	-2.946***	-2.347***
euro	-1.914	-2.816***	-2.289***
sp500	-2.309**		-3.194***
dax30	-2.580***		-3.353***
Critical values		%1 -2.32 %5 -2.15 %10 -2.07	

Note: *** and ** , denote significance at the 1% and 5% significance level, respectively.