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Growth spillovers in the MENA region

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Growth Spillovers in the MENA Region

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July 15, 2019

Abstract

In this paper, we examine the role of spillovers in economic growth for the Middle East and North Africa (MENA) region by accounting for spatial effects. Such spatial effects in growth for the MENA countries may arise on the basis of geography, bilateral trade or institutional similarities. We explicitly model such interactions using a spatial econometric approach and ask how much they are likely to matter for growth externalities and spillover effects. To detect spatial dependence in growth rates, we make of the spatial lag model as well as the model with spatially autocorrelated error terms. Using results from the spatial econometrics literature, we test for the existence and type of spatial dependence. Our results indicate that the economic growth of a MENA country is positively affected by the economic growth of countries that are geographically close and that have similar institutional characteristics rather than through the growth of its trade partners.

Keywords: Growth regressions, spillover effects, spatial econometrics, MENA countries

JEL Classification: O40, R11, F43

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1 Introduction

The relationship between economic growth and its determinants has been studied broadly in the economics literature. Most economic theories of growth have highlighted domestic factors for understanding a country's growth performance and have typically ignored the interaction among different economies. An extensive literature has studied empirically the phenomenon of the convergence of individual countries to more advanced ones based on the paradigm of neoclassical growth theory; see Mankiw *et al.* (1992) or Barro and Sala-i Martin (1995).[1] In subsequent analysis, endogenous growth theory pioneered by Lucas (1988) and Romer (1990) proposes mechanism that can potentially lead to the systematic divergence between per capita income across countries observed in the data. For this purpose, Lucas (1988) develops a model of human capital accumulation in which the initial comparative advantage of countries increases by learning-by-doing while Romer (1986, 1990) emphasizes the role of knowledge capital.

The notion that a country's growth may depend on the economic performance of its neighbors has also been emphasized in the recent literature. One mechanism through which such spillover effects may occur is through openness and trade. Grossman and Helpman (1991) argue that countries with larger and more advanced trading partners should experience greater spillover effects from them. Vamvakidis (1998) shows that the market size of neighboring countries measured as the log of neighboring countries' GDP grow faster, controlling for other measures of openness and model specification in a standard growth regression framework. He also finds that neighboring countries' level of development - especially if they are open - has significant positive spillover effects on the home country's growth.

Some studies have explicitly allowed for geographical variables directly into the analysis. Hall and Jones (1996), Sachs and Warner (1997) and Lee *et al.* (1997) find that latitude is a negative determinant of growth after controlling other related factors. Gallup and Sachs (2000) find that agricultural productivity growth is substantially lower in the tropics.[2] Generally,

[1] In this literature, β-convergence captures the notion that poor countries or regions tend to grow faster than rich ones based on measures of per capita income, attributing a finding of a negative relationship between initial per capita income and growth rates to the presence of convergence across countries. By contrast, σ-convergence occurs when the dispersion of real per capita income across a group of economies falls over time.

[2] Abreu *et al.* (2005) classify the empirical literature according to the channels through which space affects

however, the cross-sectional observations have been taken independently from one another and the importance of the dependencies between different locations in determining economic growth has been rarely analysed.

One area where the issue of spillovers in economic growth across different countries has been studied is in relation to economic growth in Sub-Saharan Africa. Easterly and Levine (1998) argue that much of the poor growth performance Sub-Saharan African countries may be due to the contagious effects of their neighbors' growth. Even after controlling for the standard indicators in growth regressions as well as variables such as black market premia, financial market depth, and fiscal stance, they find that the growth performance of neighboring countries matter. Also considering the case of Sub-Saharan African countries, Roberts and Deichman (2009) add to this literature by examining "a mechanism for the transmission of benefits from one country or region to another, namely, infrastructure investment which facilitates interaction between countries through trade or communication of ideas." Moreno and Trehan (1997) note that growth spillovers may occur through location or common shocks or even institutional factors. Commenting on factors that led to such spillovers in the East Asia experience, they note that the yen appreciation of the mid-1980's and early 1990's led to the permanent transfer of Japanese technology and production facilities to other East Asian countries. Likewise, the growth model embraced by Japan was emulated by many of its East Asian neighbors, including S. Korea.

The growth performance of the MENA region and the prevalence of such spillover effects has received less attention. Andreano *et al.* (2013) examine the process of β-convergence for a sample of 26 MENA countries that covers the period 1950 to 2007 and confirm the hypothesis of conditional convergence. While they control for the impact of the space dimension through dummies for five different regions, they argue that a more thorough spatial analysis of the region is required. Hanson *et al.* (2018) study growth spillovers in the MENA region using a structural VAR and find that trade and financial flows between MENA countries are modest. They also find that increased trade ties between China and other large emerging economies have led to an increase in growth spillovers from the largest emerging market economies to the developing

economic growth in terms of relative and absolute location.

MENA region. Moriyama (2010) examines the the spillover effects of the global financial crisis on MENA countries using a financial stress index approach and finds that increased financial stress and slowdown in economic activity in advanced economies can explain about half of the drop in real GDP growth in MENA emerging countries after the Lehman shock.

In this paper, we examine the role of spillovers in economic growth for the Middle East and North Africa (MENA) region by explicitly accounting for spatial effects. Many existing papers use panel data sets which contain information on the growth experience of a large cross-section of countries over time, or they focus on regional groupings where spatial effects are likely to be localized. In our analysis, we postulate that spatial effects in growth for the MENA countries may arise on the basis of geography, bilateral trade or institutional similarities. Thus, we explicitly model such interactions using a spatial econometric approach and ask how much they are likely to matter for growth externalities and spillover effects. Thus, our paper contributes to the literature on growth spillovers in the MENA region by seeking to determine how interdependent the growth rates of MENA countries are with each other. To detect spatial dependence in growth rates, we make use of the model with spatially lagged dependent variables as well as the model with spatially autocorrelated error terms. Using results from the spatial econometrics literature, we test for the existence and type of spatial dependence. We also provide estimates of the direct and indirect effects of the trade balance as a share of GDP on MENA countries' growth using the different estimated weighting matrices.

Our results indicate that the economic growth of a MENA country is positively affected by the economic growth of countries that are geographically close and that have similar institutional characteristics rather than through the growth of its trade partners. We also find differing patterns of the direct and indirect effects of the trade balance as a share of GDP for growth spillovers based on the different weighting matrices. Specifically, we find that the oil-exporting countries have the largest elasticities of growth with respect to the trade balance as a share of GDP based on the institutional weighting matrix. However, when using the weighting matrix based on bilateral trade, we find that Turkey now figures in addition to countries such as Saudi Arabia and the United Arab Emirates in terms of yielding the largest elasticities with respect to the trade balance as a share of GDP. These results, in turn, entail

policy recommendations that have been voiced by many commentators regarding the MENA region involving regional trade integration and institutional reform for generating intra-regional growth spillovers.

The remainder of the paper is structured as follows. Section 2 is a review of the relevant literature. Section 3 presents a brief look at the MENA economies while Section 4 describes our empirical model and data. Section 5 presents the results with their interpretation. The final section is the conclusion.

2 Literature Review

One of the best known studies that take into account the importance of location for a country's economic growth dependencies is provided by Easterly and Levine (1998), who argue that both policy choice and growth performance may be contagious in that countries tend to imitate each others' policies: while good policies were amplified in the East Asian context, the reverse has tended to occur in Sub-Saharan countries.[3] They use a border dummy variable to analyse the growth experience of Sub-Saharan Africa and find evidence of positive spatial effects across countries. They infer that the impact of policy changes on growth will be more effective when coordinated with neighboring countries' policies.

Moreno and Trehan (1997) examine growth spillovers using data on 93 countries over the period 1965 to 1989. They find evidence of extremely strong spillover effects using different measures of proximity. They carry out a number of tests to determine if location matters for growth and examine spatial growth effects using a combination of different spatial econometric models. Roberts and Deichman (2009) also investigate the strength of cross-country spillovers of long-term growth in various regions of the world, with a particular emphasis on growth in Sub-Saharan Africa. They find that effective integration through investments in transport and telecommunications arises as a prerequisite in generating spillover effects from any original growth stimuli that may affect a region.

[3]See also Collier and O'Connell (2007).

Fingleton (2001) develops the model for manufacturing productivity growth that assumes increasing returns and spatially varying technical progress. He finds that productivity levels and growth rates are higher in 178 estimated E.U. regions when the financially assisted regions have faster output growth. His model is related to endogenous growth theory and, in particular, to the "new economic geography". Ramirez and Loboguerrero (2002) use spatial econometrics to test whether a country's economic growth is influenced by the economic growth of its neighbours. When using levels of income rather than growth rates, the authors find empirical evidence of spatial dependence.

Various researchers have also extended the notion of Barro and Sala-i Martin (1995) β-convergence to a spatial context. Rey and Montouri (1998) examine the existence of spatial dependence within US regions under the unconditional β-convergence model for the 1929-1994 period. They find positive and statistically significant spatial effects in levels of state per capita incomes. Similarly, Baumont *et al.* (2003) analyze the effect of spatial dependence in a sample of 138 European regions over the 1980-1995 period. They estimate various spatial models and find strong evidence of spatial autocorrelation for the unconditional β-convergence model.

Ertur and Koch (2007) develop a growth model with technological interdependencies between countries which operate through spatial externalities. In this model, not only does the capital stock of any country increase its own level of technology but so does the stock of technology of other countries, though at a decreasing rate due to socio-economic or institutional dissimilarities captured by geographic distance or border effects. As a result of this technological externality, countries cannot be analyzed by themselves but must be considered as an interdependent system. They show that this framework yields a spatial autoregressive conditional convergence equation with parameter heterogeneity which yields a convergence speed for each country. Ertur and Koch (2011) extend this methodological framework to explain growth processes from a Schumpeterian perspective. This model differs from the Solow growth model with technological interdependence in that knowledge increases with investment in R&D. In their spatial econometric analysis, they propose different weighting matrices based on geographical distance and on trade flows separately and show that R&D expenditures play an important role in growth and development processes.

Ho *et al.* (2013) also extend the Solow growth model with spatial terms, and estimate it using a sample of 26 OECD countries over the period 1971 -2005. They show the positive spillover effects of growth from one country to its trade partners. They provide evidence for spatial spillover through trade linkage instead of geographical distance. On the other hand, Bosker and Garretsen (2009) show that the spatial linkages between countries are not only in terms of absolute geography, but also relative geography. More specifically, they analyse the importance of the geography of institutions in a sample of 147 countries and show that the institutional quality in neighboring countries is also important for a country's economic development.

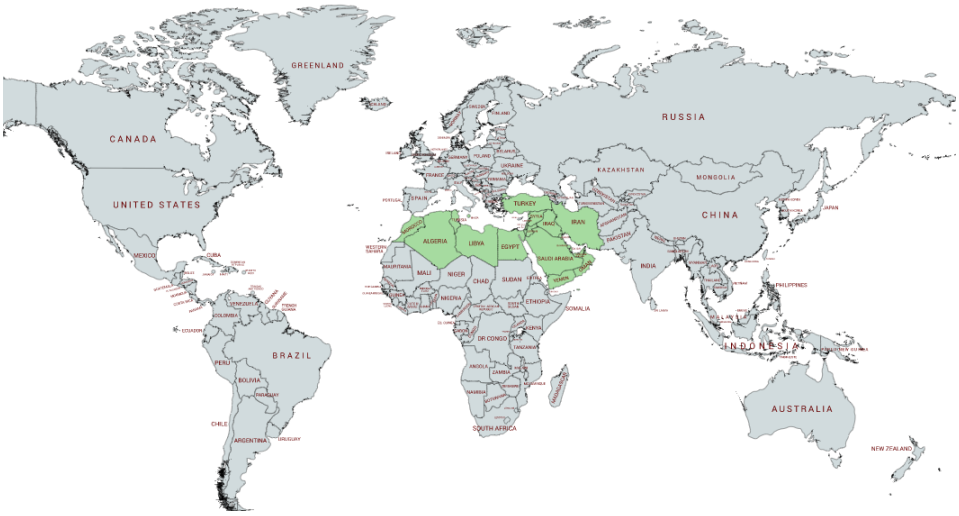
Arbia *et al.* (2010) construct spatial growth models based on geographical and institutional weighting matrices to investigate the productivity convergence across European regions for the period 1991-2004. They use an institutional weighting matrix in their study while instrumenting the endogenous institutional matrix using exogenous linguistic distance. They study the inverse of linguistic distance to create a measure of language similarity that reflects similar institutional structures. They find that the country-specific institutions are strongly and positively related to the region's productivity growth rate.

Ahmad and Hall (2012) also examine the effect of institutional quality on income growth rate on a sample of 58 developing countries over the period 1985-2008. They show the existence of a positive significant absolute effect of institutions on economic growth in developing countries. They find the institutional spillover effects on growth arise in an indirect way: institutions in one country lead to improvements in economic growth in that country, which subsequently generate spillover effects on economic growth in neighboring countries.

3 A Brief Look at the MENA Economies

The Middle East region has failed to take advantage of the expansion in world trade and foreign direct investment in the past two decades, and in fact has become one of the least integrated regions in the global economy. Although the region has 5.5 percent of the world's population (on average for 2008-10) and 3.9 percent of the world's gross domestic product (GDP), the

Figure 1: MENA region



region's share of non-oil world trade is only 1.8 percent; see Rouis and Tabor (2013).

The MENA area is characterized by a high level of volatility, due to many factors such as oil price fluctuations, climatic conditions, remittances and capital movements, political instability and regional conflicts. As Nugent and Pesaran (2006) mention, most economies in the region have been characterized by extremely high volatility, a condition only partly attributable to the fluctuating price of oil. Other reasons for such volatility range from the presence of dictatorships, civil wars, terrorism, and water shortages to economic problems arising from barriers to trade and foreign investment, dominance of public enterprises, and low-skilled work forces.

There are three main arguments for considering the spillover effects of growth in the MENA region. Firstly, as can be seen from the Figure 1 the MENA region covers a large geographical area, extending from Morocco in the west to Iran in the east and including a wide and heterogeneous group of countries with different economic characteristics. Countries of the region differ considerably in economic size, population, standards of living, public/private sector balance, natural resource endowments, external indebtedness, and trade and financial links with the rest of the world; El-Erian *et al.* (1996). The region was once an example of highly successful economic integration. Findlay and O'Rourke (2007) mention in their discussion of the Golden

Age of Islam (8th - 13th centuries) that the exchange in goods, techniques, ideas as well as movement of people was flourishing. Arab trade routes stretched from West Africa to China and India and long distance travel of final goods and raw materials took place. However, a geopolitical fragmentation of the Middle East contributed to the sunset of the Golden Age of Islam and eroded its contribution to science and trade. It is claimed that the region has never achieved the same nor even close degree of economic integration. Nowadays, intra-regional interaction is small, being heavily weighted toward labor flows between certain countries, with rather limited trade in goods, and inadequate integration of capital markets.

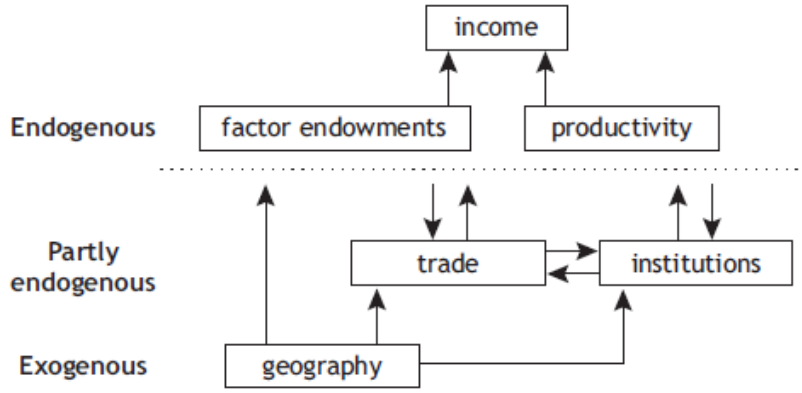
Secondly, the public sector plays a dominant role in the development process in the region, where remnants of anti-colonial struggles continue and political systems are deficient. Most of the countries in the region did not become independent states until the mid-twentieth century, when the British and French colonial powers withdrew. Central authorities have historically played a significant role in the economic life of the MENA societies. The large size of the public sector in the MENA region can be deduced from the share of public expenditures in GDP.

Thirdly, countries in the MENA region are natural-resource abundant countries and their top five export items are primary products. Integration within the MENA region remains low, particularly compared with other middle- and high-income regions of the world. Intra-regional exports have averaged less than 8 percent of total exports in the MENA region over the period 2008–10. The MENA region as a whole is characterized by exports of primary commodities, largely oil and gas (76 percent in 2008–10). Manufactured goods account for 11.4 percent, and other sectors account for the remaining 13 percent; Rouis and Tabor (2013).

4 Model Specification and Data

To account for the potential interdependencies between the different countries, we make use of spatial econometrics. As is well known, spatial econometrics is a sub-field of econometrics dealing with spatial interaction effects among geographical units. Tobler (1970) stated the First Law of Geography as: "everything is related to everything else, but near things are more related than distant thing." This first law can be counted as a keystone of the fundamental

Figure 2: All Growth Determinants



Source: Rodrik (2003)

precepts of spatial econometrics.

The first generation of spatial models was derived for cross-sectional data. The methodologies and specifications developed are mainly related to a two-dimentional approach that refers to observations on cross-sections of regions, cities or countries over several time periods. As Elhorst (2010) notes, spatial panel models can be used in applied economic research to control for relationships over time, space and between units. Panel data are generally more informative, and they contain more variation and less collinearity among the variables. The use of panel data results in a greater availability of degrees of freedom, and hence, increases efficiency in the estimation.

According to LeSage and Pace (2009), the cost of ignoring spatial dependence variable is relatively high since omitting one or more relevant explanatory variable from a regression will result in biased and inconsistent estimates. Disregarding the role of spatial relationships can underestimate spillover effects and externalities across countries. In spatial panel data econometric analysis, the spatial autocorrelation coefficient which captures the degree of neighboring relationships, is defined through the spatial weighting matrices. Given these matrices, one can create and estimate spatial econometric models. A spatial weighting matrix W is a representation of the spatial structure of the data. We should select a conceptualization that best reflects how individual units actually interact with each other.

Countries are connected to each others in several ways. The economic growth of a given MENA country depends on growth observations of its geographical neighbors, institutional neighbors and trade neighbors. Because the concept of "space" should not be restricted only to geography, we will use geographic as well as several suitably defined non-geographic notions of distance. As Rodrik (2003) suggests, geography, trade and institutions are the deeper determinants of economic growth. Figure 1 shows that income is affected by geography but also by trade and institutions, which may themselves depend on the nature of the geographic environment. In what follows, we will use these as factors of relatedness of countries' growth rate in our spatial estimation. The main goal of this paper is to determine whether the estimates of interdependencies between countries' growth rates are consistent with different kinds of spatial weighting matrices.

4.1 Spatial weighting matrices

The problem of technically incorporating spatial dependence into the model is a major issue in spatial econometrics. The spatial weighting matrices are the formal expression of spatial dependence between observations. They impose a structure with regard to each location's neighborhood and assign weights that measure the intensity of the relationship among pairs of spatial units.

The spatial weighting matrix, W, is a square $(N \times N)$, non-stochastic and symmetric matrix, whose elements w_{ij} measure the intensity of the spatial interaction between units i and j and take on a finite and non-negative value. A typical element, w_{ij}, has a value greater than 0 if the observations i and j are connected. By convention, $w_{ii} = 0$ for the diagonal elements to rule out an own effect.

The main assumption is that the structure of spatial dependence is known, not estimated, and that it specifies the degree of interdependence among observations based either on Euclidean distance, or even non-geographical distances. As Beck *et al.* (2006) note, generally the notion of observations being "nearby" one another is determined purely by physical distance in a weighting matrix. However, there is no reason why we cannot use any concept of nearness that makes theoretical sense so long as it does not violate any of the assumptions about the

weighting matrices. Elhorst (2003) mentions that spatial econometric models can also be used to explain the behavior of economic agents other than geographical units, if they are related to each other through networks. Therefore, we will do the estimations with a suitably well-defined non-geographic notion of distance as well. It can be much more effective by allowing for variants of interactions that go beyond geography. However, preserving the exogeneity of the weights is important in order to avoid identification problems, when considering such alternative specifications of weighting matrices.

4.1.1 The geographical weighting matrix

Geographical weighting matrices are clearly exogenous to the growth process, which is important for regression analysis. The use of physical distance between countries as a measure of proximity has the advantage in that it may unambiguously be considered as exogenous to the model. Therefore, it can avoid estimation problems due to identification. Most of the studies are based on geographical spatial dependence, though none of them has proved that the use of geographical distances is optimal.

The most common definition for the neighborhood is the contiguity weighting matrix, which can be defined as a common boundary relationship between two countries. However, this structure of spatial-weighting matrices has limited dependence. Therefore, we will use the physical distance between countries as a measure of geographical relatedness. The inverse-distance weighting matrix with elements d_{ij} is computed by using the geographical coordinates of countries' capital cities. The inverse of the distance $\frac{1}{d_{ij}}$ should be used as elements of the matrix, because in the distance matrix, a larger value implies a greater weight. Therefore, inverting the bilateral distances to get a larger value for the variable w_{ij} implies that country i is closer to country j in terms of the transformed weighting matrix.

$$w_{ij} = \frac{1}{d_{ij}} \Big/ \left[\sum_j \frac{1}{d_{ij}} \right].$$

In order to normalize the outside influence upon each country, the spatial weighting matrix is standardized such that the elements of a row sum up to one. Row normalization is used

to create proportional weights in cases where individual units have an unequal number of neighbors and it implies that the impact on each unit by all other units is equalized. Moreover, the mutual proportions between the elements of W remain unchanged, and do not lose their property of symmetry as a result of these normalizations.

4.1.2 The institutional weighting matrix

The impact of institutions on economic growth and its determinants is a topic of interest in the literature on new growth empirics. As Abreu *et al.* (2005) note, institutions are the result of initial conditions like climate, location, natural sources abundance, amongst other factors. Hall and Jones (1999) argue that a country's social infrastructure, which is defined as "institutions and the government policies that determine the economic environment within which individuals accumulate skills, and firms accumulate capital and produce output" is a key determinant of cross-country differences in productivity levels; see also Olson *et al.* (2000). Acemoglu *et al.* (2001) use the colonialization experience as a natural experiment and examine the relationship between institutions and long-run economic growth by instrumenting institutions with settler mortality rates. They find that early institutions affect current institutions, which have a significant effect on economic growth. Rodrik *et al.* (2004) argue for the primacy of institutions over geography and trade as a determinant of economic growth.

According to these views, we expect that the intensity of the spillover effect across countries may be related to institutional proximity. The idea is that countries sharing the similar institutions may be characterized by stronger linkages, so that spillover effects are more likely to occur among them. However, in this case, we must consider the endogeneity of institutional matrix: if the weighting matrix is constructed from time-varying institutional indicators scores, it could possibly bias the spatial estimators. Arbia *et al.* (2010) incorporate spatial externalities by means of a non-conventional spatial weight matrix built from geo-institutional distances, which they define as countries being institutionally similar. Using this definition, they find that the country-specific institutions are strongly and positively related to the regional productivity growth rate. To further avoid endogeneity problems in the construction of the weighting matrix, they use a proxy for the institutional heterogeneity index given by

the linguistic distance. Therefore, as in Arbia *et al.* (2010), we will employ an institutional weighting matrix by instrumenting it using exogenous linguistic distance.

Linguistic distance is defined as ethnological differences by families of languages. Since they are stable in the short-run, they can be unambiguously considered exogenous to the model. Melitz and Toubal (2014) construct measures of Linguistic Proximity, which show the cultural similarities between countries. They summarize the evidence of the linguistic influences in a Common Language Index (CL), which rests strictly on exogenous linguistic factors. This summary index CL is constructed from different proxies: Common Official Language (COL), Common Native Language (CNL) and Language Proximity (LP).[4]

The CL ranges between 0 and 1. It takes a value equal to zero if the degree of linguistic proximity between two countries is null, whereas CL tends to 1 when the linguistic proximity between these two countries is high.

$$w_{ij} = 0 \quad \text{if } i = j$$

$$0 < w_{ij} = \frac{CL_{ij}}{\sum_{i \neq j} CL_{ij}} \leqslant 1,$$

where CL_{ij} represents the Common Language Index (CL) between countries i and j.

4.1.3 The trade weighting matrix

The relationship between international trade and growth has been the topic of much attention in the literature. Yet a simple positive relation between countries' income and trade shares cannot establish causality, as countries that have higher income or better policies may trade more.[5] As an alternative approach, Frankel and Romer (1999) use the predictions of the gravity model, which posits that bilateral trade flows depend on economic size and the distance between two units. They argue that geographic variables may be used to create a valid instrument for

[4]Data on Common Language is available at;

$http://www.cepii.fr/cepii/en/bdd_modele/presentation.asp?id = 19$

[5]Using trade policies instead of trade shares also does not solve the endogeneity problem, as countries that adopt free-trade policies may also implement free-market monetary and fiscal policies. Since these policies are likely to lead to higher incomes, countries' trade policies are likely to be correlated with factors that are typically omitted from trade equations.

international trade and find that trade raises growth. However, we could surmise that the relationship between trade and growth could also be indicative of explicit cross-correlations in economic growth across countries.

To analyze such potential spillover effects, Moreno and Trehan (1997) use a measure of proximity based on a country's direction of trade. For each country, they weigh each foreign growth rate by the amount of trade between two countries (the sum of exports and imports), normalized by the total trade of the country in question. Aten (1996) constructs a spatial weighting matrix based on trade flows between countries, which is expressed as a proportion of total exports and imports. Likewise, Ertur and Koch (2011) use bilateral trade flows to form the spatial weighting matrix as well, but they compute trade flows as an average over the period 1990-2000 to avoid endogeneity problems. Ho *et al.* (2013) show that the economic growth of a country is positively affected by the economic growth of its trade partners through bilateral trade flows instead of that of its nearby countries using a sample of 26 OECD countries over the period 1970–2005.

The trade weighting matrix is constructed as;

$$w_{ij} = 0 \quad \text{if } i = j$$

$$w_{ij} = \frac{m_{ij} + x_{ij}}{\sum_{i \neq j} m_{ij} + x_{ij}}$$

where m_{ij} is imports between country i and j while x_{ij} shows exports.

In the spatial econometrics literature, the weighting matrix is assumed to be exogenous to the dependent variable. Here, because GDP growth may affect the trade flow in time t, we use the average of trade flows between period 1990-2014 to avoid endogeneity problems as in Ertur and Koch (2011).

4.2 The spatial growth model

Following Durlauf *et al.* (2005), a panel data model for the growth rate of real GDP per capita may defined as follows

$$\begin{aligned} g_{it} &= \alpha + \gamma \log Y_{i,t-1} + X^*_{i,t}\theta + \epsilon_{it} \\ &= \alpha + X_{i,t}\beta + \epsilon_{it}, \end{aligned} \tag{4.1}$$

where $g_{it} = (\log Y_{i,t} - \log Y_{i,t-1})/T$ is a growth rate of GDP per capita and, $Y_{i,t}$ is GDP per capita for time t and $Y_{i,t-1}$ is initial level of GDP per capita for a given period, T is the time length, α is vetor of constant terms, and X^*_{it} is a vector of explanatory variables. This representation follows from the simple growth regression model analyzed by Barro (1991) and others. We include initial GDP per capita $Y_{i,t-1}$ among the vector of explanatory variables, X_{it} and re-write the growth regression model in an alternative way to provide consistency with the remainder of our analysis below.

To extend this model with spatial effects, the Spatial Autoregressive Model (SAR) and Spatial Error Model (SEM) are typically used in the growth literature. These models show whether the spatial dependence is in the dependent term (lag dependent variable) or in the disturbances, respectively.

$$SAR: \quad g_{it} = \rho \Sigma_{j=1}^{N} w_{ij} g_{jt} + X_{i,t}\beta + \mu_i + \epsilon_{i,t} \tag{4.2}$$

$$\epsilon_{i,t} \backsim N(0, \sigma_\epsilon^2) \quad and \quad E(\epsilon_{i,t}, \epsilon_{i,s}) = 0 \quad i \neq j \quad and/or \quad t \neq s$$

where ρ is called spatial autoregressive coefficient, w_{ij} is an element of a spatial weight matrix W, and μ_i is a vector of parameters to be estimated in FE. SAR is more appropriate when the growth rate of a particular country is related to that of its neighbor's growth. Moreno and Trehan (1997), Roberts and Deichman (2009) and Ho *et al.* (2013) use SAR to show the economic growth of a country is positively affected by the economic growth of its neighboring countries.

The SEM model has a spatial lag structure in the error term, implying it is more suitable if countries share similar unobserved features.

$$SEM: \quad g_{it} = X_{it}\beta + \mu_i + \phi_{i,t} \quad and \quad \phi_{i,t} = \lambda \Sigma_{j=1}^{N} w_{ij}\phi_{ij} + \varepsilon_{it} \tag{4.3}$$

$$\epsilon_{i,t} \backsim N(0, \sigma_\epsilon^2) \quad and \quad E(\epsilon_{i,t}, \epsilon_{i,s}) = 0 \quad i \neq j \quad and/or \quad t \neq s$$

where $\phi_{i,t}$ reflects the spatially autocorrelated error term and λ is called the spatial autocorrelation coefficient. Moreno and Trehan (1997) use both the SAR and SEM models. They show the effects of shocks that are common to geographic regions. However, they argue that models allowing for more general spillovers fit the data better. Baumont *et al.* (2003) also argue that

SEM is the more appropriate spatial regime for their sample of 138 European regions over the period 1980-1995, as their estimation of Lagrange Multiplier tests indicate that the presence of spatial autocorrelation rather than a spatial lag variable.

The use of Lagrange Multiplier tests provides a good guide to decide which specification of spatial models is the most appropriate. Florax *et al.* (2003) develop the model selection criteria using Lagrange Multiplier tests with LM_ρ and LM_λ for a spatially lagged dependent variable and spatial error correlation, respectively. They also present robust versions of these tests that control for local mis-specification. Denote the robust version of the Lagrange multiplier test for spatial lagged dependence in the presence of spatial error autocorrelation by L^*_ρ and the robust version of the Lagrange multiplier test for spatial error autocorrelation in the presence of spatially lagged dependent variable by L^*_λ. Following Florax *et al.* (2003), a hybrid specification strategy that combines the classical and robust tests may be implemented as follows:[6]

1. Estimate the initial model $g_{it} = \alpha + X_{i,t}\beta + \epsilon_{it}$ by OLS.

2. Test the hypothesis of no spatial dependence due to an omitted spatial lag or due to spatially autoregressive errors, using LM_ρ and LM_λ.

3. If both tests are insignificant, then we cannot reject the hypothesis of no spatial lags and no spatial error term.

4. If both tests are significant, then estimate the specification pointed to by the more significant of the *robust* tests. For example, if $L^*_\rho > L^*_\lambda$, then select SAR. If $L^*_\rho < L^*_\lambda$, then select SEM.

5. If LM_ρ is significant but LM_λ is not, then select SAR. Otherwise, select SEM.

[6] Florax *et al.* (2003) also show how similar specification strategies may be implemented using only the classical or robust versions of the LM tests. They further compare the classical, robust and hybrid LM based strategies to a so-called Hendry strategy that uses the general-to-specific approach and show that the LM based strategies dominate with respect to detecting spatial dependence.

4.3 Variable description and data

There is no agreed upon definition of MENA countries. Several international organizations like the IMF and the World Bank define the MENA region to include different countries. Here, with the available data, we select the following 18 MENA countries; Bahrain, Djibouti, Algeria, Egypt, Islamic Republic of Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Morocco, Malta, Oman, Qatar, Saudi Arabia, Tunisia, Turkey and United Arab Emirates. We use a panel of nine periods based on 5-year averages of real GDP growth rates.

In our analysis, we also include the standard variables used in growth regressions to control for model mis-specification and to obtain the net effects of the economic performance of the neighbors. The macroeconomic variables included in the right-hand side are: POP (mean logarithmic growth rate of population as an annual percentage), INV (the share of investment in real GDP), $\log GDP_{initial}$ (log of the initial value of the per capita GDP), GOV (government consumption spending as a percentage of GDP; as a proxy for government expenditure), and TRA (trade balance measured as export minus imports as a share of GDP).[7],[8] These macroeconomic variables are selected according to factors that might affect the economic growth in the empirical literature; see Barro and Sala-i Martin (1995) and Barro (2001). Table 1 gives an overview of the selected variables of this study. The annual data on all variables are collected from Penn World Table for the sample period between 1970 - 2014.

5 Estimation and Results

In analyses that seek to uncover dependencies, the first question to consider is whether the data exhibit spatial autocorrelation or not. The general approach is to start with a non-spatial

[7] In the growth regression literature, the impact of trade is often measured as trade openness, which is defined as the sum of exports and imports. While we also tried including this variable in our spatial model, the coefficient on both INV and TRA became insignificant, though the spatial autoregerssive parameter ρ inceased slightly. Hence, we chose to measure the impact of trade through the trade balance, which may be more relevant for MENA countries who, on average, have trade deficits; see Table 1 below.

[8] We also tried including a measure of human capital. However, due to the lack of data availability, this dramatically reduces N and makes the estimation unreliable.

Table 1: Descriptive statistics of variables

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
$GDPpc_{growthrate}$	162	0.030	0.067	−0.154	−0.003	0.060	0.268
$GDP_{initial}$	162	23,764	37,542	1,048	4,551	24,375	244,668
POP	162	0.033	0.029	−0.038	0.017	0.040	0.177
GOV	162	0.215	0.110	0.031	0.148	0.263	0.613
INV	162	0.255	0.105	0.033	0.180	0.321	0.599
TRA	162	−0.015	0.236	−0.810	−0.115	0.124	0.830

linear regression model and then test whether or not the model needs to be extended with spatial interaction effects; see Elhorst (2010). Among many measures of spatial relationships, Moran's I statistic is the most widely used measure to test for spatial dependence. Moran's I statistic can be used to generate data that can theoretically or statistically justify the use of spatial models and it provides a method of checking for spatial correlation in the data, within an exploratory analysis framework. If the panel data involves a spatial dependence, then OLS may result biased and inefficient coefficient estimates due to the omitted variable. In this case, Maximum Likelihood estimation will be more appropriate; Elhorst (2003).

Also, in panel data estimation, specific effects must be controlled for. As in traditional models, these can be fixed effects (FE), random effects (RE) and models with no specific effects (pooled). For FE models, specific effects can be estimated as the individual (for units), time (for periods), or two-way (for units and periods). Elhorst (2010) notes that the spatial specific effects may be treated as fixed effects or as random effects. In the fixed effects model, a dummy variable is introduced for each spatial unit, while in the random effects model, μ_i is treated as a random variable that is independently and identically distributed with zero mean and variance σ. Furthermore, it is assumed that the random variables μ_i and ε_{it} are independent of each other. In our analysis, we rely on the spatial Hausman test, which has

Table 2: Moran's I test for spatial autocorrelation in OLS regression with different matrices and LM tests for spatial error vs. spatial lag model

	geographical W	institutional W	trade W
Moran's I statistic	0.1026***	0.1312***	0.1134***
LM_ρ statistic: no spatial lag	22.438 ***	28.767***	24.599***
Robust LM_ρ^* statistic: no spatial lag	14.442 ***	10.191***	11.082***
LM_λ statistic: no spatial error	15.263 ***	21.686***	17.72***
Robust LM_λ^* statistic: no spatial error	4.4682*	3.1109*	4.2026*

Note: * $p < 0.1$, **$p < 0.05$, *** $p < 0.01$

the null hypothesis that the random effects model is consistent. We reject the null hypothesis with highly significant p-value, and a FE model is thus chosen for the rest of this empirical analysis.

To select the most appropriate specification, we start from the model without spatial autocorrelation and implement Lagrange multiplier tests. Moran's I test adapted to OLS regression residuals indicates the existence of spatial dependence in the growth regression. Table 2 shows that the Moran's I test against spatial dependence strongly rejects the null hypothesis, regardless of the spatial weight matrix that is used. Therefore, we carry out the modelling of economic growth in the presence of spatial effects.

Additionally, we perform Lagrange Multiplier tests to distinguish between the two forms of spatial dependence: endogenous spatial lag or spatial autocorrelation of errors. The second and fourth rows of Table 2 show that we can reject the null hypothesis of no spatial lags and no spatial error term for the classical version of the LM test using L_ρ and L_λ at the 1% level. These results suggest that spatial dependence is important for the growth processes of the MENA countries. Hence, we implement step 3 of the Florax *et al.* (2003) specification strategy and compare the robust versions of the LM test statistics given by L_ρ^* and L_λ^*. The SAR model dominates the SEM for capturing since $LM_\rho^* > LM_\lambda^*$ for all of the different weighting matrices that we consider in our analysis.

5.1 Estimation of models with spatial dependence

Table 3: Spatially autoregressive models

	Dependent variable: GDP per capita growth rate			
	OLS	Geographical W	Institutional W	Trade W
$\log GDP_{initial}$	-0.037^{***}	-0.037^{***}	-0.0038^{***}	$-$-0.037***
	(0.011)	(0.0105)	(0.0104)	(0.0105)
POP	-0.671^{**}	-0.586^{**}	-0.602^{***}	-0.617^{***}
	(0.251)	(0.225)	(0.222)	(0.227)
GOV	-0.111^{*}	-0.083	-0.076	-0.087
	(0.0692)	(0.0622)	(0.06146)	(0.0627)
INV	0.149^{*}	0.153^{**}	0.159^{**}	0.165^{**}
	(0.079)	(0.0709)	(0.070)	(0.0716)
TRA	0.180^{***}	0.161^{***}	0.152^{***}	0.159^{***}
	(0.048)	(0.0435)	(0.0429)	(0.0439)
ρ		0.376^{***}	0.425^{***}	0.255^{**}
		(0.130)	(0.118)	(0.105)
Observations	162	162	162	162
R^2	0.195	0.318	0.335	0.305

Note: Standard errors in parentheses
* $p < 0.1$, **$p < 0.05$, *** $p < 0.01$

Table 3 presents the results obtained in the estimation of the models with spatially lagged dependent variables or the spatial autregressive model (SAR). In the first column, we report non-spatial results with OLS estimation while columns two to four provide estimates with geographical, institutional and trade weighting matrices, respectively. We start with OLS esti-

mation as a benchmark specification for ease of comparison. Table 3 shows that the coefficients of growth determinants are not considerably changed by the inclusion of spatial variables. The coefficients for the logarithm of initial GDP per capita are consistently negative and statistically significant across all estimations. This supports the conditional convergence hypothesis postulated in the growth literature. As expected, we get the negative impact of population growth and government expenditures on countries' per capita growth rates, while investment and the trade balance as a share of GDP have positive effects on the GDP growth rate of each country.

The key result in Table 3 that differentiates our analysis from the standard growth regression results has to do with the spatial effects captured through the weighted GDP growth of neighboring countries. The positive and significant value of the spatial autocorrelation coefficient ρ implies that part of the economic growth of each of the investigated countries is through the spatial effect of neighboring countries' growth. The parameter ρ indicates that a 1-percent increase in the weighted average of neighbor growth rates increases a MENA country's domestic growth by 0.38 %, 0.42 %, 0.25% with geographical, institutional and trade weighting matrices, respectively.

Despite evidence of a significant effect from spatial lagged dependent variables, Table 3 shows that the estimated coefficient of the spatial lag term using trade weights is nearly half of the estimated coefficients with geographical or institutional weights. This finding may be attributed to the weakness of intra-regional trade of MENA countries that we discussed in Section 3. As is well known, many of these countries are natural resource abundant, and export mostly oil and oil-related products and generally import foodstuffs. Therefore, our results indicate that intra-regional trade has proved ineffective at promoting growth spillovers within the MENA region.

In Table 4, we report the results for the model with spatially autocorrelated errors. The results are in Table 4. We observe that the magnitude and sign of the coefficients on the explanatory variables are very similar to those for the model with spatially lagged dependent variables. The finding that the magnitude of the spatial autocorrelation on the error terms, λ, using trade weights is nearly half of the estimated coefficients with geographical or institutional

weights implies that the weak role for trade in generating growth spillovers remains when such spillovers are attributed to the impact of common shocks that may hit the different countries. Comparing the SAR specification reported in Table 3 with the SEM specification reported in Table 4, we find that the former displays higher R^2 values, attesting to its superior performance in the previously reported LM tests.

Table 4: Spatial error models

	Dependent variable: GDP per capita growth rate			
	OLS	Geographical W	Institutional W	Trade W
$\log GDP_{initial}$	-0.037^{***}	-0.041^{***}	-0.046^{***}	-0.037^{***}
	(0.011)	(0.0111)	(0.011)	(0.0111)
POP	-0.671^{**}	-0.496^{**}	-0.495^{***}	-0.631^{***}
	(0.251)	(0.239)	(0.235)	(0.237)
GOV	-0.111^{*}	-0.065	-0.063	-0.083
	(0.0692)	(0.0628)	(0.0606)	(0.0628)
INV	0.149^{*}	0.148^{**}	0.158^{**}	0.182^{**}
	(0.079)	(0.0710)	(0.069)	(0.0719)
TRA	0.180^{***}	0.151^{***}	0.134^{***}	0.146^{***}
	(0.048)	(0.0438)	(0.0435)	(0.0448)
λ		0.397^{***}	0.492^{***}	0.233^{*}
		(0.133)	(0.115)	(0.114)
Observations	162	162	162	162
R^2	0.195	0.265	0.255	0.265

Note: Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Taken together, the results of Table 3 and 4 indicate that growth spillovers in the MENA

region tend to occur through geographical and institutional proximity rather than trade. This holds true whether spatial effects are modeled through spatial autocorrelation in the dependent variable or the error terms, and suggests that the trade channel for generating spillover effects is especially weak in the MENA region. These findings have ramifications for growth in the MENA region, as trade is known to enhance productivity growth through economies of scale, increased competition, knowledge acquisition, innovation, to name a few. Furthermore, more liberalized trade may allow countries to move up the value chain.[9] On the other hand, institutional factors may enhance growth through the observance of a rules-based regime, greater inclusiveness through the creation of democratic institutions of governance, the decline in corruption and other forms of rent-seeking activities. In the literature, Moreno and Trehan (1997) suggest that proximity matters for more reasons than just trade. Also, the results of Ho *et al.* (2013) indicate an evidence for spatial spillover through trade linkages instead of geographical distance. However, for the sample of MENA region countries, our results suggest that the economic growth of a MENA country is positively affected by the economic growth of countries that are geographically close and that have similar institutional characteristics rather than through the GDP growth of its trade partners.

5.2 Direct and indirect effects

In a traditional non-spatial model, the partial derivative associated with X is simply going to be the parameter β. However, in a SAR model, it is more complicated. In matrix form, equation (4.2) becomes

$$g = \rho W g + X\beta + u, \tag{5.4}$$

which can be written as

$$(I - \rho W)g = X\beta + u,$$

implying

$$g = (I - \rho W)^{-1} X\beta + (I - \rho W)^{-1} u.$$

[9] See Karam and Zaki (2015).

Thus,

$$\frac{\partial g}{\partial X} = (I - \rho W)^{-1}\beta$$

where X is an $N \times k$ matrix of exogenous and non-stochastic explanatory variables, W is a non-stochastic interaction matrix whose diagonal elements are zero, ρ is the true parameter measuring spatial autoregressive term, while β is the true value of the $k \times 1$ vector of unknown parameters associated to the explanatory variables. Finally, u is the vector of independent error terms with a zero mean and variance σ^2.

The magnitude of the change in X on the elements of g will depend on (1) the degree of friction between countries which is governed by the W matrix used in the model, (2) the parameter ρ measuring the strength of spatial dependence between countries and (3) the estimated parameter β. This is because the change in X in country i not only has a primary effect on g in country i, but also potential effects on g in all other countries in the sample. These secondary effects on g can be counted as a spillover effects. LeSage and Pace (2009) show how to compute the statistical measures of dispersion for these effects. These measures allow inferences regarding the statistical significance of the direct, indirect and total impacts that arise from changes in the explanatory variables.

The diagonal elements of the $N \times N$ matrix $G = (I - \rho W)^{-1}$ contain the direct impacts, and off-diagonal elements represent indirect impacts. As Debarsy and Ertur (2019) note, the impact matrices G are generally full and not symmetric regardless of the sparsity and structure of the interaction matrix W. They call the country in column j of this matrix as the emitting country and country in row i the receiving country. The sum of the ith row of the G matrix represents the total impact on the dependent variable in country i due to a 1 unit change in X in all of the countries in the sample. The sum of column j gives the total impact on the dependent variable of all the countries of a 1 unit change of X in country j.

The direct effect can be used to test the hypothesis as to whether a particular variable has a significant effect on the dependent variable in itself. This direct effect would be analogous in interpretation to the single parameter β associated with X in a non-spatial framework. However, the magnitude of those direct effects can slightly change across countries due to feedback effects. As Debarsy and Ertur (2019) note: "The own derivative for country i includes

feedback effects, where country i affects country j and also country j also affects country i as well as longer paths which might go from country i to j to k and back to i." By contrast, the indirect effect is measured by the average of either the row sums or the column sums of the non-diagonal elements and shows the changes in the average effect that comes from all other countries. In the spatial autoregeressive model (SAR), the indirect effect can be used to test whether spatial spillovers exist.[10]

Table 5 gives us the average impact measures of all explanatory variable in our analysis. It implies that the growth rate of GDP per capita in each country depends not only on the values of the explanatory variables in that country, but also on the values of the explanatory variables in the other countries. The first column of the Table 5 gives the measure of *average direct effect*, which summarizes the impact of changes in the explanatory variables using an average across the entire sample of countries. The direct effects of an increase in the explanatory variables are quite significant. However, there are no significant indirect effects on neighboring growth rates.

Table 6 presents the $N \times N$ estimated matrix of elasticities of the trade balance as a share of GDP, which uses institutional matrix in our econometric model. We multiply the impact matrix G with 0.15296, which is the estimated coefficient on the trade balance as a fraction of GDP from the third column of Table 3. The bold elements on the main diagonal correspond to the direct elasticities of GDP growth of a given country with respect to its own trade balance. We do not observe much difference between countries because of the small scale of feedback effects. Algeria, Israel, Jordan, Kuwait, Morocco, Qatar, Saudi Arabia and Turkey have higher than average direct impact 0.1557%, which can be seen from Table 5. On the other hand Djibouti, Egypt and Tunisia have lower than average with 0.1538% 0.1540% and 0.1541% respectively.[11]

Turning to the indirect effects, Figure 3 presents the indirect effects that are generated as

[10] By contrast, in spatial error models (SEM), only the direct effect exists.

[11] It is possible to create the elasticities of the investment share to GDP using the estimated coefficient of the share of investment to GDP (0.1627) from Table 3 multiplied with the impact matrix G. However, we have omitted this information because it provides very similar information to the trade balance elasticities that we present in Tables 6a-6b.

Table 5: Impact measures using institutional matrix

	Direct	Indirect	Total
$\log GDP_{initial}$	-0.03888	-0.02759	-0.0664
	(0.0004)	(0.06)	(0.002)
POP	-0.6135	-0.4356	-1.0492
	(0.011)	(0.129)	(0.02)
GOV	-0.0776	-0.0551	-0.1327
	(0.241)	(0.329)	(0.255)
INV	0.1627	0.1155	0.2783
	(0.014)	(0.147)	(0.03)
TRA	0.1557	0.1106	0.2664
	(0.0004)	(0.096)	(0.008)

Note: Simulated p-values in parentheses.

the sum of the corresponding columns of Table 6 excluding diagonal elements. The indirect effects of countries to the region mostly comes from the oil exporting countries like Algeria, Kuwait, Oman, Qatar and Saudi Arabia as well as Israel. As we mentioned earlier, these countries also have higher than average direct effects. Based on a notion of institutional proximity, we find that the spillover effects of growth are due to economic activities in countries that trade primarily with the rest of the world. The growth effects that oil-rich countries create for oil-poor ones in the region stem from such factors as remittances, aid and investment flows. However, Luciani (2017) argues that political and economic developments since the 1990's have reduced the impact of such factors for growth in the MENA region. Specifically, beginning with the invasion of Kuwait by Iraq, the oil-rich Gulf countries have taken measures such as expelling massive numbers of immigrants from other Arab countries and creating the Gulf

Table 6.a: Impact matrix of trade for MENA countries using institutional W matrix

	ARE	BHR	DJI	DZA	EGY	IRN	IRQ	ISR	JOR
ARE	**0.155784**	0.00595	0.002207	0.008744	0.002034	0.006581	0.005023	0.00895	0.00895
BHR	0.006386	**0.155592**	0.002255	0.00862	0.002327	0.006528	0.005153	0.008819	0.008819
DJI	0.007266	0.006915	**0.15386**	0.008911	0.000867	0.007369	0.002523	0.009058	0.009058
DZA	0.006601	0.006063	0.002043	**0.156744**	0.001774	0.006758	0.004589	0.009361	0.009361
EGY	0.006551	0.006984	0.000848	0.00757	**0.154045**	0.006723	0.004189	0.007661	0.007661
IRN	0.006446	0.005957	0.002192	0.008768	0.002044	**0.155844**	0.004985	0.008976	0.008976
IRQ	0.006934	0.006628	0.001058	0.008391	0.001796	0.007026	**0.155013**	0.008521	0.008521
ISR	0.006615	0.006073	0.002034	0.009165	0.001758	0.006773	0.004562	**0.156831**	0.009393
JOR	0.006615	0.006073	0.002034	0.009165	0.001758	0.006773	0.004562	0.009393	**0.156831**
KWT	0.006592	0.006056	0.00205	0.009114	0.001786	0.006748	0.004607	0.009339	0.009339
LBN	0.007224	0.00703	0.000856	0.00816	0.001998	0.007284	0.005746	0.008243	0.008243
MAR	0.006505	0.005994	0.002128	0.008913	0.001911	0.006654	0.004814	0.009129	0.009129
MLT	0.006368	0.00591	0.002306	0.008555	0.002224	0.006505	0.005282	0.00875	0.00875
OMN	0.006533	0.006028	0.002079	0.008994	0.00208	0.006689	0.004689	0.009214	0.009214
QAT	0.006573	0.006042	0.002065	0.009072	0.00181	0.006728	0.004647	0.009295	0.009295
SAU	0.00662	0.006077	0.00203	0.009175	0.001753	0.006778	0.004553	0.009403	0.009403
TUN	0.00681	0.006636	0.000832	0.007757	0.007166	0.006874	0.00446	0.007841	0.007841
TUR	0.006515	0.006001	0.002118	0.008937	0.001894	0.006665	0.004787	0.009154	0.009154

Table 6.b: Impact matrix of trade for MENA countries using institutional W matrix

	KWT	LBN	MAR	MLT	OMN	QAT	SAU	TUN	TUR
ARE	0.008606	0.005333	0.007355	0.005583	0.007998	0.00833	0.009018	0.002475	0.007495
BHR	0.008486	0.005571	0.007274	0.005561	0.00792	0.008219	0.008886	0.002588	0.00741
DJI	0.008813	0.002082	0.007921	0.006655	0.008377	0.008616	0.009107	0.000995	0.008021
DZA	0.008983	0.004548	0.007608	0.005662	0.008312	0.00868	0.009436	0.002128	0.007762
EGY	0.00751	0.00475	0.006958	0.006279	0.008202	0.007388	0.007691	0.008386	0.007019
IRN	0.00863	0.005267	0.00737	0.005586	0.00802	0.008352	0.009045	0.002446	0.007511
IRQ	0.008304	0.005857	0.007514	0.006393	0.007925	0.00813	0.008564	0.002237	0.007603
ISR	0.009013	0.004498	0.007629	0.00567	0.008337	0.008707	0.009469	0.002106	0.007784
JOR	0.009013	0.004498	0.007629	0.00567	0.008337	0.008707	0.009469	0.002106	0.007784
KWT	**0.156687**	0.004583	0.007595	0.005657	0.008295	0.008661	0.009414	0.002143	0.007748
LBN	0.008104	**0.155075**	0.007597	0.006875	0.007867	0.007993	0.008271	0.002195	0.007654
MAR	0.00877	0.004961	**0.156164**	0.005612	0.008133	0.008481	0.0092	0.00231	0.007609
MLT	0.008424	0.005789	0.007238	**0.155437**	0.007853	0.008162	0.008815	0.002678	0.007371
OMN	0.008847	0.004745	0.007512	0.005625	**0.15644**	0.008553	0.009287	0.002224	0.007661
QAT	0.008923	0.004656	0.007566	0.005647	0.008261	**0.156571**	0.00937	0.002175	0.007718
SAU	0.009022	0.004482	0.007636	0.005673	0.008345	0.008716	**0.156859**	0.002099	0.007791
TUN	0.007701	0.004461	0.007188	0.006461	0.007493	0.007588	0.007869	**0.154191**	0.007246
TUR	0.008793	0.004912	0.007478	0.005617	0.008152	0.008502	0.009226	0.002288	**0.156222**

Cooperation Council (GCC) as a way of furthering their own economic agenda. He further argues that the cycle of low oil prices in the 1990's and 2000's reverting back to higher oil prices since 2004 also led to the worsening of the income distribution in the MENA region without contributing significantly to growth.

In Figure 4 and 5, we also show the indirect effects obtained for the geographical and trade matrices, respectively. However, their patterns are completely different from each other, as Debarsy and Ertur (2019) also note in their analysis of technological spillovers on TFP growth with worldwide interactions. In Figure 4 using the geographical weighting matrix as a interaction matrix, we find that the United Arab Emirates, Lebanon and Saudi Arabia display higher indirect effects of trade on growth measured by the trade balance as a share of GDP. On the other hand, when using the bilateral trade weighting matrix, we again find a different pattern. In this case, Figure 5 shows that the countries with the largest elasticities of GDP growth with respect to the trade balance as a share of GDP are the United Arab Emirates, Saudi Arabia and Turkey. The inclusion of Turkey, a non-oil exporting country, is revealing in that it shows that the trade effects of growth arise mainly *outside* of the MENA region, as many commentators have claimed. While Turkey may be nominally grouped among the MENA countries, its policies of trade integration and financial liberalization instituted since the early 2000's imply that it has followed a different growth trajectory than the other non-oil exporting countries of the MENA region.

6 Conclusion

This paper investigates the existence of growth spillovers among MENA countries with respect to geographical, institutional and trade characteristics. We use spatial econometric techniques to explore and understand possible linkages between integration and economic growth within the region. Our results suggest that the economic growth of MENA countries is positively affected by the economic growth of a country with institutional and geographical proximity. However, trade linkages among the different partners matter less. This may have to do with the resource-based nature of many MENA countries and the fact that MENA counties trade

Figure 3: Indirect effects of trade balance share using institutional W

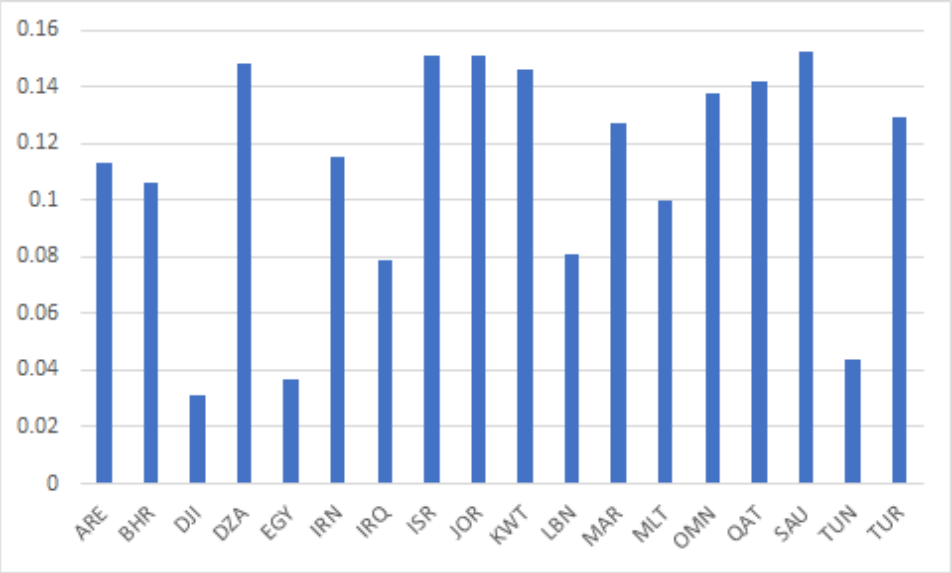


Figure 4: Indirect effects of trade balance share using geographical W

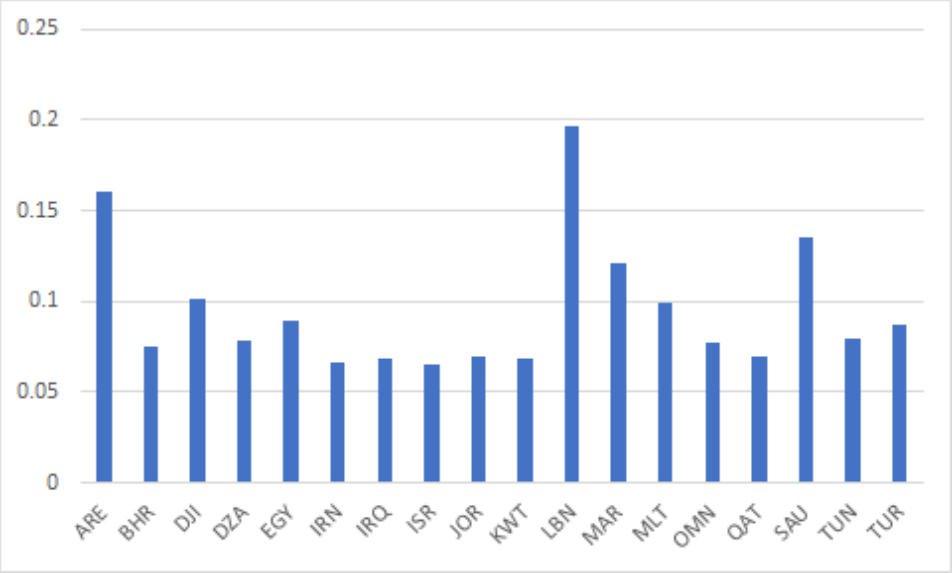
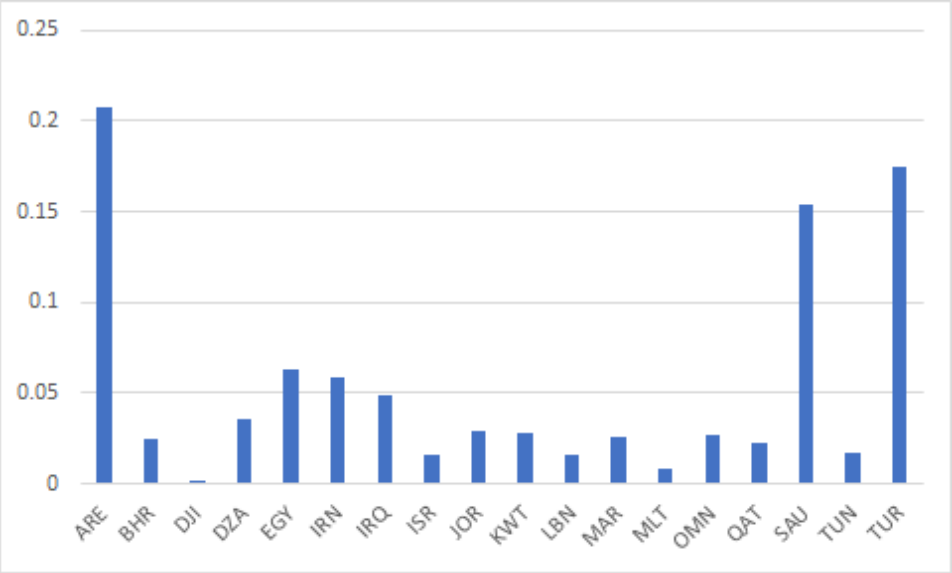


Figure 5: Indirect effects of trade balance share using trade W



primarily with countries or entities outside of their region such as the EU or China. As Karam and Zaki (2015) have argued, another explanation may have to do with the lack of trade liberalization and the restrictive trade practices in the MENA region, especially trade in services.

The policy choices of MENA countries have been the topic of extensive analysis. Typically, the focus has been on understanding the role of national policies and the benefits emanating them for the individual country and the region. In this paper, we have taken an alternative approach and examined the role of growth interdependence in the MENA region. While the role of geography seems more straightforward to explain, the fact that institutional characteristics may be a source of regional interdependence is a novel result that bears further analysis. Our results suggest that the changing face of governance in the region may be an important determinant of how growth from one country spills over to another. Combining this finding with the finding that trade linkages contribute little to generating such spillovers, our results suggest a two-pronged policy approach for the MENA: increase and diversify trade linkages and trade liberalization while simultaneously improving institutional structures and regional

governance. The benefits from following such a strategy may yield great dividends in view of the spillover effects involved.

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