

Ordu-Akkaya, Beyza Mina

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Migration policy uncertainty and stock market investor sentiment

Beyza Mina Ordu-Akkaya
*Department of Business Administration,
Social Sciences University of Ankara, Ankara, Turkey*

Abstract

Purpose – The purpose of this paper is to examine the volatility transmission between migration policy uncertainty indices (MI) of France, Germany, UK and the USA, and respective stock markets of these countries. Therefore, the author's major intention is to understand whether MI is a critical factor affecting company valuations and investor sentiment.

Design/methodology/approach – The author proxies volatility via EGARCH (1,1) for all series and employs Diebold–Yilmaz (2012) methodology to test the spillover, which is a simple yet very intuitive procedure. This method allows one to analyze the numerical amount of spillover, as well as the direction.

Findings – Findings propose that volatility transmission is from migration index to stock markets for the UK and US markets, but similar findings are not applicable for France and Germany. However, when cross-market transmissions are analyzed, it is observed that migration policy uncertainty of US spills significant volatility to all European stock markets. Hence, the findings underline the central role of US markets.

Originality/value – Given the increasing worries about migration across the USA and Europe, the author tries to cast light on whether investor sentiment alters by migration policies. The literature is recently building and best of the author's knowledge; the paper is the first to investigate the cross-country spillover between MIs, which has not been performed before.

Keywords Politics, Stock markets, Investor sentiment, Migration policy, Volatility spillover

Paper type Research paper

1. Introduction

United Nations (UN) reported that total number of migrants has increased by almost 50 percent from 2000 to 2017 (UN, 2017). One of the underlying reasons for this surprising increase is the civil war bursting out in 2011, in Syria. There are over 7m Syrians who crossed the Syrian border to resettle at a different country (UN, 2017). Although majority of asylum seekers are relocated to Turkey, Lebanon, Jordan, Iraq and Egypt, they are still seeking ways to cross the Aegean Sea to settle in one of the European countries. Moreover, the seekers are not only from Syria; citizens of Afghanistan, Pakistan, Iraq, Bangladesh and many other citizens of underdeveloped countries have been looking for a way out from their countries for a more prosperous and peaceful life.

On the other hand, Europe does not seem to be that keen on welcoming them. In 2015, Chancellor Angela Merkel stated that gates of Germany are open to refugees and especially to Syrians (Hall and Lichfield, 2015). Then, the EU Chief Claude-Juncker urged other European countries to show solidarity, but, unfortunately, countries have been highly hesitant on refugee acceptance. These developments paved the way for an unexpected rise in right-wing parties in the elections of France, the Netherlands and Austria. Even the surprising result on Brexit in June 2016 had been attributed to the increase in potential migrants in the country (Pells, 2016).

JEL Classification — F22, G10, G15

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These developments were not limited to European countries. In 2016, there was a fierce competition for the presidential office of the USA. In his election speech in Arizona, Donald Trump told he is going to build a wall in the Southern Border to prevent illegal Mexican migrants (*New York Times*, 2016). These statements could have helped him to be elected (Cassidy, 2016).

Given the critical role of migration policy on election results, we aim to examine the role of such policy alterations on stock market volatilities. Equity market investors consider and discuss news flows through the perspective of the valuations. So how could immigration change valuations? Migration policy might result in right-wing parties to gain strength across population, and such could result in altering policies on many areas of the economy. Second, migration is generally perceived to be attached with terrorist attacks and hence could result in a perception of rise in geopolitical risks (Czudaj, 2018). Last, but not least, refugees could put an additional burden on the labor market, social security system and economy (Borjas, 2003).

We measure migration policy uncertainty through Baker *et al.*'s (2016) index which is available in quarterly frequency. The authors compute the index via scanning several newspapers for a selected number of key words, for UK, Germany, France and USA. Via employing migration policy uncertainty, we examine the volatility spillover between migration policy uncertainty index (MI) and stock markets of aforementioned countries. We do not restrict our analysis with pairwise analysis, but also check the direction of the spillover and cross-spillovers across MIs and stock markets. To our knowledge, our paper is one of the first to analyze the relationship between cross-country and cross-index basis.

Our findings indeed propose that the transmission of volatility is from migration policy uncertainty index to stock market for the USA. Though this direction of information transmission is not applicable for European countries. The spillover is the other way around, namely, from stock market to MIs for France and the UK. Although this sounds odd, results on cross-market spillover indicate that European market investor sentiment is highly sensitive not to their own migration policy uncertainty, but to the USA. This finding implies the central role of US markets in many areas of investor sentiment, even at migration policy.

The paper is organized as follows. Section 2 summarizes the literature related with the research question of the paper. Section 3, introduces the methodology employed, and Section 4 elaborates the data. Section 5 reports and concludes empirical results.

2. Literature review

Our paper is related with three strands of literature. As we mention above, there are three major channels of migration to affect stock market investor sentiment. First of all, as we have seen in the last decade, right-wing party politicians have highly benefited from potential migration claims to their countries. So how does the right-wing election win is perceived by investors on average? One of the first studies on this area is by Santa-Clara and Valkanov (2003), who test the impact of Democrats and Republicans separately on stock market, whilst controlling for several macroeconomic factors. Although Huang (1985) and Johnson *et al.* (1999) show there is a difference in stock returns under left and right-wing parties, Santa-Clara and Valkanov (2003), using a data for the last century, find that the excess return of CRSP index is 2 and 11 percent under Republican and Democrat management, respectively. Therefore, they conclude that equity market investors perceive left-wing to be more stock market-friendly. Wong and McAleer (2009) support their findings for the USA, and Chrétien and Coggins (2009) also argue that Democrat premium is also applicable for Canadian equities. However, Powell *et al.* (2009) state that long-regimes such as presidential cycles lead to a spurious regression problem, if standard testing procedures are used. Therefore, they indicate that findings of previous likewise studies are questionable.

Later, these types of studies are shifted more toward other markets. Anderson *et al.* (2008) study Australia and New Zealand markets and find that stock markets incline toward

a higher return during right-leaning governments. Bohl and Gottschalk (2006) study 15 international markets including major European countries, Japan and the USA, and find that left-leaning governments do not necessarily lead to higher returns.

More recent studies find that rather than a left- or right-wing party; a shift in the major political orientation (from right- to left-wing or vice versa) of the country induces an additional stock market volatility (Bialkowski *et al.*, 2008).

Another channel for migration fear to affect stock market movements is through geopolitical risks (Czudaj, 2018). First of all, an increase in migration fear could lead the population to become hesitant on security issues and thus is related with the impact of geopolitical risks on economic variables. Given the perception of migrants across natives as low-skilled and uneducated, natives attach migrants by burglary, theft, terrorist activities and other security-related issues. More voluminous literature is on the impact of terrorism on economic growth. Eckstein and Tsiddon (2004) state that terrorist events could lead economies to narrow by almost 10 percent. Similarly, Blomberg *et al.* (2004) examine 177 countries and indicate these kind of one-off events do not change the economic conditions of OECD countries, significantly. However, if the country is a developing one, terrorism has negative effect on the wealth of the nation.

Later, Karolyi and Martell (2010) study the relationship between US stock markets and terrorist activities. They employ event-study analysis and show that stock prices decrease on an average of -0.8 percent, which results in an average loss per firm per attack of US \$401m in firm market capitalization. Arin *et al.* (2008) extend the analysis to six countries that, time-to-time, cope with terrorism: these are Indonesia, Israel, Spain, Thailand, Turkey and UK. Results propose that stock markets of emerging countries are hurt more from terror shocks. Brounen and Derwall (2010) employ stock markets data of Canada, France, Germany, Italy, Japan, the Netherlands, the UK and the USA, and examine their sensitivity to terror attacks. Findings imply that the major impact is through the 9/11 event and the rest do not have much effect on these developed markets.

Last but not least, worries of equity market investors would further elevate after immigration, since migration policy affects traditional economic aspects such as social security system, housing markets, schooling and government spending. For instance, Borjas (2003) examines the impact of immigration on the US labor market and finds that natives are indeed hurt by immigrants who are similarly skilled and educated. The author even finds out that a 10 percent supply in the immigrants lowers the wage of competing native workers by 3–4 percent. Later, Beerli and Peri (2018) study the Switzerland labor market, which opened its border region between 1999 and 2004. Contrary to Borjas (2003), they find that the average pay increased for natives after liberalization. Boeri *et al.* (2015) study how immigrants shape the housing market in Italy, and find that if the share of migrants in a block rises from 15 to 25 percent, the employment rate falls from 88 to 68 percent. The authors indicate that this is attributable to immigrants living in ghetto regions having less potential to be employed. Therefore, immigration and economic conditions are closely intertwined and immigration could affect investor sentiment.

3. Methodology

We employ a recent volatility spillover analysis via Diebold and Yilmaz (2012), which is based upon the pretty well-known forecast error variance decomposition (FEVD) methodology. FEVD allows one to analyze the relative importance of each variable on other selected variables in the VAR, through forecasting the H -step-ahead variance. In our setting, FEVD provides us to understand the impact of 1 standard deviation shock in migration policy uncertainty index (MI) on the stock market volatility.

It is also worthwhile to mention that Diebold and Yilmaz (2012) employ generalized frameworks (Koop *et al.*, 1996; Pesaran and Shin, 1998) but not the traditional method using

Cholesky-decomposition. The disadvantage of Cholesky-decomposition is the necessity to order variables upon the importance of the impact on other variables. However, the theoretical background might not be always adequate to make such an ordering. Therefore, generalized frameworks are not prone to such problems.

To calculate generalized FEVD, we start with computing a vector autoregression model which has two lags, according to the Schwartz criterion. The model is as follows:

$$S_t = \sum_{i=1}^2 \vartheta_i S_{t-i} + \sum_{i=1}^2 \alpha_i FMI_{t-i} + \sum_{i=1}^2 \beta_i GMI_{t-i} + \sum_{i=1}^2 \gamma_i UKMI_{t-i} + \sum_{i=1}^2 \theta_i USMI_{t-i} + \varepsilon_t, \quad (1)$$

where S stands for the CAC40, DAX, FTSE100 or S&P500, so they are the stock markets of respective countries. We also include migration policy uncertainty indices of all countries available to the VAR to examine the cross-market spillover effect between countries. We perform this model four times for France, Germany, UK and the USA.

The moving average representation of the VAR model is as follows:

$$Y_t = A(L)u_t, \quad (2)$$

where $A(L)$ is the moving average coefficients and allows one to divide the H -step-ahead forecast error variances of each variable into parts attributable to the various system shocks. Next, we calculate FEVD:

$$\delta_{ij} = \frac{\sigma_{jj}^{-1} \sum_{h=0}^{H-1} (e'_i A_h \Sigma e_j)^2}{\sum_{h=0}^{H-1} (e'_i A_h \Sigma A'_h e_i)^2}, \quad (3)$$

where σ_{jj} stands for the standard deviation of ε_j , Σ is the covariance matrix for the error vector. Since there are five variables in each model, e_j is a selection 5×1 vector. The result of the calculation is a 5×5 model whose each entry provides the contribution of variable j on the forecast error variance of variable i . Diagonals of the matrix show the contribution of variable i on itself, and off-diagonals show pairwise-contributions, which are from variable i to variable j .

Then δ_{ij} is normalized via:

$$\tilde{\delta}_{ij} = \frac{\delta_{ij}}{\sum_{j=1}^N \delta_{ij}}. \quad (4)$$

One can calculate the gross spillover from i to j by Equation (4), and the notation of the spillover from i to j is $GS_{i \rightarrow j}$:

$$GS_{i \rightarrow j} = \frac{\sum_{j=1}^N \tilde{\delta}_{ji}}{N} \times 100. \quad (5)$$

The net spillover is basically the difference between the gross spillover from i to j and the gross spillover from j to i . So it is:

$$NS_{ij} = GS_{j \leftarrow i} - GS_{i \leftarrow j}. \quad (6)$$

4. Data

We examine volatility spillover between migration policy uncertainty and stock markets for the major immigrant receivers, namely, USA, UK, France and Germany. Since these markets are also major financial markets, our analysis would also cast light on whether migration is critical enough to affect stock markets and investor sentiment. We employ S&P500, FTSE100, CAC40 and DAX indices to proxy for US, UK, France and Germany stock markets, respectively.

We measure the migration policy uncertainty through the index developed by Baker *et al.* (2016), which is publicly available in quarterly frequency for the period between 1990 and 2018. The authors construct the index via counting articles which at least has one term from each of groups of migration, economy, policy and uncertainty:

- migration (M)-related words such as “border control,” “Schengen,” “open borders,” “migrant,” “migration,” “asylum,” “refugee,” “immigrant,” “immigration,” “assimilation,” “human trafficking”;
- economy (E): “economic,” “economy”;
- policy (P): “regulation,” “deficit,” “white house,” “legislation,” “congress,” “federal reserve”;
- uncertainty (U): “uncertainty,” “uncertain.”

Next, they normalize the number by the total number of newspaper articles which are published at *Le Monde* for France; *Frankfurter Allgemeine Zeitung* and *Handelsblatt* for Germany; the *Financial Times* and the *Times of London* for the UK; and US newspapers indexed by the Access World News Newsbank database

The historical overview of indices is presented in Figure 1.

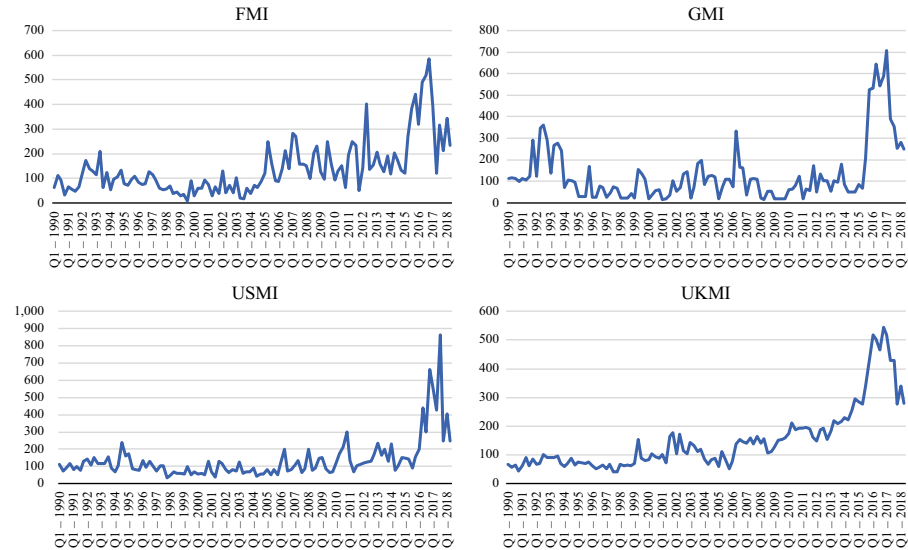


Figure 1.
Migration policy
uncertainty index

Notes: The figure depicts historical values of migration policy uncertainty index, which is developed by Baker *et al.* (2016). It is available in quarterly frequency starting from 1990. The authors measure this index for France (FMI), Germany (GMI), UK (UKMI) and the USA (USMI)

Our sample period for the analysis is the second quarter of 1990 and the second quarter of 2018 for the USA, Germany and France. However, our analysis for the UK starts by the first quarter of 1993, due to the availability of stock market data.

Since we test for the volatility spillover, we calculate returns of each series via the conventional method of $R_{i,t} = \ln(P_{i,t}) - \ln(P_{i,t-1})$. Next, we proxy for volatility through calculating EGARCH (1,1), following Soytaş and Oran (2011). They state, whilst using EGARCH, that there is no need to levy restrictions to ensure positive variances. Moreover, stock market data are available in daily but migration policy uncertainty indices are in quarterly frequency, and hence we calculate quarterly volatilities of all series. Descriptive statistics for volatility series are shown in Table I.

As one can observe that the mean volatility of DAX is higher than any other stock market, but the highest volatility is experienced in the US market. Between migration policy uncertainty indices, France and Germany are the most volatile ones.

5. Discussion of findings

We present findings of Diebold–Yilmaz volatility spillover tests for each country, respectively. We start with France at which, Table II presents results for the connectedness analysis between CAC40 and migration policy uncertainty indices. We base our results on a horizon of $H=4$. Diagonals depict contribution of the variable itself on its own variance, and hence, they are the highest numbers. Off-diagonals present the contribution of variable i on the other variable j ; for instance, France migration index explains 1.3 percent of the four-step ahead forecast error variance in French stocks. The other way around, CAC40 explains 7.7 percent of the four-step ahead forecast error variance in FMI. If one would like to find the net connectedness, then we deduct 1.1 from 7.7 percent and come up with 6.4, which indicates the direction of the spillover. Although both FMI and CAC40 affect each other, the higher spillover is from CAC40 to FMI and hence the spillover is from stocks to migration index. Therefore, France's migration policy uncertainty does not seem to affect equity market investors' investment sentiment.

Figure 2 presents our findings in an illustrative format: (a) and (b) show gross and net spillovers, respectively. First, we compute gross spillovers between asset i and asset j , and if the average spillover figure is greater than 1, we plot a bi-directional arrow in (a). If the net spillover is greater than 1, then we plot a uni-directional arrow showing the direction of the spillover at (b).

Although CAC40 seems to be a volatility giver to FMI, when we check for cross-market volatility spillovers, the story changes. USMI has a significant impact on the French stock

	CAC40	DAX	FMI	FTSE100	GMI	SP500	UKMI	USMI
Mean	0.08	0.09	0.63	0.05	0.69	0.06	0.25	0.46
Median	0.07	0.08	0.58	0.05	0.70	0.05	0.23	0.46
Maximum	0.13	0.14	1.29	0.15	1.20	0.19	0.47	0.65
Minimum	0.07	0.07	0.44	0.04	0.21	0.05	0.16	0.27
SD	0.01	0.01	0.17	0.02	0.23	0.02	0.07	0.09
Skewness	2.06	1.96	1.82	2.55	−0.02	3.41	1.12	−0.10
Kurtosis	7.74	7.19	6.56	11.10	2.19	14.71	3.66	2.41
Observations	113	113	113	100	113	113	113	113

Notes: CAC40, DAX, FTSE100 and S&P500 represent stock markets of France, Germany, UK and the USA, respectively. Similarly, FMI, GMI, UKMI and USMI represent migration policy uncertainty indices of France, Germany, UK and the USA. The table presents descriptive statistics employed in the study. Data are available in quarterly frequency and for the period between Q2-1990 and Q2-2018 for all variables except FTSE1000, which is available between Q1-1993 and Q2-2018. We proxy volatility via EGARCH (1,1)

Table I.
Descriptive statistics

Table II.
Diebold–Yilmaz
output – France

Panel A – volatility spillover table						
	Stocks	FMI	GMI	USMI	UKMI	From others
Stocks	88.4	1.3	0.5	8.4	1.4	11.6
FMI	7.7	88.1	0.7	1.3	2.2	11.9
GMI	0.3	0.1	94.5	2.4	2.8	5.5
USMI	1.5	0.6	1.4	95.3	1.2	4.7
UKMI	2.4	1.1	1.6	0.8	94.2	5.8
Contribution to others	11.9	3.1	4.1	12.9	7.6	39.5
Contribution including own	100.2	91.2	98.6	108.2	101.8	
Panel B – net spillover						
	Stocks	FMI	GMI	USMI	UKMI	
Stocks						
FMI	6.4					
GMI	−0.3	−0.6				
USMI	−6.9	−0.7	−1.0			
UKMI	1.0	−1.2	−1.2	−0.4		

Notes: FMI, GMI, UKMI and USMI indicate migration policy uncertainty indices of France, Germany, UK and the USA, respectively. The table presents the volatility spillover tests utilizing Diebold and Yilmaz (2012) framework. Panel A shows the gross spillover findings. The “Contribution to others” row display the contribution of the selected variable i on forecast error variance of other variables, in total. “Contribution including own” indicates contribution of variance of variable i on itself as well as other variables and hence is the sum of the column. Panel B depicts the net (pairwise) spillovers between each pair. One can find the directional spillover via deducting same pairs’ gross spillovers from each other. Positive (negative) figure shows the spillover from column (row) to row (column). Stocks represent CAC40

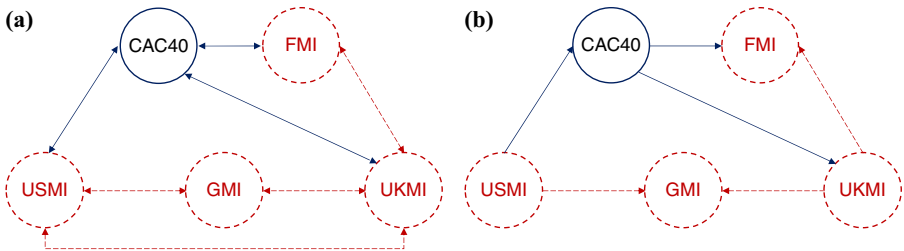


Figure 2.
Gross and
net spillover
illustration – France

market and as one can see from Table II, migration index of US explain 8.4 percent of forecast error variance of CAC40, which is pretty high. Moreover, USMI has a high connectedness with the UK and Germany, and even has a net spillover on Germany. Therefore, we can conclude that although FMI does not seem to affect investor sentiment, USMI is the major volatility giver across markets.

In the next tables and figures, we present findings for Germany, UK and the USA, respectively. Findings from Table III and Figure 3 indicate that, surprisingly, there is no connection between Germany migration policy uncertainty index and DAX. This non-existent connection might hint that there is some other indirect relationship which might arise through

Panel A – volatility spillover table

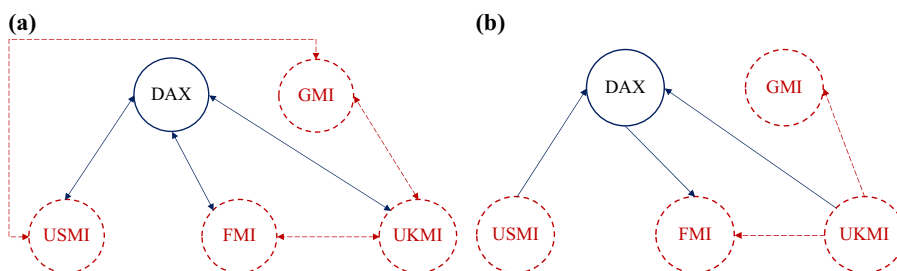
	Stocks	FMI	GMI	USMI	UKMI	From others
Stocks	90.2	1.2	0.2	4.1	4.3	9.8
FMI	7.9	88.2	0.7	1.2	2.1	11.8
GMI	0.1	0.4	94.2	2.5	2.8	5.8
USMI	0.6	0.5	1.6	96.1	1.3	3.9
UKMI	2.6	0.9	1.8	0.7	94.0	6.0
Contribution to others	11.1	3.0	4.3	8.4	10.5	37.3
Contribution including own	101.3	91.2	98.5	104.5	104.5	

Panel B – net spillover

	Stocks	FMI	GMI	USMI	UKMI
Stocks					
FMI	6.7				
GMI	-0.1	-0.3			
USMI	-3.5	-0.7	-0.9		
UKMI	-1.7	-1.1	-1.1	-0.6	

Notes: Stocks represent DAX; FMI, GMI, UKMI and USMI indicate migration policy uncertainty indices of France, Germany, UK and the US, respectively. The table presents the volatility spillover tests utilizing Diebold and Yilmaz (2012) framework. Panel A shows the gross spillover findings. The “Contribution to others” row display the contribution of the selected variable i on forecast error variance of other variables, in total. “Contribution including own” indicates contribution of variance of variable i on itself as well as other variables and hence is the sum of the column. Panel B depicts the net (pairwise) spillovers between each pair. One can find the directional spillover via deducting same pairs’ gross spillovers from each other. Positive (negative) figure shows spillover from column (row) to row (column)

Table III.
Diebold–Yilmaz
output – Germany



Notes: DAX represents German stocks; FMI, GMI, UKMI and USMI indicate migration policy uncertainty indices of France, Germany, UK and the USA, respectively. The figure presents the volatility network illustrations. (a) displays the gross spillover between selected variables. Based on Table II output, we calculate average gross spillovers between variable i and variable j [$(GS_{j \leftarrow i} + GS_{i \leftarrow j})/2$]. If the average spillover is greater than 1 (which indicates that the contribution of 1 standard deviation shock in one of the variables to the others’ forecast error variance is at least 1 percent), there is a significant spillover between these variables. Therefore, we plot a bi-directional arrow between such variables. (b) depicts the net spillover, and if it is greater than 1 ($NS_{ij} = GS_{j \leftarrow i} - GS_{i \leftarrow j}$), we depict a uni-directional arrow indicating the direction. The direction of arrow tells us, which variable is a volatility receiver or is a giver. The dashed line represents connectedness between cross-market MIs, and the straight line is between respective stock market and MIs

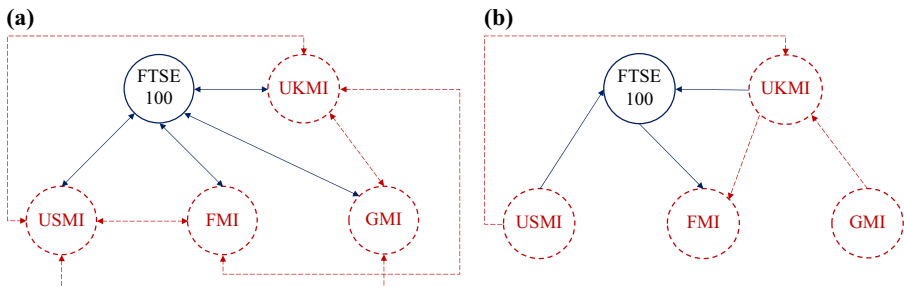
Figure 3.
Gross and net
spillover illustration –
Germany

other markets. As Figure 3 shows, US and UK migration policy uncertainty indices play a more important role in investment sentiment of DAX investors. The critical importance of financial markets of the USA and UK comes forward once again. UKMI and USMI explain 4.3 and 4.1 percent of forecast error variance of DAX, whereas GMI explain a minimal amount of 0.2 percent. When we check the “Contribution including own” row, we see that FMI and GMI are the major volatility receivers across these variables (Figure 4).

Diebold and Yilmaz’s (2012) output for UK shows that the interaction between FTSE100 and UKMI is bi-directional, but the spillover is from the migration index to stocks on a net basis. This means that different from France and Germany, FTSE investors closely follow migration policy uncertainty of UK. UKMI explain 5.2 percent of forecast error variance of FTSE100, which conveys the importance of migration policy on stock market movements. Moreover, the US market is still an indirect influencer on the UK market, through the connectedness between migration indices. As one can see from Table IV, USMI explains 7.6 percent of the forecast error variance of UKMI, which further underlines the importance of US markets (Figure 5).

Last but not least, we check the US market and how investors approach migration policy uncertainty in the USA. Table V shows that USMI explains 4.6 percent of forecast error variance of S&P500 and is critically important in understanding the volatility characteristics of US stock markets. Moreover, USMI is still critical to explain France, Germany and UK migration indices. However, after incorporating S&P500 in the model, we see that S&P500 has net spillover on UKMI and FMI, indicating the information transmission role of the US stock market. Therefore, we can conclude that S&P500 encompass several information and sentiments regarding investors from different areas of the world.

As a result, our findings indicate that the USA has a central role for investor sentiment even for migration policy. Although local migration policies do not directly transmit volatility to European stock market, US migration policy has an effect on all stock markets. Therefore, we can comment that equity market volatility is driven by migration policies, and markets have a strong connection.



Notes: FTSE100 represents UK stocks; FMI, GMI, UKMI and USMI indicate migration policy uncertainty indices of France, Germany, UK and the USA, respectively. The figure presents the volatility network illustrations. (a) displays the gross spillover between selected variables. Based on Table II output, we calculate average gross spillovers between variable i and variable j [$(GS_{j \leftarrow i} + GS_{i \leftarrow j})/2$]. If the average spillover is greater than 1 (which indicates that the contribution of 1 standard deviation shock in one of the variables to the others’ forecast error variance is at least 1 percent), there is a significant spillover between these variables. Therefore, we plot a bi-directional arrow between such variables. (b) depicts the net spillover, and if it is greater than 1 ($NS_{ij} = GS_{j \leftarrow i} - GS_{i \leftarrow j}$), we depict a uni-directional arrow indicating the direction. The direction of arrow tells us which variable is a volatility receiver or is a giver. The dashed line represents connectedness between cross-market MIs, and the straight line is between respective stock market and MIs

Figure 4.
Gross and
net spillover
illustration – UK

Panel A – volatility spillover table

	Stocks	FMI	GMI	USMI	UKMI	From others
Stocks	86.0	0.6	1.3	6.8	5.2	14.0
FMI	5.1	88.7	0.8	0.8	4.6	11.3
GMI	1.2	0.1	94.3	2.1	2.2	5.7
USMI	0.4	1.2	3.0	93.3	2.2	6.7
UKMI	2.2	1.0	3.7	7.6	85.5	14.5
Contribution to others	8.9	2.9	8.8	17.3	14.2	52.1
Contribution including own	94.9	91.6	103.1	110.7	99.7	

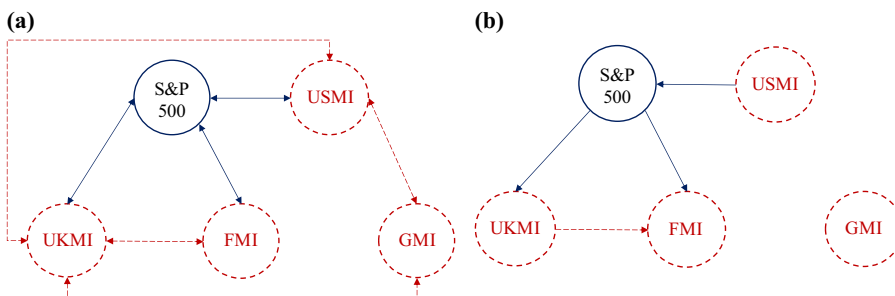
Panel B – net spillover

	Stocks	FMI	GMI	USMI	UKMI
Stocks					
FMI	4.5				
GMI	−0.1	−0.6			
USMI	−6.5	0.4	0.9		
UKMI	−3.0	−3.6	1.5	5.4	

Notes: Stocks represent FTSE100; FMI, GMI, UKMI and USMI indicate migration policy uncertainty indices of France, Germany, UK and the USA, respectively. The table presents the volatility spillover tests utilizing Diebold and Yilmaz (2012) framework. Panel A shows the gross spillover findings. The “Contribution to others” row display the contribution of the selected variable i on forecast error variance of other variables, in total. “Contribution including own” indicates contribution of variance of variable i on itself as well as other variables and hence is the sum of the column. Panel B depicts the net (pairwise) spillovers between each pair. One can find the directional spillover via deducting same pairs’ gross spillovers from each other. Positive (negative) figure shows spillover from column (row) to row (column)

Table IV.
Diebold–Yilmaz
output – UK

For a further research, scholars might extend the analysis to other developed and developing markets. Furthermore, it would be interesting to understand why USMI has a central role: is it because the US financial market is the central market or their migration policy critically affects other countries?



Notes: S&P500 represents US stocks; FMI, GMI, UKMI and USMI indicate migration policy uncertainty indices of France, Germany, UK and the USA, respectively. The figure presents the volatility network illustrations. (a) displays the gross spillover between selected variables. Based on Table II output, we calculate average gross spillovers between variable i and variable j [$(GS_{j \leftarrow i} + GS_{i \leftarrow j})/2$]. If the average spillover is greater than 1 (which indicates that the contribution of 1 standard deviation shock in one of the variables to the others’ forecast error variance is at least 1 percent), there is a significant spillover between these variables. Therefore, we plot a bi-directional arrow between such variables. (b) depicts the net spillover, and if it is greater than 1 ($NS_{ij} = GS_{j \leftarrow i} - GS_{i \leftarrow j}$), we depict a uni-directional arrow indicating the direction. The direction of arrow tells us, which variable is a volatility receiver or is a giver. The dashed line represents connectedness between cross-market MIs, and the straight line is between respective stock market and MIs

Figure 5.
Gross and
net spillover
illustration – USA

Table V.
Diebold–Yilmaz
output – USA

Panel A – volatility spillover table						
	Stocks	FMI	GMI	USMI	UKMI	From Others
Stocks	93.0	1.2	0.1	4.6	1.1	7.0
FMI	3.6	91.9	0.8	1.2	2.4	8.1
GMI	0.0	0.1	95.2	2.1	2.6	4.8
USMI	2.6	0.5	1.6	94.1	1.3	5.9
UKMI	2.5	1.3	1.7	0.9	93.7	6.3
Contribution to others	8.7	3.0	4.2	8.8	7.5	32.1
Contribution including own	101.7	94.9	99.4	102.9	101.2	64%
Panel B – net spillover						
	Stocks	FMI	GMI	USMI	UKMI	
Stocks						
FMI	2.5					
GMI	−0.1	−0.6				
USMI	−2.1	−0.8	−0.5			
UKMI	1.3	−1.2	−0.9	−0.5		

Notes: The table presents the volatility spillover tests utilizing Diebold and Yilmaz (2012) framework. Panel A shows the gross spillover findings. The “Contribution to others” row displays the contribution of the selected variable *i* on forecast error variance of other variables, in total. “Contribution including own” indicates contribution of variance of variable *i* on itself as well as other variables and hence is the sum of the column. Panel B depicts the net (pairwise) spillovers between each pair. One can find the directional spillover via deducting same pairs’ gross spillovers from each other. Positive (negative) figure shows spillover from column (row) to row (column)

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Corresponding author

Beyza Mina Ordu-Akkaya can be contacted at: beyza.akkaya@asbu.edu.tr