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Arab Countries between Winter and Spring: Where Democracy Shock Goes Next!

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Abstract: We examine the role of democracy shocks in the cross-country economic growth processes over a period of five decades since 1960. The recent uprisings that arose independently and spread across the Arab world form the main context of our investigation. We study if (i) a shock to democracy in one country triggers institutional reforms and growth upsurge in the neighbouring countries, and (ii) the magnitude and direction of response to democracy shocks are contingent upon income pathways of countries. To estimate the spillover effects of democracy shocks, we model and estimate growth interdependence among individual countries with similar democratic characteristics. To study the nature of responses of democracy shocks on cross-country growth processes, we build and estimate a Global Vector Autoregression (GVAR) model where we allow countries to be interdependent with regard to bilateral migration and geographical proximity. Using the GVAR model, we also stimulate a positive shock to democracy in Egypt—the most populous Arabic country—and study its impacts on institutional reforms and economic growth in the rest of the Arab World. We find that high and upper-middle income countries are immune to democracy shocks in Egypt, whereas the lower middle and low income countries are susceptible to another revolutionary wave.

Keywords: democracy shocks; Arab Spring; spatial growth interdependence; Global VAR; democracy; revolutionary wave

JEL Classification: B52; C22; C23; E02; F59; O24; O40; R11

1. Introduction

In the context of a nation's political-economic dynamics, the state of democracy often masks the spatio-temporal impacts of democratic quality it might experience from the neighbourhood. Surprisingly, this hidden effect is not rigorously modelled or robustly evidenced empirically possibly because, in the conventional empirical approach, dynamic interdependence among countries' political-economic processes is assumed but not explicitly modelled. Within the conventional estimation paradigm, [Acemoglu et al. \(2014\)](#) show that democracy exerts positive effects on cross-country economic growth of both developed and developing countries. However, such effects can also be inherently spatial in nature as economies which are tightly interlinked by geography, trade, migration, and socio-cultural parameters are bound to experience some degree of spillover effects of a

decision taken elsewhere in the ‘neighbourhood’¹. The study by [Diebolt et al. \(2013\)](#) is a prominent example in this regard, where the authors show that countries which are close to each other with respect to similarity in democratic characteristics demonstrate highly interdependent growth processes. While in these and related studies, spatial spillover effects of democracy on growth are estimated, the nascent literature has offered insufficient evidence till date on how democratic quality in one country could trigger similar process in the neighbourhood and in turn, would determine the growth processes of these countries. A recent historic political episode related to the sequence of events in the Arab Spring has indeed triggered new questions on democracy-growth relationship, especially on how democracy shocks might affect neighbouring economies’ democratic and (interdependent) growth processes. A shock needs a medium to migrate and leave a permanent or transitory impact on the system. In the context of our work, this medium can be envisaged in the form of the degree of economic development. Accordingly, there are two broad research questions this paper aims to address: First, does a shock to democracy in one country trigger institutional reforms and growth upsurge in the neighbouring countries? Second, is the nature of response to democracy shocks conditional on countries income pathways? To investigate this further, we study the case of the Arab Spring and employ a Global Vector Autoregression (GVAR) model to quantify its effects.

To the best of our knowledge, the research we have undertaken in this paper is among the few such attempts which address both spillover effects of democracy shocks and the dynamics of causality and cointegration within a systematic framework. We aim to contribute to the literature in three significant ways. First, we investigate how a proximity effect of democracy motivates continuous growth and democracy spillovers in the neighbouring economies. Following the momentous historical developments in the Arab Spring, this is particularly a pertinent query. Second, we study how countries, characterised by their development status, are going to respond to institutional shocks occurring in the neighbourhood? Are countries, which are persistently autocratic, or have experienced democratic/autocratic reversals, going to respond to democracy shocks in a neighbouring economy? Will the size of the economy, where democracy shocks are originating, determine the magnitude of growth and democratic effects in the neighbourhood (that is, interconnected strongly by geographic distance and social dynamics)? Third, we construct a ‘democratic distance’ metric among countries to study spillover effects of economic growth. A spatially interdependent growth model is then estimated by employing spatial vector autoregressive approach where a first hand analysis of the effect of ‘proximity’ in democratic sense is quantified on dynamic complementarity of Arab countries growth processes. This result is used as a foundation to undertake a rigorous GVAR analysis that helps to explain the way democracy shocks in one country may affect its neighbours in a ‘global’ context (i.e., the contagion as well as dynamic effects of democracy on the cross-country interdependent system).

We adopt a unique approach to study democracy-economic growth relationships by explicitly linking countries by their geographical and economic ‘proximity’. For the latter, we use bilateral migration as a measure of economic distance. In particular, we exploit the properties of the GVAR model to simulate the effect of democracy shocks in a panel of nineteen Arabic countries. Towards this end, we are motivated by a number of recent studies where GVAR framework has been employed to model spillover effects; see for instance, [Cakir and Kabundi \(2013\)](#) and [Koukouritakis et al. \(2015\)](#). Using this framework, we simulate the effects of the shocks to selected variables in the system and report the impacts they may have on other variables over time. In doing so, we attempt to answer the question whether Egypt can be a motivating force of democratisation to other Arab countries.²

The rest of the paper is planned as follows. Section 2 reviews the existing literature. Section 3 offers an overview of the democratic challenges in the Arab World. Section 4 presents the dataset. In

¹ ‘Space’ in this case can be defined in both geographic and relational sense.

² One could further incorporate other countries from developed and developing regions to lend robustness of our empirical results. However, such an analysis while could be intuitive, it can be contested on the ground that democratic spillover effects are more acutely felt among neighbouring regions.

Section 5 we present some preliminary empirical observations leading to the estimation of the GVAR model, the methodology which is described in Section 6. The main empirical results are presented in Section 7. Finally, Section 8 provides robustness checks and Section 9 summarises the main findings of the paper.

2. Synoptic View of the Literature

A number of influential studies show that democracy has positive effects on economic growth. Among recent work, [Rodrik and Wacziarg \(2005\)](#), [Papaioannou and Siourounis \(2008\)](#), [Yang \(2011\)](#), and [Acemoglu et al. \(2014\)](#) are some of the leading examples in this regard. [Rodrik and Wacziarg \(2005\)](#) argue that democratic economies have better adaptive capabilities against adverse shocks. [Knutson \(2012\)](#) finds robust empirical support in that democracies produce higher economic growth than autocracies via improved technical change. Similarly, [Papaioannou and Siourounis \(2008\)](#), and [Yang \(2011\)](#) also reflect on the growth enhancing effect of the process of democratisation. Among sceptics, [Tavares and Wacziarg \(2001\)](#) study the channels through which democracy influences growth, and show that democracies are associated with low levels of private investment and high government spending, which in turn retards economic success. However, the weight of evidence in favour of the significant positive effects of democracy seems to have outweighed the evidence in favour of its negative effects. At the same time, [Papaioannou and Siourounis \(2008\)](#), among others, also demonstrate that the timing of democratisation is important towards understanding if democracy will have persistently positive/negative effects on economic growth.

Moreover, a body of literature has increasingly stressed that democracy not only exerts positive effects on growth but such effects are spatial in nature (see among others, [O'Loughlin et al. \(1998\)](#), [Murdoch and Sandler \(2002\)](#), [Diebolt et al. \(2013\)](#)). [O'Loughlin et al. \(1998\)](#) present a theoretical model and accompanying computer simulation that explain the diffusion process of democracy based on the dynamics of public opinion and mass revolutions.³ Building on a democratic distance function and employing a spatial vector autoregression mechanism, [Diebolt et al. \(2013\)](#) estimate the magnitudes of dynamic complementarity in countries' growth processes as a function of democratic distance. A few studies have used political institutions in neighbouring countries as an instrumental variable for political institutions in a country under investigation. For example, using a sample of 141 countries, [Madsen et al. \(2015\)](#) use linguistic distance-weighted foreign democracy as an instrument for domestic democracy. These and similar studies, thus establish an important point in democracy-growth relationship: Both democratisation and the democratic stock in one country can trigger dynamic spatial spillover effects in countries with spatial proximity.

However, to the best of our knowledge, there is no such study that addresses both cross-country spillover of institutional shocks and its dynamics, especially in the Arab World. As such, we utilise the Arab Spring to complement the current literature by investigating how countries respond to institutional shocks occurring in the neighbourhood. [Elkink \(2011\)](#) and [O'Loughlin et al. \(1998\)](#) provide some analysis of democracy diffusion in the international context. The models employed in these studies offer some theoretical insights of the effect of democratic diffusion ([Elkink 2011](#)) and the role of geography in the analysis of spatial effects of democracy ([O'Loughlin et al. \(1998\)](#)). In these and in the literature that followed (e.g., [Diebolt et al. \(2013\)](#)) spatial and temporal aspects of democratic diffusion in the world system has been analysed. [Schwarz \(2008\)](#) provides useful insights into state-formation, and highlights where Arab states are strong (security function and in times of oil booms, welfare function) and where they are weak (representation function, and in times of fiscal crisis, welfare function). Following these and related literature, it is not possible to answer, how a proximity

³ Indeed, following [O'Loughlin et al. \(1998\)](#), the diffusion of attitudes, in combination with a cascading model of revolutions, is a possible theoretical source of explanation of the spatial spillover clustering democracy. The implications of these theoretical predictions can be far reaching with respect to both evolution of political economy and social restructuring in the long run.

effect of democracy can motivate a persistent growth and democratic spillovers in neighbouring countries. In view of the events in the Arab Spring, this is particularly a pertinent query, which we would make an attempt to address using alternate methodological framework.

From a political economic perspective, it is important to study democratisation in Arab countries and how it may proceed differently than it has in other regions, due to political cultures, in particular the role of Islam in politics and the important role of oil in some of the regions' economies. A variety of theories investigate (the impact of) the lack of democracy in the Arab world. These explanations can be grouped into four categories: (i) pertaining to cultural perquisites for democracy; (ii) Arab world's location; (iii) foreign involvement; and, finally, (iv) importance of government agency (either with regard to the institutions the governments create or the strategies they employ (Miller et al. 2012)). However, the most prevalent explanation for the Arab world's lack of democracy is the presence of oil (Stevens 2011). In addition, when statistically tested, the relationship between Islam and democracy shows that Muslim-majority countries are less likely to be democratic than non-Muslim majority countries (see, for example, Potrafke (2012, 2013)). Nevertheless, we do not aim to explore the reasons for the lack of democracy in these countries. Instead, we focus our primary objective on whether a shock to democracy in Egypt could motivate an uprising of similar events in the region, and how the possibility of such effects might impact the dynamics of growth interdependence in the region.

3. Democratic Challenges and Growth among the Arab Economies

3.1. Background

What is happening in Arab Spring countries now raises many questions and captures the world's attention. The Egyptian revolution, following on the Tunisian uprising, has sent shock waves across the Arab world, and has inspired a new political awareness in other Arab countries that might motivate a regime change. Jordan, for example, is a prime candidate to follow the Egyptian road. The country faced a rising unemployment rate and growing poverty. Yemen, with 45% of the population living on less than 2 dollars a day, may have followed the same revolutionary movement. Algeria also saw recent protest and movements against the rising cost of basic food. Several governments have responded to more limited protest and movements with promises of political and constitutional reform. Such processes are under way in Morocco and Oman. A group of economically powerful Gulf states—Saudi Arabia, the UAE and Qatar—remain resolutely opposed to fundamental reforms, including the introduction of representative democracy. Saudi Arabia has sought to pre-empt pro-democracy protests by announcing a massive programme of state investment, in an attempt to address grievances about high rates of unemployment and the lack of affordable housing. It is also playing an important role in countering the pro-democracy trend, most conspicuously through its military intervention in Bahrain. This raises the question of whether the Arab world might experience a wave of democratisation sooner or latter, as in eastern Europe after 1989. If democracy deepens in Tunisia and Egypt, other countries in the Arab world will have the opportunity to learn from their example.

Although there are growing literature⁴ on the likely effects of democratisation on states' economic and social structure, relatively few empirical studies raise questions on whether recent democratisation in Egypt and Tunisia will unfold in similar way to the other Arab countries. If being (oil) rich is a prohibitive limit to the path of democratisation, an interesting question then is to ask: does the presence of oil really have antidemocratic effect? Miller et al. (2012) consider the challenges ahead for Egypt and Tunisia and offer some lessons from past transition experiences. Their case studies provide insightful evidence that no threshold of economic development is required for democratisation. This is also reflected in the work of Przeworski (2004). Moreover, the claim that oil and democracy do not

⁴ Jeffrey (2007), for instance, uses comparative analysis of Bosnia and Iraq to explore how fraught moral and political questions prompt by contemporary practices of state building.

mix is used by many scholars to explain why the high income states of the Arab Middle East have not become democratic. Studies on Algeria, Iraq, and the Arab Gulf states have all suggested that the government's oil wealth has blocked a transition to democracy ([Huntington \(1993\)](#)).⁵

3.2. Arab Economies and the Democratic Challenges

The background discussion above provides an indication of possible interconnectedness between democracy and economic growth in Arab countries. In fact, scholars have argued that Arab world has never had a consolidated democracy within its ranks. It does include a few examples of hybrid regimes and in the literature these regimes have been referred to as competitive authoritarian, electoral authoritarian, and partly free, among other labels. Three hybrid regimes in the Arab world- Lebanon, Kuwait, and Iraq- are often referred to as democratising regimes. However, each of these countries faces considerable obstacles to evolving into stable democratic systems. Beyond the Arab world's hybrid regimes, which operate within constitutional systems that have some features of democracy, the region contains a wide variety of more purely authoritarian regimes. Of these, there are seven monarchies- Bahrain, the United Arab Emirates, Saudi Arabia, Qatar, Morocco, Jordan, and Oman- and, prior to the Arab Spring, there were six republics headed by long-ruling autocrats- Syria, Yemen, Algeria, Libya, Tunisia, and Egypt. Of the republics, as of early 2012, Tunisia was a nascent electoral democracy still in a transitional phase; Egypt had held parliamentary elections but was experiencing a more uncertain transition than Tunisia; autocratic leaders had been removed in Libya (violently) and Yemen (through negotiation), but transition processes had barely begun ([Miller et al. 2012](#)). Therefore, there are two regimes types in the Arab world that are thought to be particularly resistant to democratisation: dynastic monarchies and personalised regimes. In addition, Arab leaders have dampened enthusiasm for democracy by pitting regime opponents against each other, so that each prefers maintaining the current leadership to the possibility of their rival coming to power. Current regimes also have employed highly effective strategies for managing opposition and reducing pressure for meaningful political change.

As regional revolutions in Yemen, Syria, Libya, and Bahrain have yet to see their results, we consider Tunisia and Egypt as better placed to the process of democratisation. However, we mainly focus on Egypt given its sizeable population in the Arab world (nearly one third of the Arab population). Prior to the revolution, the economy in Egypt as a whole was performing better than ever. GDP growth had shifted into a much higher gear. Although the growth rate under the regime of Mubarak pointed to a healthy economy, this indicator masked the very real economic insecurity felt by many Egyptians. The economic growth was accompanied by rising inequality that reached levels not seen before in Egypt's modern history ([El-Shimy 2011](#)). Egyptians also saw an erosion of their economic position due to increases in inflation. Food prices rose 20% just in 2010 alone. Corruption reached an extreme, with Egypt rated 80th in the world. The economic, political, and social reasons behind the Egypt revolution were expressed by serious signs of discontent prior to the revolution taking place ⁶. In addition, one politically explosive issue is the countries' high unemployment rate among youth. There is universal agreement that unemployment, in particular youth unemployment, and poverty played a significant, if not the most important, role in the Arab Spring ⁷. Two-thirds of Egyptians are under 30, and each year 700,000 new graduates chase 200,000 new jobs ([Green 2011](#)). Unofficial statistics mirror an upward trend but paint an even graver picture, indicating figures twice as high as those derived from government data.

⁵ Another angle considers that religious affiliation is closely linked with institutional quality. [Pryor \(2007\)](#) finds that Islam has significantly negative impact on political rights. On the other hand, [Toros \(2010\)](#) concludes that democratic and religious values coexist and there is only a limited connection between Islam and attitude to democracy in Turkey. Hence, the experience of Turkey constitutes one example of how democratic values can take root and develop in a Muslim population.

⁶ In 2004 there were about 266 acts of protest; and by 2008 they reached 630.

⁷ In 2005, the youth unemployment rate in Egypt was 34% and 31% in Tunisia.

4. Data

We use annual data for nineteen Arab countries spanning over the period of 1960–2012⁸. For our purpose, we group countries in the GVAR model according to their income levels, viz., high, upper middle, lower middle and low income countries (see Table 1). The variables used in the individual country models include an index for democracy, economic development, human capital stock and trade openness. In addition, to construct the methodology, we use oil prices, bilateral migration and geographical distance. Data are extracted from the World Bank's WDI database unless stated otherwise. Economic development is measured as the real GDP per capita at 2001 international purchasing power parity. Human capital stock is measured as the average years of schooling in the total population of age 15 and above, given by Barro and Lee (2013).⁹ Trade openness is the sum of exports and imports as a share of GDP.

The annual series for oil prices are computed based on the average daily closing prices obtained for all trading days within the year. This is a Brent crude oil price in the basis of free on board (F.O.B.) in terms US \$/Barrel. Data are collected from DataStream (Ticker: WDOCBRNT).

Table 1. Dataset country classification according to income level.

High Income	Upper Middle	Lower Middle	Low Income
Bahrain	Algeria	Djibouti	Comoros
Kuwait	Jordan	Iraq	Mauritania
Oman	Lebanon	Morocco	Somalia
Saudi Arabia	Libya	Sudan	
	Tunisia	Egypt *	
		Yemen	

Note: Country income classification is based on the World Bank 2012 definition. It divided countries according to their 2011 per capita GNI as follows: low income (\$1025 or less); lower middle income (\$1026–4035); upper middle income (\$4036–12,475); and high income (\$12,476 or more). * denotes the reference country in the GVAR model.

To proxy for democracy (i.e., institutional quality), we use the Polity IV database provided by Marshal et al. (2012). More particularly, we use the *polity2* index which is based on subscores for constraints on the chief executive, the competitiveness of political participation, and the openness and competitiveness of executive recruitment. The *polity2* score ranges from −10 to 10 with higher values denoting more democratic institutions. However, when grouping countries according to their income level in the GVAR model, we transform the *polity2* into a 0–10 index to avoid negative values cancelling out positive values as well as to ease the interpretation of the impulse response functions.

5. Preliminary Observations

We present some stylised facts which otherwise characterise the inter-linkage between the process of democratisation and income growth conditional on institutional settings.

⁸ To avoid possible distortions caused by the Egyptian military coup in 2013, we chose to limit our dataset to 2012. Yet, we exploit the environment of the Egyptian uprising to motivate for our study without necessarily modelling a particular event. Like is the case with all VAR models, we use information the data provides to learn about what is most likely to happen in a given situation (e.g., a positive shock to democracy in Egypt). We ask what if democracy succeeds in Egypt, how this is expected to affect the rest of the Arab World. Perhaps the large amount of grants and development aid provided by the oil-rich Arab states following the fall of the democratically elected Muslim Brotherhood regime well explain the impact that democracy in Egypt could have in the region. In fact, authoritarians in the Arab World are not expected to support the success of democracy in Egypt. In addition, although adding observations may improve the efficiency of the estimation, we strongly believe that we have a sufficient number of time series observations to warrant sensible econometric results. Therefore, we believe it is sensible to consider 2012 as the endpoint in our dataset. Yet, it is possible for future research to extend our dataset to explore whether or not changes after 2012 confirm our findings.

⁹ This dataset on schooling is calculated based a five year basis, which we smoothed to obtain the annual data series.

5.1. Observation 1: Non-Unique Democratisation Episodes and Transition Probability

Following Papaioannou and Siourounis (2008), we construct various democratisation episodes and regime changes among countries. Table A1, in the Appendix A, presents the democratisation event chronology among nineteen Arab countries. The event chronology reveals a heterogeneous pattern of democratisation: the number of countries with ‘transition to democracy’ event is far smaller than the one with ‘transition to autocracy’. Transition to democracy is also not very strong and one of them is in the borderline (for instance, Comoros in 1990). The only persistent effect is the persistence of autocracy and/or regime change with fairly weak persistence in transition to democracy. In Table A2, the results are qualified by Markovian transition probability matrix. As is evident, among all countries, on the average, the transition between democratic states is fairly large (often around 90%) implying that there is a strong persistence of previous period democratic state. In the Table, except for a few, majority of the countries are characterised by transition to autocracy and therefore, the high transition probability among two similar values of democracy (e.g., between 10, –10 and so forth) imply no major reversal of democratic trend.

5.2. Observation 2: Spatial Dynamic Interdependence

We also present a brief analysis of dynamic spatial interdependence among countries’ growth processes where ‘space’ is defined in an ‘economic’ or ‘relational’ sense as in (Diebolt et al. (2013)). Since, our primary interest is to study the diffusion of democratic shocks and estimating their responsiveness conditional on the countries’ development pathways, it is necessary thus to understand—as and when economic distance among countries rise—how do their growth processes respond in terms of complementarity and interdependence. Following Diebolt et al. (2013), we can define ‘democratic distance’ as a measure of distance among countries with respect to democratisation and oil price shocks. It is expected that if countries’ growth processes are highly interdependent (that is, with dynamic spillovers as function of this distance is greater than zero), then a democratic shock would negatively affect countries in the ‘neighbourhood’ during early stages of growth, but would be instrumental in facilitating a stable and higher growth in the long-run. As in Diebolt et al. (2013), we present the spatio-temporal framework of growth interdependence among Arab countries as:

$$Y_{i,t+1} = \alpha_i Y_{i,t} + \sum_{j \neq i}^N f_i(\mathbf{D}_t(i, j)) Y_{j,t} + \gamma(\mathbf{D}_t(i, j)) X_{i,t} + \epsilon(\mathbf{D}_t(i, j)) \quad (1)$$

where for country i ($i = 1, \dots, N$), $\{Y_{t-l}, D_{t-l}, l \geq 0\}$, is history of the output per capita growth. Using a cardinal B-Spline, the authors estimated the parameters related to f function (that is, $f_i(\mathbf{D}_t(i, j))Y_{j,t}$) where the functional relation was left open in order to uncover true functional form. $\mathbf{D}_t(i, j)$ is a distance matrix, the elements of which concern democratic distance of a country from its neighbour. We estimated the spatial interdependence coefficient of economic growth among Arab countries as a function of the democratic distance measure. The results from estimating Equation (1) are presented in Table 2 and Figure 1, where $\hat{\alpha}$ is the estimated dynamic spatial VAR coefficient and $\hat{\sigma}^2$ is the dynamic spatial error covariance matrix. Both are expressed and estimated as functions of democratisation distance. The spatial VAR coefficient for each country represents interesting patterns. Positive dynamic spatial VAR coefficients are noted for Algeria, Jordan, Egypt, and Sudan, for instance, whereas large negative spatial VAR coefficients are estimated for Djibouti and Morocco. We found the error covariance to evince a monotonic decay with increasing distance, indicating good model fit.

The evidence of large negative and positive spatial VAR coefficients indicate that democratic shocks would affect dynamics of interdependence and complementarity among countries’ growth pathways over time. The spatial diffusion of democracy and its effects on growth are important in that a strategy of cooperative policy programs to improve democratic quality in neighbouring countries can be pareto improving in terms of long-term welfare of both the individual and all countries taken

together. To understand how democratic shocks affect the causality and direction of effects within a systemic framework, we present next the GVAR model and its corresponding results.

Table 2. Features of spatial growth interdependence.

	$\hat{\alpha}$	$\hat{\sigma}^2$
Algeria	0.1239	0.0072
Bahrain	0.0756	0.0071
Comoros	−0.2110	0.0021
Djibouti	−0.4673	0.0104
Egypt	0.1701	0.0003
Iraq	−0.1227	0.0664
Jordan	0.3531	0.0045
Kuwait	−0.1590	0.0328
Lebanon	−0.1082	0.0633
Libya	0.0007	0.0141
Mauritania	0.0416	0.0010
Morocco	−0.2305	0.0003
Oman	0.0663	0.0250
Saudi Arabia	−0.1916	0.0195
Somalia	−0.1979	0.0070
Sudan	0.1948	0.0051
Tunisia	−0.0887	0.0000

Note: $\hat{\alpha}$ & $\hat{\sigma}^2$ denote dynamic spatial autocorrelation and dynamic spatial error covariance.

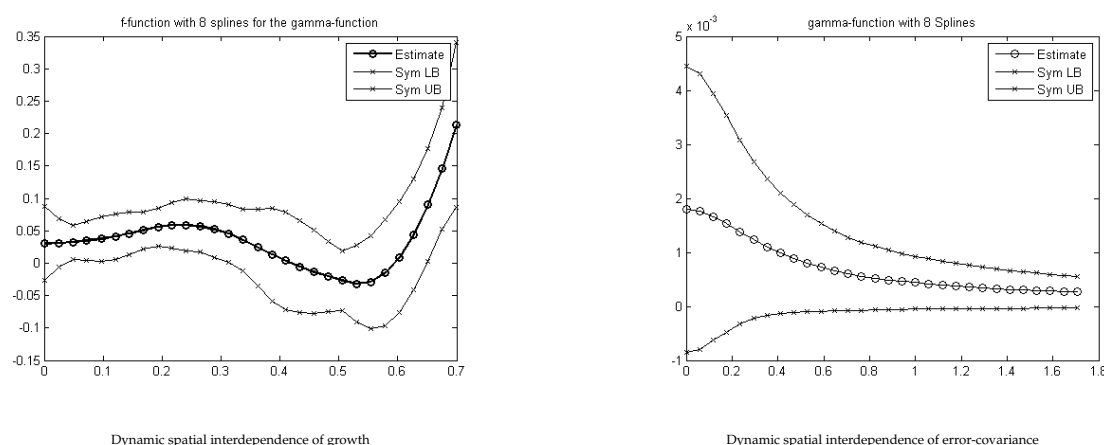


Figure 1. Spatial Vector Autoregression results: (i) growth interdependence as a function of democratic distance (**left panel**), (ii) error variance-covariance matrix as a function of democratic distance (**right panel**).

6. Model and Estimation

In the previous section, we presented two key observations pointing to the fact that both democracy and democratisation are instrumental in realizing positive and interdependent growth processes among Arab countries. A natural question that may arise now is how democratic shocks in one country affect growth and institutional pattern in proximus countries (defined in both geographic and relational sense). Characterisation of democratic shocks transmission mechanism for the Arab World is therefore necessary to shed important insights into the future of growth interdependence and institutional changes in these countries. Using the GVAR mechanism developed by [Pesaran et al. \(2004\)](#) and [Pesaran and Smith \(2006\)](#), the current paper investigates the transmission of democratic shocks originated in Egypt and its propagation mechanism to the Arab world countries.

6.1. Country Specific Models

Consider $N + 1$ countries in the global economy, indexed by $i = 0, 1, 2, \dots, N$, where $N = 18$ and country $i = 0$ serves as a reference country. For each country i a $VARX^*(p_i, q_i)$ model, where p_i and q_i are the lag orders of the domestic and foreign variables, can be presented as follows:

$$\mathbf{x}_{it} = \mathbf{a}_{i0} + \mathbf{a}_{i1}t + \Phi_{i1}\mathbf{x}_{i,t-1} + \dots + \Phi_{ip_i}\mathbf{x}_{i,t-p_i} + \Lambda_{i0}\mathbf{x}_{it}^* + \Lambda_{i1}\mathbf{x}_{i,t-1}^* + \dots + \Lambda_{iq_i}\mathbf{x}_{i,t-q_i}^* + \mathbf{u}_{it} \quad (2)$$

where $t = 1, 2, \dots, T$, \mathbf{x}_{it} is a $k_i \times 1$ vector of domestic variables belonging to country i , at time t , \mathbf{x}_{it}^* is a $k_i^* \times 1$ vector of country i specific foreign variables, \mathbf{a}_{i0} is a $k_i \times 1$ vector of fixed intercept coefficients, \mathbf{a}_{i1} is a $k_i \times 1$ vector of coefficients of the deterministic time trend, Φ_i is a $k_i \times k_i$ matrix of coefficients associated to lagged domestic variables, Λ_{i0} and Λ_{i1} are $k_i \times k_i^*$ matrices of coefficients related to contemporaneous and lagged foreign variables respectively. The error term \mathbf{u}_{it} is a $k_i \times 1$ vector of idiosyncratic, serially uncorrelated, country specific shocks, where $\mathbf{u}_{it} \sim i.i.d$ and have a zero mean with a covariance matrix Σ_{ij} . Country-specific foreign variables are constructed as cross-sectional averages of the domestic variables using fixed weights w_{ij} . Countries in our GVAR model are linked through a novel composite matrix that exploits information from countries bilateral migration and geographical distance. Although the majority of the GVAR applications tend to use either trade or financial, our weight matrix is based on bilateral migration and geographic distance to reflect possible transmission mechanisms in the context of democracy shocks. Given the low level of economic integration (with the exception of GCC countries), we believe that trade and financial linkages are not the best proxy of how shocks to democracy in Egypt can transmit to other neighbouring countries. Our proposed weight matrix, in contrast, implies that a country which have more Egyptian immigrants and/or closer in geographical sense to Egypt is expected to be relatively more sensitive to institutional shocks (reforms) in Egypt.

$$\mathbf{x}_{it}^* = \sum_{j=0}^N w_{ij}\mathbf{x}_{jt} \quad (3)$$

where $j = 0, 1, \dots, N$, $w_{ii} = 0$, and $\sum_{j=0}^N w_{ij} = 1$. \mathbf{x}_{it}^* is a vector of the foreign variables for country i in time t and \mathbf{x}_{jt} is a vector of their endogenous counterparts in the whole system except for country i . w_{it} denotes the fixed-weights matrix of country i with country j , see Table A3 in the Appendix. In addition to these foreign variables constructed as the sum weighted contributions of the $N - 1$ other countries, the model contains unweighted oil prices ($poil$) as a global variable, which is weakly exogenous to all countries in the system except Egypt's model wherein $poil$ enters as an endogenous variable. Thus, the resulting GVAR model is no more than a $VAR(p)$ model containing global endogenous variables.

To explicitly account for the long-run relationships in the country-specific $VARX$ models in Equation (2), this study considers the error correction representation $VECMX$ of these models. To combine the country-specific $VARX^*(p_i, q_i)$ models into a global VAR model, firstly, the $k \times 1$ vector of the global variables is collected where $k = \sum_{i=0}^N k_i$, $\mathbf{x}_t = (\mathbf{x}_{0t}', \dots, \mathbf{x}_{Nt}')'$ (i.e., collecting a vector of all the endogenous variables of the system). Secondly, using the link matrices $\mathbf{W}_i(k_i + k_i^*) \times k$ matrix based on the fixed weights w_{ij} , the GVAR model can be presented as follows.

$$\mathbf{A}_{i0}\mathbf{W}_i\mathbf{x}_t = \mathbf{a}_{i0} + \mathbf{a}_{i1}t + \sum_{j=1}^p \mathbf{A}_{ij}\mathbf{W}_i\mathbf{x}_{t-j} + \mathbf{u}_t, \quad (4)$$

for $i = 0, 1, 2, \dots, N$.

It is straightforward to stack the country-specific $VARX^*(p_i, q_i)$ models in Equation (4). It is worth mentioning that all of the GVAR parameters are obtained for the country-specific models $VARX^*(p_i, q_i)$ and the transformation using the link matrices \mathbf{W}_i .

In our GVAR model, the reference country is Egypt, given its populous size and influence within the Arab World. Endogenous variables in individual country models are democracy index, real GDP, openness and schooling. Additionally, foreign real GDP, foreign democracy index, openness of other countries and foreign schooling are included as weakly exogenous variables into the system

constructed based on a constant weights matrix. The global variable is the oil price, which is treated weakly exogenous in all country specific models except Egypt (i.e., our reference country). Different regions are constructed based on weighted averages of country models, for which we use a matrix based on each country's GDP contribution relative to the GDP of the whole region. After estimating country specific VARX models, we stack these models.

7. Empirical Results

7.1. GVAR Diagnostic Tests

Firstly, we test for the integration order of the variables using the augmented Dickey-Fuller (ADF) unit root test. Table A4 presents ADF statistics of all the region-specific domestic variables, whilst Table A5 includes the foreign variables. The results, support in general, the treatment of the variables as being $I(1)$. Secondly, we test for the order of the VARX models as well as the number of cointegrating relationships. The results in Table A6 are based on the maximum eigenvalue and trace statistics at the 5% significance level. As shown in Table A6, the models have two or one cointegrating relationships. Thirdly, we test for the presence of serial correlation among the residuals. Table A7 reports the F-statistics for the serial correlation of the VECMX models along with the corresponding critical values at 5% significance level. We fail to reject the null hypothesis of no serial correlation. Finally, the weak exogeneity of the foreign variables is an essential assumption for the GVAR set up. This assumption implies that there is no long run feedback from the endogenous variables to the foreign variables. Therefore, we conduct a formal test of the weak exogeneity assumption by testing the joint significance of the estimated error correction terms in a set of auxiliary equations, wherein foreign variables are made endogenous. If foreign variables are weakly exogenous, we expect the estimated coefficients for the error correction terms not to be statistically significant. The results from the exogeneity test are reported in Table A8. These results show that the foreign variables pass the weak exogeneity test as we fail to reject the null hypothesis.

7.2. Dynamic Analysis

Using the generalised impulse response functions (GIRFs) from a GVAR(2) model we chart the impact of a positive shock to democracy in Egypt on democracy and growth across the Arab world over time. The results summarised below are based on the median estimates resulting from bootstrapping the model (500 replications) considering 95% confidence intervals of the error bands. Figure 2 shows response of democracy to a positive shock to the democracy index in Egypt while Figure 3 shows growth responses to the same shock.

Referring to Figure 2, it seems that a 1σ shock to the democracy index in Egypt has a statistically significant impact on both low and lower-middle income countries¹⁰. The Egyptian democratic positive shock is more likely to induce democracy in those groups of countries by about 4% in low income countries and about 2% in lower-middle income countries. To further explain what this means, suppose that the 0–10 *polity* index increases by one sample standard deviation (σ) (equivalent to 0.08 point change in the *polity* index in our sample). Then, all else equal, the *polity* index is likely to increase by 0.4 points in low income countries, and by 0.2 points in lower middle income countries. This effect becomes profound and persists after four years around 1% and 0.6% in low and lower-middle income countries, respectively. Interestingly, the same shock does not seem to have a statistically significant

¹⁰ It would have been very insightful had we been able to examine the effects of a full transition (i.e., dictatorship to democracy) rather than only a 1σ shock to democracy. Given the context of the Arab World which lacks examples of democracy, such full transition scenario would not only overlook the context within which this study is applied but also is a very challenging task. Moreover, we believe that democracy is rather a process that accumulates over time and might not happen as an overnight shock. Even though one can create a rough dichotomous measure of democracy (e.g., 0 and 1), Gründler and Krieger (2016) argue that graded measures of democracy are superior to dichotomous classification.

impact on democracy in both high and upper-middle income countries, which continues to be the case over the entire range of the time horizon.

Moreover, we report the response of GDP growth processes within the Arab World to a simulated ‘improvement’ in institutional quality in Egypt. In particular, Figure 3 shows the GIRFs of GDP resulting from a one standard deviation (1SD) shock to the *polity* index in Egypt. Similar to democracy response, GDP growth processes in high and upper middle income countries do not respond to institutional shocks in Egypt. In the meantime, the Egyptian democratic positive shock is likely to induce growth processes in low and lower income countries. However, these responses appear to be statistically significant only for the first six years in low income countries and insignificant the case of lower middle income countries.

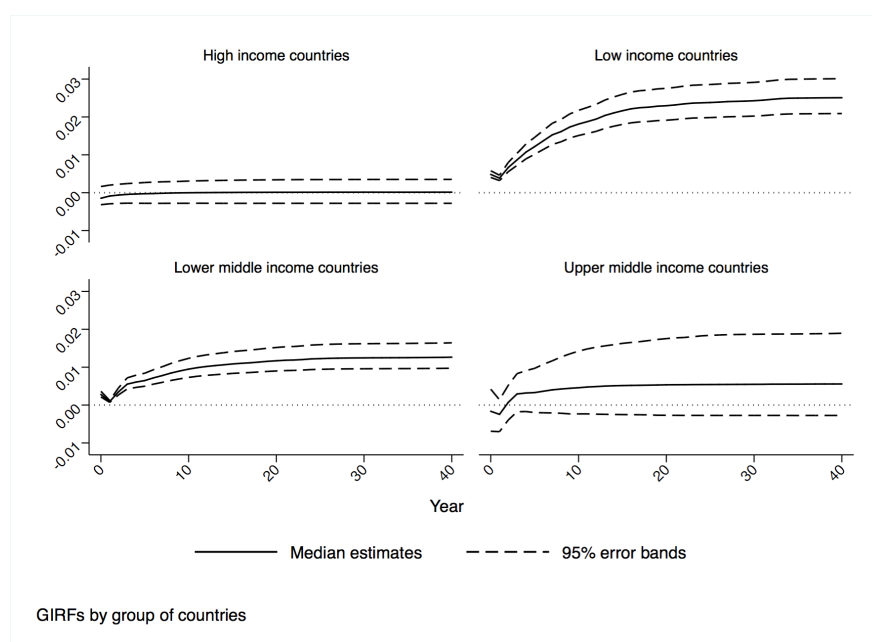


Figure 2. Democracy responses to 1-SD positive shock to democracy (polity index) in Egypt.

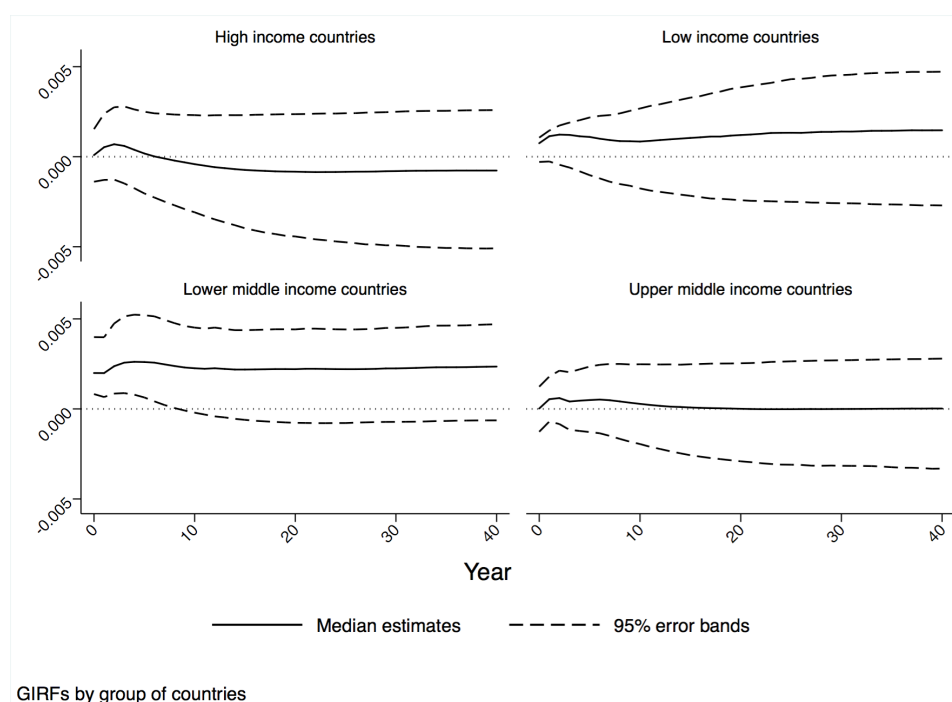


Figure 3. Growth responses to 1-SD positive shock to democracy in Egypt.

8. Robustness Checks

Our results in Section 7 show how a positive shock to political settings in Egypt can have spillover effects on other Arab countries' political institutions and economic growth. To proxy for political settings, we use one of the most popular indexes in the literature (i.e., polity index). Yet, measuring the quality of political institutions and capturing ongoing political reform processes in a given country is not an easy task. This implies that our results might be driven mainly by our measure of political settings. To check how sensitive our results are to different measures of the quality political institutions, we replace our polity index with a recently introduced index for democracy which is proposed by Gründler and Krieger (2016). The new index, namely the support vector machines democracy index (SVMDI) which is based on a mathematical algorithm for pattern recognition, is a continuous measure of institutional settings and takes values from zero to one with a very detailed and sensitive measurement of democracy. We re-estimate our GVAR model and report the GIRFs below. Our results did not change significantly when using a different proxy for political settings. Figure 4, which reports the GIRFs for a 1-SD positive shock in Egypt and responses of the new democracy index by group of countries, shows there is a positive and statistically significant responses in both low and lower-middle income countries. This confirms our previous conclusion in that a positive shock to democracy in Egypt is likely to induce democracy in those groups of countries. The GIRFs in Figure 4 confirm our conclusion on that the shock would not have a statistically significant impact on democracy in both high and upper-middle income countries.

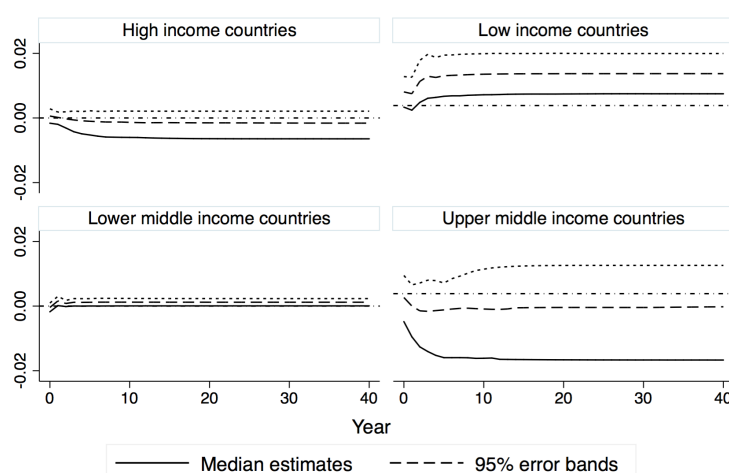


Figure 4. Democracy responses to 1-SD positive shock to the support vector machines democracy index (SVMDI) democracy index in Egypt.

9. Concluding Remarks

We investigate the spillover effect of democratic shocks, and how it may trigger the state of democracy and economic growth among countries in proximity. We defined 'proximity' in both geographic and relational sense. In the specific context of the Arab Spring, we arrived at a number of important conclusions. We found that there was heterogeneous dynamic interdependence among Arab countries' growth processes, and such an interdependence varied measurably as democratic distance became larger over time. The implication is that Arabic countries, which are affine with respect to democratic qualities and socio-economic parameters, are very likely to be affected by democratic shocks. This is confirmed by our GVAR analysis, which finds that (i) high and upper middle income countries are immune to the recent democratic shock transference; and (ii) the lower middle and low income countries seem to be perfect candidates for another revolutionary wave.

Our investigation led to shed light on the important issue of transmission of democratic shocks and its realised impacts on countries classified by their degree of development. We tested this first, by assuming that countries were interconnected by similarity of democratic quality, where we found a

strong evidence of spatial interdependence of economic growth processes among Arabian economies. Both the signs and magnitudes of interdependence were observed to vary measurably; some countries (viz., Algeria, Sudan, Jordan, and Egypt) display positive growth interdependence as a function of democratic distance, whereas others (viz., Djibouti, Iraq, Morocco, and Somalia, among others) display negative interdependence. An important implication of this result is that (positive/negative) shocks to institutional quality (i.e., in our case, whether countries opting for democracy or autocracy) within the relation space of countries can demonstrate long-run positive and/or negative spillover effects. This possibility was then investigated in our work by employing a GVAR framework.

Using this framework, we examined whether the current revolution waves in Egypt were more likely to transfer to other Arabic countries. Two important results emerged; first, there was a strong evidence of possible transmission of positive democratic shocks in the case of low and lower-middle income countries. Second, we found that countries with high level of economic development appeared to be immune to democratic shocks. Moreover, the full realisation of the positive shock in low development countries was observed to occur with a lag of about 4 years. A possible explanation could be that democratic shocks and their transmission are well explained in light of the economic conditions in the corresponding country. Moreover, countries that showed no response to democratic shocks in Egypt were found to be those which rely heavily on oil exports. This is in line with [Ross \(2001\)](#) who show that being an oil-rich economy inflicts a damage to democracy (this is supported by what is known as rentier effect). In fact, the claim that oil and democracy do not mix is used by many scholars to explain why high income states of the Arab World have not become democratic. Studies on Algeria, Iraq, and the Arab Gulf states have all suggested that the government's oil wealth has blocked the transition to democracy ([Huntington 1993](#)). Our findings contribute to this strand of literature in concluding that the abundance of oil is not only a prohibitive limit to the path of democratisation within the country but also has an antidemocratic effect that blocks the transmission of democratic shocks in the neighbourhood.

Our results give rise to interesting policy implications. Firstly, governments in low and lower income countries in the Arab World should adopt 'real' economic reforms if they wish to neutralise the spillover effects of democratic shocks in their neighbourhood. Such economic reforms should be on top of the post-revolution governments agenda. We agree in this regard with ([Cheibub et al. 1996](#)) who demonstrates that democracies in poor countries have significantly better prospects if they can maintain their economic growth. Secondly, high-performing economies should invest in improving law and order, social development, and transparency so that they may reverse the negative effects of the oil 'curse' on democracy, and should open the door for a real democratic transition process to kick off. The reason is that a 'shock in any form—positive or negative—cannot be bound within a geographic space. Expansionary social and economic policies can be the best form of collaterals in the presence of revolutionary waves in the region.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Democratisation Event Chronology.

Transition to Democracy	Transition to Autocracy	Regime Change	Borderline Democratisation Episode	Reverse Transition
ALGERIA (2004)	ALGERIA (1962)	ALGERIA (1992)	Comoros (1990)	Lebanon (1975)
COMOROS (1990)	BAHRAIN (1972)	ALGERIA (2003)		
COMOROS (1996)	COMOROS (1976)	BAHRAIN (1996)		
COMOROS (2002)	COMOROS (1995)	COMOROS (1998)		
DJIBOUTI (1999)	COMOROS (1999)	DJIBOUTI (1977)		
MAURITANIA (2007)	DJIBOUTI (1977)	DJIBOUTI (1978)		
	EGYPT (1960)	EGYPT (1993)		
	IRAQ (1960)	JORDAN (1970)		
	JORDAN (1960)	JORDAN (1992)		
	KUWAIT (1963)	KUWAIT (1975)		
	KUWAIT (1991)	KUWAIT (1990)		
	LEBANON (1975)	LEBANON (1990)		
	LIBYA (1960)	LIBYA (1962)		
	MAURITANIA (1960)	LIBYA (2004)		
	MOROCCO (1960)	MAURITANIA (1989)		
	OMAN (1960)	MOROCCO (1988)		
	SOMALIA (2000)	MOROCCO (1991)		
	TUNISIA (1960)			
	YEMEN (1990)			

Note: Year of autocratic or democratic episodes as indicated are in brackets.

Table A2. Markov transition probabilities for Polity2.

	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	0	2	4	5	6	7	8	9
−10	0.928	0.044	0.015	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
−9	0.008	0.919	0.048	0.008	0.000	0.000	0.008	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
−8	0.035	0.052	0.845	0.052	0.000	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
−7	0.007	0.007	0.000	0.931	0.028	0.000	0.007	0.007	0.000	0.000	0.000	0.007	0.007	0.000	0.000	0.000	0.000	0.000
−6	0.017	0.000	0.000	0.017	0.915	0.017	0.000	0.017	0.000	0.000	0.000	0.017	0.000	0.000	0.000	0.000	0.000	0.000
−5	0.000	0.000	0.000	0.048	0.048	0.714	0.095	0.095	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
−4	0.000	0.000	0.000	0.067	0.000	0.067	0.667	0.133	0.067	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
−3	0.000	0.040	0.000	0.000	0.000	0.040	0.040	0.760	0.040	0.000	0.000	0.040	0.040	0.000	0.000	0.000	0.000	0.000
−2	0.000	0.000	0.000	0.030	0.000	0.000	0.000	0.030	0.909	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
−1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.889	0.000	0.111	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.046	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.909	0.000	0.046	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000	0.091	0.000	0.000	0.091	0.000	0.091	0.000	0.636	0.000	0.091	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000	0.167	0.000	0.000	0.000	0.167	0.000	0.000	0.667	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.500	0.000	0.000	0.500
7	0.000	0.000	0.000	0.067	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.867	0.067	0.000
8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.077	0.000	0.000	0.000	0.000	0.000	0.923	0.000
9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000

Note: The transition probabilities are calculated for all countries as a whole.

Table A3. Fixed-weight matrix.

	ALG	BAH	COM	DJI	EGY	IRA	JOR	KUW	LEB	LIB	MAU	MOR	OMA	QAT	SAU	SOM	SUD	SYR	TUN
ALG	0.05	0.04	0.03	0.03	0.00	0.01	0.01	0.02	0.02	0.05	0.12	0.35	0.02	0.04	0.03	0.00	0.00	0.01	0.07
BAH	0.03	0.06	0.05	0.06	0.01	0.05	0.03	0.03	0.04	0.04	0.02	0.01	0.08	0.06	0.05	0.02	0.01	0.03	0.02
COM	0.03	0.04	0.09	0.05	0.00	0.01	0.01	0.02	0.02	0.03	0.01	0.00	0.02	0.04	0.03	0.02	0.00	0.01	0.02
DJI	0.03	0.05	0.07	0.08	0.00	0.01	0.01	0.02	0.02	0.04	0.07	0.01	0.03	0.05	0.04	0.48	0.01	0.01	0.02
EGY	0.05	0.05	0.05	0.06	0.00	0.02	0.02	0.03	0.04	0.07	0.04	0.03	0.03	0.06	0.07	0.03	0.06	0.03	0.03
IRA	0.04	0.06	0.04	0.05	0.00	0.01	0.01	0.06	0.03	0.04	0.03	0.01	0.03	0.06	0.04	0.01	0.01	0.01	0.03
JOR	0.04	0.06	0.04	0.05	0.06	0.11	0.01	0.03	0.03	0.05	0.02	0.02	0.04	0.06	0.07	0.01	0.01	0.11	0.03
KUW	0.04	0.08	0.05	0.06	0.07	0.45	0.59	0.03	0.30	0.04	0.05	0.01	0.33	0.06	0.25	0.03	0.02	0.29	0.03
LEB	0.05	0.05	0.04	0.05	0.02	0.04	0.02	0.05	0.03	0.05	0.05	0.06	0.04	0.05	0.04	0.02	0.03	0.03	0.03
LIB	0.09	0.05	0.03	0.04	0.18	0.02	0.01	0.02	0.07	0.05	0.09	0.05	0.03	0.05	0.05	0.01	0.04	0.08	0.44
MAU	0.03	0.04	0.07	0.04	0.00	0.01	0.01	0.01	0.02	0.02	0.15	0.03	0.02	0.04	0.03	0.02	0.00	0.00	0.01
MOR	0.14	0.04	0.02	0.02	0.00	0.01	0.01	0.02	0.02	0.05	0.12	0.03	0.02	0.04	0.03	0.00	0.00	0.01	0.03
OMA	0.03	0.06	0.05	0.06	0.02	0.02	0.02	0.04	0.03	0.03	0.01	0.01	0.04	0.06	0.05	0.02	0.04	0.01	0.02
QAT	0.05	0.06	0.05	0.06	0.03	0.05	0.02	0.06	0.04	0.05	0.02	0.07	0.05	0.06	0.05	0.03	0.04	0.03	0.03
SAU	0.04	0.06	0.05	0.06	0.56	0.13	0.18	0.47	0.18	0.04	0.00	0.13	0.09	0.06	0.04	0.23	0.68	0.30	0.08
SOM	0.03	0.05	0.08	0.07	0.00	0.01	0.01	0.02	0.02	0.03	0.02	0.01	0.03	0.05	0.03	0.03	0.02	0.01	0.02
SUD	0.04	0.05	0.12	0.07	0.00	0.01	0.01	0.02	0.03	0.20	0.06	0.07	0.03	0.05	0.04	0.02	0.01	0.01	0.04
SYR	0.04	0.05	0.04	0.05	0.01	0.03	0.02	0.03	0.03	0.04	0.04	0.02	0.04	0.06	0.04	0.01	0.02	0.01	0.03
TUN	0.16	0.05	0.03	0.03	0.00	0.01	0.01	0.02	0.02	0.07	0.10	0.08	0.02	0.04	0.03	0.00	0.00	0.01	0.03

Table A4. Unit-root test statistics for domestic variables at the 5% significance level.

Domestic	Critical	High Income	Low Income	Lower Middle	Upper Middle
<i>gdp</i>	−3.24	−1.11	−1.15	−1.65	−0.67
<i>Dgdp</i>	−2.89	−2.93	−3.2	−4.78	−3.77
<i>democ</i>	−3.45	−3.05	−2.02	−1.66	−2.55
<i>Ddemoc</i>	−2.89	−4.49	−4.92	−3.95	−6.71
<i>openness</i>	−3.45	−1.65	−1.66	−1.78	−2.23
<i>Dopenness</i>	−2.89	−5.44	−4.5	−6.02	−4.04
<i>school</i>	−3.45	−3.24	−0.91	−3.01	−2.71
<i>Dschool</i>	−2.89	−2.04	−2.43	−1.95	−1.9

Based on univariate autoregressive specifications, the ADF statistics for the level and first differences of the variables are all computed on the same sample period, namely, 1960–2012. The ADF statistics for all level variables are based on regressions including a linear trend. The optimal lag length is determined based on the akaike information criterion (AIC).

Table A5. Unit-root test statistics for foreign variables at the 5% significance level.

Foreign	Critical	High Income	Low Income	Lower Middle	Upper Middle
<i>gdp</i> *	−3.45	−1.82	−1.68	−0.48	−4.68
<i>Dgdp</i> *	−2.89	−4.84	−3.91	−3	−2.98
<i>democ</i> *	−3.45	−0.06 *	−0.97	−1.24	−0.56
<i>Ddemoc</i> *	−2.89	−3.3	−4.07	−5.18	−3.69
<i>openness</i> *	−3.45	−2.75	−2.32	−2.51	−2.56
<i>Dopenness</i> *	−2.89	−5.16	−3.97	−3.82	−4.85
<i>school</i> *	−3.45	−3	−3.04	−3.06	−3.27
<i>Dschool</i> *	−2.89	−1.89	−2	−1.94	−1.99

Based on univariate autoregressive specifications, the ADF statistics for the level and first differences of the variables are all computed on the same sample period, namely, 1960–2012. The ADF statistics for all level variables are based on regressions including a linear trend. The optimal lag length is determined based on the akaike information criterion (AIC). Besides, the Unit-Root test statistics for the global variable (i.e., oil prices) is −0.134 at −3.24 critical value of 95% confidence level. * denotes a foreign variable constructed as in Equation (3).

Table A6. Order and number of cointegration relationships in the country-specific models.

VARX*			
Country	p_i	q_i	Relationships
high income	2	1	2
low income	2	1	2
lower middle	2	1	2
upper middle	2	1	1

p_i and q_i are the lag order of domestic and foreign variables in Equation (2). Relationships is the number of cointegrating vectors in individual country error correction models. VARX* denote a VAR model with weakly exogenous variables (X*) constructed as in Equation (3).

Table A7. F Statistics for tests of residual serial correlation for region-specific VARX *.

Region	F Critical	<i>gdp</i>	<i>democ</i>	<i>Openness</i>	<i>School</i>	<i>Poil</i>
high income	3.25	0.9	1.48	1.33	1.52	1.57
low income	3.25	2.99	0.58	0.48	1.65	
lower middle	3.25	2.12	0.3	0.11	0.18	
upper middle	3.24	1.85	0.17	6.27*	0.39	

* Denotes statistical significance at the 5% level or less.

Table A8. F Statistics for testing the weak exogeneity of the region-specific foreign variables.

Region	F Critical	gdp *	democ *	Openness *	School *	Poil *
high income	3.28	0.3	0.38	1.09	0.35	1.04
low income	3.28	0.41	0.44	0.19	0.33	1.88
lower middle	3.28	0.45	2.09	0.14	1.33	0.14
upper middle	4.12	1.74	0.81	0.66	0.5	4.14 *

* Denotes statistical significance at the 5% level or less.

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