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Abstract

In this paper, we utilize time series tests with structural breaks to test for evidence of an adverse impact on economic growth rates in North African countries following the 2007-2009 global financial crisis and recession. One or two structural breaks in economic growth are identified in each country, except for Morocco where no break is found. However, breaks that coincide with the financial crisis are found in only two of the six countries (Libya and Mauritania), while other breaks coincide most often with earlier U.S. or EU recessions. To further examine the impact of shocks, impulse response functions are estimated from VAR models with structural breaks. We again find no evidence that shocks from the recent financial crisis will have a significant impact on economic growth in North Africa. We conclude that shocks from the 2007-2009 global economic crisis will have only temporary effects on economic growth rates in North Africa and are likely not a main factor to explain the uprisings in 2011.

ملخص

نستخدم في هذه الورقة متواليات عددية و فجوات هيكلية لاختبار أدلة وجود تأثيرعكسي على معدلات النمو الاقتصادي في بلدان شمال أفريقيا في أعقاب أزمة الركود المالية العالمية فى الفترة من 2007-2009. و سيتم تحديد واحد أو اثنين من الفجوات الهيكلية في النمو الاقتصادي في كل بلد من البلدان محل الدراسة ، باستثناء المغرب حيث لم يتم العثور على أي فجوة. فى الوقت الذى شهدت فيه فجوات متزامنة مع الازمة المالية في اثنتين فقط من الدول الست (ليبيا وموريتانيا)، بينما تزامنت الفجوات الأخرى في معظم الأحيان مع فترات الركود السابقة للازمة فى كلا من الولايات المتحدة أو الاتحاد الأوروبي . و لدراسة أثر الصدمات بشكل اكثر عمقا ، تم تقدير وظائف الاستجابة المحفزة أثناء الفجوات الهيكلية من خلال نماذج . VAR لم نجد أي دليل على أن الصدمات الناجمة عن الأزمة المالية الأخيرة سيكون لها تأثير كبير على النمو الاقتصادي في شمال أفريقيا. و مما سبق , نخلص إلى أن الصدمات الناتجة عن الأزمة الاقتصادية العالمية للفترة من 2007-2009 سوف يكون لها آثار مؤقتة فقط على معدلات النمو الاقتصادي في شمال أفريقيا، ومن المرجح ألا تكون العامل الرئيسي لشرح انتفاضات 2011.

1. Introduction

The uprisings in North Africa in the first quarter of 2011-the "North Africa Spring"-has induced many analysts and area studies experts to suggest a host of factors as the root cause of the turmoil. These factors include: a) a high rate of unemployment among the youth and college graduates with lack of economic prospects; b) insufficient democratic reforms; c) autocratic rulers who hold onto power too long; d) wide-spread corruption; e) rise in cost of food items and a high rate of inflation in general; f) non inclusive growth coupled with major income disparities; g) and a general lack of respect for law and order. Combining these factors with growing access to the Internet and social media technologies, especially among the youth, made the feasibility and costs of organizing and assembling against non-democratic regimes appear reasonable-despite the presence of police, emergency laws, and expected harsh punishments if caught. Thus, and as experts suggest, it was just a matter of time before such uprisings would occur.[1]

Following publication of the 2010 Human Development Report (UNDP, HDR, 2010), it is interesting to note that in recent years the North African (NA) countries have received increasing attention as an example of progress in both economic and human welfare. [2] In particular, three of these countries - Tunisia, Algeria, and Morocco - are listed in the report among the top ten economies in the world showing the greatest improvement in human development, as measured by the Human Development Index (HDI) relative to their 1970 starting points. However, while some economists have called this the "North African Miracle," others have voiced skepticism. [3]

In light of the above, the focus in the present paper is timely and can been seen as complementary to the search for underlying reasons of the uprisings as well as providing potential support to the HDI improvements and inclusive growth argument. Resilience, vitality, and global dependency are the focal points as we try to identify the impact on the NA economies from the recent global financial crisis and recession. A host of research questions will be pursued: Did the global financial crisis of 2007-2009 impact economic growth in the NA countries? If the answer is positive, how severe is the impact? Will the impact be expected to have permanent effects on economic growth or be mostly transitory? Which countries in North Africa are most impacted? And finally, what are the implications of our findings on the causes of the uprisings?

We first examine several descriptive statistics around the time of the recent financial crisis. From Table 1, it is clear that economic growth in North Africa was not only more resilient to the global financial and economic crisis than the rest of the African continent, but performed better than almost all other regions in the world (except for emerging Asia).

In particular, the global slowdown in 2008 did not result in a recession in North Africa, as average real GDP growth remained positive while declining 1.6 percentage points, from 5.4% in 2008 to 3.8% in 2009. A similar story is suggested when examining unemployment in Table 2, where we see only relatively small changes in unemployment rates during the time period of 2007-2009.

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[1] Aly, H., January 25th in Egypt and January 14th in Tunis: Is Contagion Possible?, The Marion Star, February 6th, 2011.

[2] UNDP, Human Development Report 2010 (The Real Wealth of Nations: Pathways to Human Development), (New York: Palgrave Macmillan, 2010).

[3] See, for example, the Web blog of Dani Rodrik and comments posted on this issue at: http://rodrik.typepad.com/dani_rodriks_weblog/2010/11/the-unsung-development-miracles-of-our-time.htmlhttp://rodrik.typepad.com/dani_rodriks_weblog/2010/11/the-unsung-development-miracles-of-our-time.html.

A closer look at the country level might provide a more informed picture. For instance, Libya and Algeria, two oil exporting countries, saw their GDP growth slow to 2.1 % and 2.2% in 2009 from 3.8% and 2.4% in 2008, respectively, due to a fall in international oil prices and to lower production quotas from the Organization of the Petroleum Exporting Countries (OPEC).[4] For Egypt, the balance of payments was in deficit for the first time in five years due to declining current account receipts, falling remittances from abroad, and receding foreign investment, in addition to the stimulus package adopted to mitigate the impact of the crisis. [5] In Morocco and Tunisia, the growth rate of GDP slid to 5.0% and 3.1% in 2009 from the previous year (5.6% and 4.6%); essentially due to a decline in exports of manufactured products to the European market. Finally, Mauritania is the only NA country that experienced a negative growth rate in 2009. The crisis also came as a blessing in disguise for the oil importing countries when the price of oil and major food items plummeted leading to much lower inflation in these countries. [6]

In the next section, we provide a brief economic background on the six NA economies that we investigate (Algeria, Egypt, Libya, Morocco, Tunisia, and Mauritania). In Section 3, we describe the time series methodologies and the data that we utilize to investigate and provide answers to our questions. In Section 4, the results of our study along with explanations will be presented. In Section 5, we summarize and suggest some possible implications.

2. An Economic Overview of North Africa

North Africa constitutes a major economic powerhouse within the African continent. The region comprising Algeria, Egypt, Libya, Morocco, Tunisia, and Mauritania has strong economic potential and is expected to have solid growth prospects. The region is favored by its strategic location at the crossroads of three continents, abundant energy resources, strong linkages to the European Union (EU), and growing financial sectors. [7]

As of 2009, the NA countries possess a combined GDP of roughly US$ 532 billion (almost 33% of the total GDP of the African continent) with around 17% of Africa's total population (170 million people). From the data in Tables 1, 2, and 3 (below), it is apparent that North Africa resisted the recent global economic downturn well, with both the region's oil importers and exporters reporting positive growth rates and marking an average GDP growth of around 2.64% in 2009.

This outcome can be possibly attributed to the relatively low exposure of the NA financial sector to global financial markets. An index of financial openness for the year immediately prior to the global recession is displayed in Table 4 (below). Except for Egypt, all of the NA countries have relatively low exposure to global capital markets as measured by the index.

The NA countries are diverse in their resource endowments and stage of economic development. The countries have followed different economic paths and their basic economic indicators tell their stories**.** [8] For instance, the average life expectancy of the region is around 70 years, but ranges from almost 74 years in Libya and Tunisia to around 57 years in Mauritania.

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[4] African Development Bank platform data, 2009.

[5] African Economic Outlook, "Egypt: Country Notes," 2009.

[6] IBID, different countries notes, 2009.

[7] M. Muhlberger and M. Semmelmann, North Africa-Mediterranean neighbors on the rise, Deutsche Bank Research, WWW.Dbresearch.Com, May (2010).

[8] A. Galal and K. Sekkat, Development Prospects for North Africa, ERF policy perspectives No. 1, WWW.ERF.ORG.EG, January 2010.

The region has a diversity of natural resource (energy) endowments, which has impacted fluctuations in economic growth, the distribution of growth among sectors in each economy, and national public finances. As noted in Table 3, Egypt is the most populated country in the region with around 83 million while Mauritania is the least populated with 3.2 million. The main economic indicators vary widely across the region, with per capita GDP ranging from a low of almost US$ 1,200 in Mauritania to a high of around US$ 11,000 in Libya, with an average of US$ 3,132. Both Algeria and Libya exhibit large current account surpluses of 35% and 27% of GDP (2008), whereas all other countries have manageable deficits. Foreign reserves and external debt show a similar pattern. In the past ten years, inflation has been almost non-existent in Libya; moderate in Morocco, Tunisia, and Algeria; and significant in Egypt, and Mauritania, where prices have roughly doubled from 2000-2010.

Further diversity within the region can be observed in Table 5 where it is apparent that the NA region can be divided into two distinct groups: The oil importing and more diversified countries of Egypt, Tunisia, Morocco, and to some extent Mauritania; and the oil exporting, mono-economy countries of Algeria and Libya.

Thus, as the worst financial crisis since the great depression emanated in the US and expanded to Europe, the oil importing countries of North Africa felt the impact through the usual financial channels from limited access to foreign finance and a plummeting in some stock markets. [9] However, as the crisis progressed, the brunt of the impact was channeled through ripple effects on trade, remittances, tourism, and FDI flows. For this group, a recovery of trade began in 2010 (7.7%) after the contraction of 2009 (-13%). While remittance flows are expected to grow by 1.3 percent in 2010, this is much slower than in the pre-crisis period. Most importantly, however, the crisis might have delayed the implementation of some reform policies, but this was not the case. In contrast, Tunisia, Egypt, and Morocco continued to push ahead with economic reforms that began prior to the financial crisis.

Mauritania is a special case. With a population of approximately 3 million, a GDP of 3 billion (less than 1/2 % of the NA GDP) and the lowest per capita income and human development indicators in the region, Mauritania is considered an outlier among the NA countries. Nevertheless, despite having the most isolated financial system in the region, Mauritania was the only NA country with negative economic growth in 2009. The major culprit, however, was likely not the global financial crisis and recession, but the crisis in domestic security from the coup d'état in 2008.

In Libya and Algeria, due to the limited integration of their financial sectors into global financial markets, and as a result of the paramount importance of oil exports in their GDP (from Table 5, we can see that Libya's net exports-mainly oil-represents almost half of its GDP whereas Algeria's net exports are closer to 20% of GDP), the impact of the recent financial crisis was primarily through the oil price channel and lower production quotas in the Organization of Petroleum Exporting Countries (OPEC).

Europe has historically been the destination of choice for NA products and migration (legal and illegal), and the largest source of Foreign Direct Investment (FDI). Trade in services has been gaining a significant importance throughout North Africa and tourism is already a major source of foreign currency in many of these countries. In addition, remittances to North Africa from Europe total more than US$ 17 billion in 2006. As indicated by the data in Tables 6-A and 6-B (below), Europe is far by the major trading partner in all of the NA countries.

[9] In Egypt, the stock market capitalization decreased from EGP 813 billion in June 2008 (91 per cent of GDP) to EGP 464 billion (52 per cent of GDP) in June 2009.

In terms of trade, the USA is second to Europe by a wide margin. Trade within the NA region, however, remains relatively low despite the fact that these countries have signed many bilateral (e.g. Tunisia-Morocco, Egypt-Tunisia), sub-regional, and other regional trade agreements. In practice, however, none of these agreements is significant due mainly to various rivalries and lack of political will. As indicated in Table 6A and 6B, intra-regional trade among the NA countries, and between NA and SSA (Sub Saharan Africa), remains quite limited.

3. Methodology

The primary research question that we seek to answer is whether the recent financial crisis originating in the United States (U.S.) and the global recession that followed had a significant impact on the economies of North Africa (Algeria, Egypt, Libya, Morocco, Tunisia, and Mauritania). To examine this question, we utilize annual data from the International Monetary Fund from 1980-2015 (IMF, 2010). This data set is convenient, since the IMF provides forecasts through 2015 when current data is not available. By utilizing this data set, we can search for a break around the time of the recent financial crisis, which would otherwise not be possible at this time. Thus, while these findings can been seen as preliminary, our goal is to utilize the currently available data to provide results that policy makers and others can utilize in an expedient manner until further analysis can be undertaken in future years when more data is available. Perhaps most important for our particular investigation, the IMF forecast data utilized in the later years of our sample period were constructed prior to the 2011 uprisings. As such, utilizing these data is advantageous in the sense that we can more accurately search for evidence of breaks associated with the financial crisis without having to separate effects on economic growth that might be attributed to the uprisings from those that might be attributed to the financial crisis.

We focus our empirical investigation on the annual rate of economic growth in each country as measured by the percentage change in Real Gross Domestic Product (real GDP). Since our data on real GDP is in constant price national currency units, we additionally consider time series on units of national currency per current international dollar to control for fluctuations in exchange rates (1981-2015, IMF, 2010). Since the recent financial crisis is generally regarded to have originated in the U.S., we include the annual growth rate of U.S. real GDP in our investigation. Given that the European Union (EU) is a major trading partner with the NA countries, we also include the annual growth rate of EU real GDP in our VAR tests.

We begin our investigation by examining the time series properties of each series using unit root tests with structural breaks. Structural breaks are included for three reasons. First, we want to avoid possible bias that can lead to failure to reject a false unit root if structural breaks are present but ignored (Perron, 1989). Second, we want to identify if important breaks in level and trend are present and, if so, do breaks correspond to the time period of the 2007-2009 financial crisis and recession. Third, prior to performing additional time series tests, we want to determine if each series is stationary to avoid potentially spurious estimation results. Moreover, if growth rates are stationary, then shocks will have temporary effects. In contrast, if growth rates are nonstationary, then shocks will have permanent effects with no tendency to return to a stable mean or trend. Since a structural break implies an infrequent permanent change in the level and/or trend of a time series, a series that is stationary around breaks is often described as a trend-break stationary series.

After testing for unit roots and identifying breaks, we then estimate Vector Auto-Regression (VAR) models for each country, while controlling for breaks. Including breaks in the VAR models can be important, since ignoring breaks can potentially lead to spurious results and incorrect conclusions. In addition, we want to determine if shocks from the recent financial

crisis impact economic growth rates in North Africa. After estimating VAR models with breaks, we estimate impulse response functions to look for evidence of an impact on NA economies from the U.S. financial crisis. Given that economic ties are greater between the EU and NA than between the U.S. and NA, we additionally include the growth rate of the EU in our VAR models. As noted above, economic growth in the EU can potentially have a greater impact on the NA economies due to greater linkages in terms of trade and remittances. Given that we utilize real GDP growth rates measured in national currency units, we also include the rate of currency depreciation in our VAR models to control for fluctuations in exchange rates.

We begin our testing procedure by utilizing the Lagrange Multiplier (LM) unit root tests of Lee and Strazicich (2003, 2004). These tests can be utilized to identify one or two level and trend breaks while jointly testing the null hypothesis of a unit root. An important feature of these tests is that they are not subject to spurious rejections and will be valid whether a break occurs under the null or alternative hypothesis (Lee and Strazicich, 2001, 2003). The LM unit root test can be described as follows:

$$\Delta y_t = \delta' \Delta Z_t + \varphi \tilde{S}_{t-1} + \Sigma \gamma_i \Delta \tilde{S}_{t-i} + \varepsilon_t \,, \qquad (1)$$

where $\tilde{S}_t$ is a de-trended series such that $\tilde{S}_t = y_t - \tilde{\psi}_x - Z_t\tilde{\delta}$, t = 2,..,T; $\tilde{\delta}$ is a vector of coefficients in the regression of Δy_t on ΔZ_t; $\tilde{\psi}_x = y_1 - Z_1\tilde{\delta}$, where y_1 and Z_1 are the first observations of y_t and Z_t, respectively; Δ is the difference operator; and ε_t is an *iid* error term with zero mean and finite variance. In the model with two level and trend breaks, Z_t can be described by $[1, t, D_{1t}, D_{2t}, DT_{1t}^*, DT_{2t}^*]'$, where $D_{jt} = 1$ for $t \geq T_{Bj} + 1$, j = 1, 2, and zero otherwise, $DT_{jt}^* = t - T_{Bj}$ for $t \geq T_{Bj} + 1$, j = 1, 2, and zero otherwise, and T_{Bj} is the time period of the breaks. Given that the test regression (1) includes ΔZ_t instead of Z_t, ΔZ_t can be described by $[1, B_{1t}, B_{2t}, D_{1t}, D_{2t}]'$, where $B_{jt} = \Delta D_{jt}$ and $D_{jt} = \Delta DT_{jt}^*$, j = 1, 2. $\tilde{\tau}$ is the t-test statistic to test the unit root null hypothesis, $\varphi = 0$ in (1). Rejection of the null implies that $\varphi < 0$, where y_t is a trend-break stationary time series that is stationary around one or two (permanent) level and trend breaks.

First differenced lagged terms $\Delta\tilde{S}_{t-i}$, i = 1,..,k, are included in (1) as necessary to correct for serial correlation. To estimate the optimal number of lagged first differenced lag terms, we utilize a general-to-specific procedure. At each combination of break points, $\lambda = (\lambda_1, \lambda_2)'$, where $\lambda_j = T_{Bj}/T$, j=1, 2, in the time interval [.1T, .9T] to eliminate end points, we begin with the maximum of k = 8 lagged terms and examine the t-statistic on the last term to see if it is significantly different from zero at the 10% level (in an asymptotic distribution). If maximum lagged term is not significant, the term is dropped and the model re-estimated using k = 7 terms, etc. The procedure is repeated until either the maximum lagged term is found or k = 0, at which point the procedure stops. This type of general-to-specific procedure has been found to perform well as compared to other similar procedures (e.g., Ng and Perron, 1995).

We begin by utilizing the two-break unit root test and examine the t-statistics on each of the identified breaks. If only one level and/or trend break is significant at the 10% level, then testing is repeated using the one-break test. In the case of no break is found to be significant

(at the 10% level), then we use conventional (no-break) Augmented Dickey-Fuller (ADF) unit root tests.[10]

4. Results

The results of performing the LM unit root tests on real GDP growth rates with breaks are displayed in Table 7. In each country, except the U.S., the null of a unit root is rejected at the usual significance levels. One or two breaks in level and trend are identified in each country, except for Morocco. Examination of the break years provides some interesting results. Nearly every identified break year is associated with a U.S. recession (1990-1991, 2001, and 2008). However, only in two of the six NA countries (Libya and Mauritania) is there a significant break in the real GDP growth rate during the 2007-2009 global financial crises and recession. In contrast, a significant break in economic growth during the crisis cannot be identified in the other four NA countries. Morocco has no significant break in the rate of economic growth. Note that while only one significant break is identified for Egypt, the identified break year of 1994 does not correspond with any of the recent U.S. recessions. As might be expected, structural breaks in economic growth during the financial crisis were identified in both the U.S. and the EU (in 2008). The earlier identified breaks of 1990 in the U.S. and 1992 in the EU correspond with recessions that occurred in the U.S. in 1990-1991 and EU in 1992-1993, respectively. Given that no break was identified for Morocco, we utilized the conventional (no-break) ADF unit root test in this case.

To visually examine the time paths of real GDP growth with the breaks, we constructed plots of each growth rate series along with a simple OLS regression on the identified break(s). Plots for each NA country are displayed in Figure 1. Plots for the U.S. and EU are displayed in Figure 2. Similar LM unit root test results for the rate of currency depreciation are displayed in Table 8. The rate of currency depreciation is stationary around one or two breaks in each NA country.[11]

We next utilize the identified breaks to estimate Vector Auto-Regression (VAR) models and impulse response functions. Given that each growth rate series is stationary around one or two permanent breaks, except for Morocco which has no break, we conclude that shocks have only temporary effects with the exception of the identified (one or two) permanent breaks that are associated (mostly) with earlier U.S. and EU recessions. Before proceeding, we adopt the parsimony principle and examine the possibility that some time series may be stationary even if breaks are omitted from the unit root tests. To test for this possibility, we additionally performed conventional ADF tests on each time series. The results are displayed in Table 9 and 10 for real GDP growth and the rate of currency depreciation, respectively. From the results in Table 9, we see that each real GDP growth rate series is stationary except for Algeria and Tunisia. Therefore, to conserve degrees of freedom, we focus our VAR investigation only on the 2008 break in U.S. real GDP growth and include additional breaks as necessary only in those countries with time series that were not stationary in the conventional ADF tests. For example, when estimating the VAR model for Tunisia we will include breaks in 1990 and 2008 since the (no-break) ADF tests could not reject the unit root for real GDP growth. To conserve degrees of freedom, we omit Algeria and Libya from our VAR investigation since it would be necessary to include breaks in 1990 and 2002 for Algeria and in 1996 and 2006 for Libya, respectively, in order to ensure that all series are stationary.

[10] See Lee and Strazicich (2003, 2004) for further details on the one- and two-break LM unit root tests. The Gauss codes utilized for the one- and two-break LM unit root tests are available on the web site: http://www.cba.ua.edu/~jlee/gauss.

[11] Given that the focus of our investigation is on economic growth rates, we refrain from discussion of breaks in the currency depreciation series.

The number of lags in each VAR was determined by minimizing the Schwarz Information Criterion (SIC). [12] All VARs include a common intercept and trend to allow for level and trend breaks. To conserve space, we report only the impulse response functions with the NA country and the U.S. and EU economic growth rate. The estimated impulse response functions are displayed in Figures 3 to 7. While some impact of shocks from the U.S. or EU real GDP growth rate on NA real GDP growth rates is apparent from the estimated impulse response functions, none are significantly different from zero.

5. Conclusion

Perhaps the most interesting finding of this study is the overall confirmation of the resilience of the NA economies in the face of the 2007-2009 global financial crisis and recession. While the NA region as a whole weathered the storm better than most, there are some differences to note at the country level. First, Morocco is the only NA country that did not experience a permanent break throughout 1980-2015. While the EU is Morocco's major trading partner (receiving around 62% of the country's total exports and providing over 58% of its total imports), Morocco experienced a 6% acceleration in the mining, manufacturing and construction sectors. A major bumper crop in the second half of 2009 (30.7% growth) has likely also helped Morocco to mitigate any effects of the recent financial crisis.

While Tunisia, Egypt, and Algeria experienced transitory effects, no structural break in economic growth was found associated with the financial crisis. This outcome might have benefited from counter-cyclical policies undertaken in these countries. For example, the Egyptian government undertook several measures to prevent a sharp decline in economic activity during this time period. In particular, counter-cyclical fiscal and monetary policies in the form of two major stimulus packages and a lowering of interest rates may have helped to boost economic activity, while other targeted projects cushioned effects on the exposed sectors of manufacturing, tourism, and foreign trade.[13] In Tunisia, in addition to similar counter-cyclical policies, an increase of Maghreb-based visitors mainly from Libya and Algeria enhanced the tourism sector during this time period. FDI inflows in Tunisia are also expected to improve in 2010, as the slow-down in Europe pushes European industries to look for more cost effective locations and accelerate delocalization or outsourcing plans. In the oil exporting country of Algeria, the highest exposure emanated from the decline in oil prices and demand for oil while OPEC production cuts helped to stabilize the price. Moreover, other economic sectors real in Algeria experienced some success in 2009. In particular, agriculture jumped 17% in 2009 due to unprecedented cereal production. In addition, reasonable growth in the services, infrastructure and construction sectors, pulled by strong public demand, likely helped the Algerian economy mitigate any negative impact from the financial crisis.[14]

On the other hand, the two very diverse and different economies of Libya and Mauritania each experienced a significant permanent break in economic growth in 2008. First, it is important to note that while the break in Mauritania is predominantly negative, the break in Libya is rather positive as illustrated in Figure 1. As previously noted, Mauritania is a rather special case in North Africa with its less developed economy and

[12] All confidence intervals in the impulse response functions were generated using Monte Carlo simulations since the underlying distributions were unknown. Several orderings of the variables in the VAR models were undertaken to estimate the impulse response functions in each case with qualitatively similar results to those reported in our paper. The estimated VAR models and impulse response functions are available from the authors upon request.

[13] See the African Economic Outlook, 2010, http://www.africaneconomicoutlook.org/en/countries/north-africa/egypt/.

[14] IBID, http://www.africaneconomicoutlook.org/en/countries/north-africa/algeria/.

relatively small population. Moreover, due to its mostly isolated financial system, the global recession was not expected to have much of an impact on Mauritania's economy. However, in spite of this, Mauritania was the only economy in the region to experience a negative rate of economic growth in 2009. The major culprit, however, was likely not the global financial crisis and recession, but rather the 2008 coup d'état.

In terms of Libya, one of Africa's wealthiest nations with the continent's largest proven oil reserves and third biggest oil producer behind Angola and Nigeria, the country was only moderately affected by the global financial crisis early on due to lower oil prices. However, soon after, the lower commodity prices eased inflation to approximately 2.5 % for the first nine months of 2009 compared to 10.4 % year-on-year. Moreover, and most important, the time period of the global financial crisis coincided with a wide lifting of international economic sanctions and inclusion of Libya into the community of nations. Following this, the financial crisis presented Libya with an opportunity to invest in and acquire major assets in the EU and elsewhere. In late 2008, Libya invested in the ailing Unicredit - Italy's second largest Bank. In addition, Libya renewed its cooperation agreement with Greece amidst the latter's debt crisis. As a result, while rich country investors have been retrenching in the global slowdown, Libya emerged as a key player by picking up discounted European assets. The Libyan Investment Authority (LIA), Libya's largest sovereign wealth fund created in 2007 with a starting capital of USD 65 billion, diversified its portfolio in this time period to include agriculture, real estate, infrastructure, and oil and gas, in addition to global securities and equity stakes. Geographically, the LIA has investments in Europe, Africa and Latin America. The LIA has been credited for providing a shield to economic effects from the financial crisis and allowing Libya to accumulate substantial net foreign assets, estimated at USD $86 billion in 2008 in addition to those held at the central bank.[15] Thus, it is not surprising to see the upward and positive trend in Libya's economic growth following the structural break in 2008.

In sum, we find no significant evidence that the 2007-2009 global financial crisis and recession had a permanent impact on economic growth in Algeria, Egypt, Morocco, and Tunisia. The results presented here suggest that any impact of the global financial crisis on economic growth in these countries will be transitory. While Libya experienced a permanent break in economic growth in 2008, the impact on economic growth is likely positive. While Mauritania experienced a permanent break in economic growth in 2008 and negative growth in 2009, the impact on growth is likely not due to the global financial crisis but to the 2008 coup d'état experienced in this country. We conclude that the 2007-2009 global financial crisis and recession was not a major factor to explain the uprisings in North Africa and one must look elsewhere to explain the root causes of the uprisings in these countries.

[15] IBID, http://www.africaneconomicoutlook.org/en/countries/north-africa/libya.

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Figure 1: Plots of Regressions of the Annual Growth Rate in RGDP on Level and Trend Breaks, North African Countries, 1980-2015

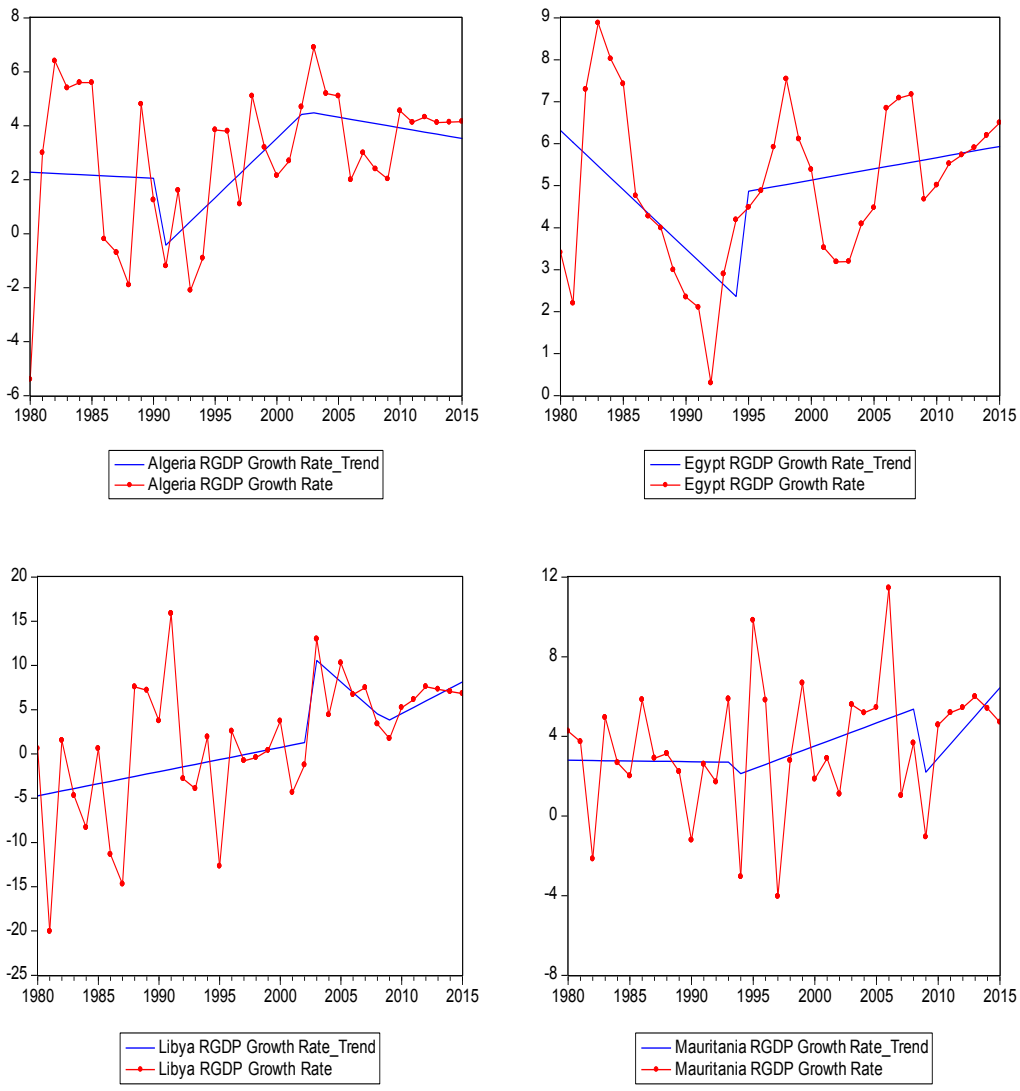


Figure 1: (continued)

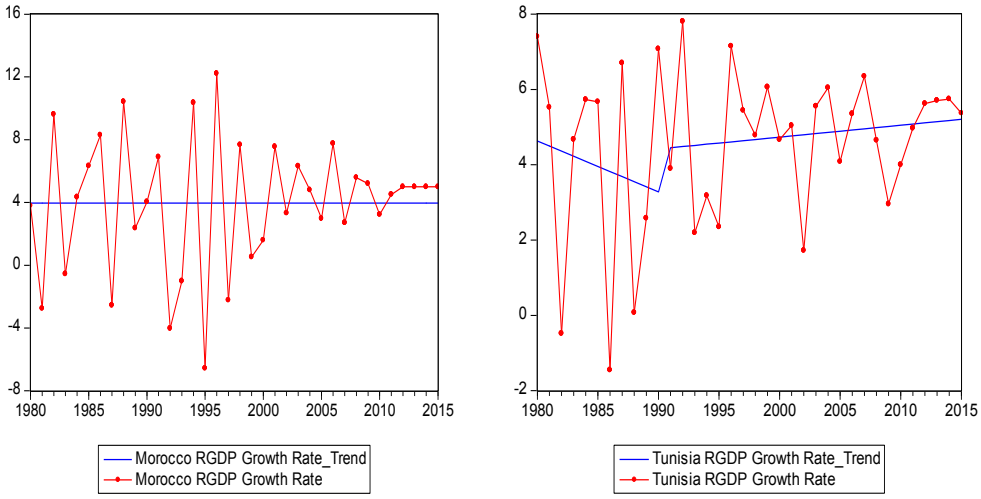
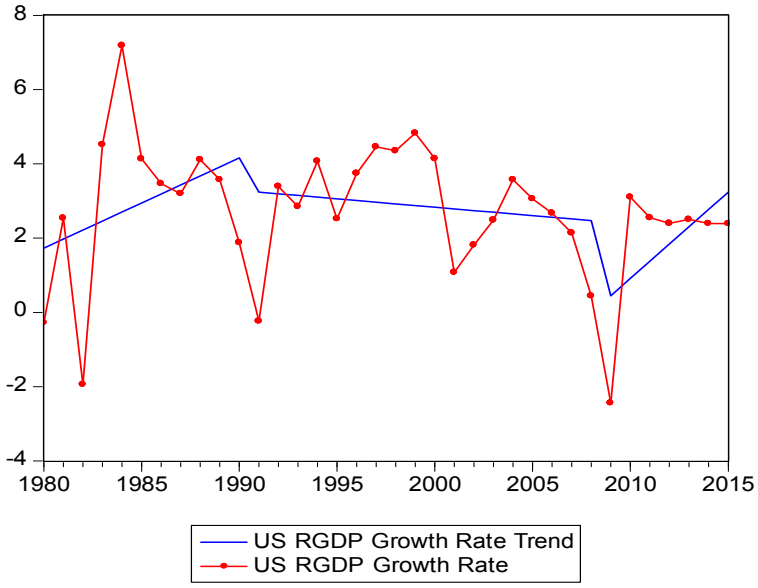


Figure 2: Plots of Regressions of the Annual Growth Rate in RGDP on Level and Trend Breaks, United State and European Union, 1980-2015



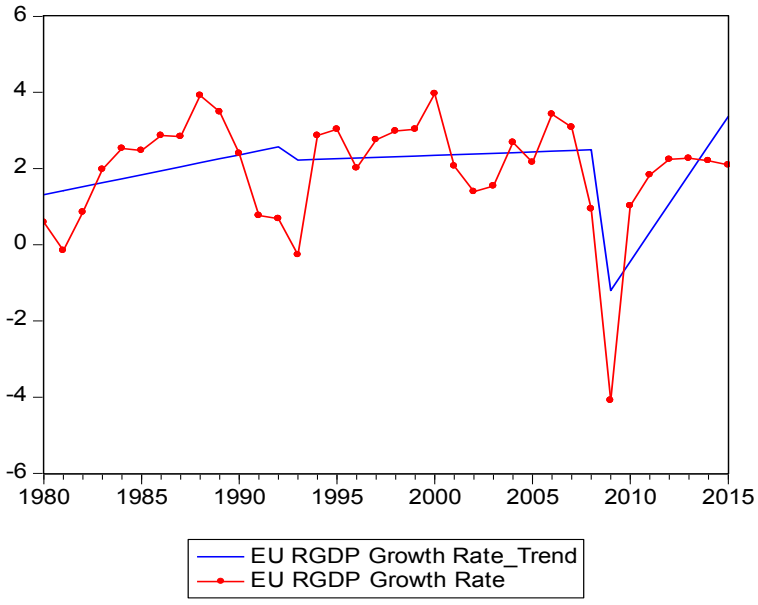


Figure 3: Impulse Response Functions Showing the Response of Real GDP Growth in Egypt to Shocks in U.S. and EU Real GDP Growth, Annual Data, 1981-2015

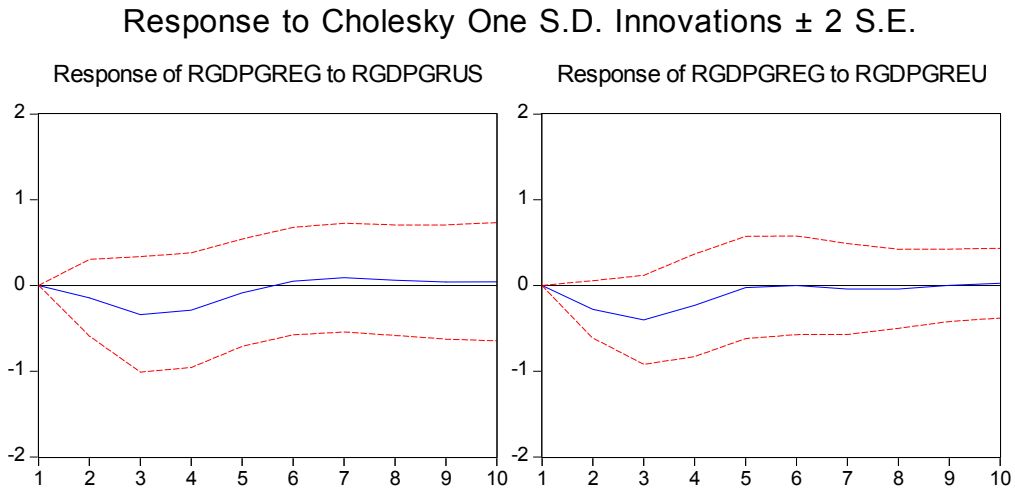


Figure 4: Impulse Response Functions Showing the Response of Real GDP Growth in Mauritania to Shocks in U.S. and EU Real GDP Growth, Annual Data, 1981-2015

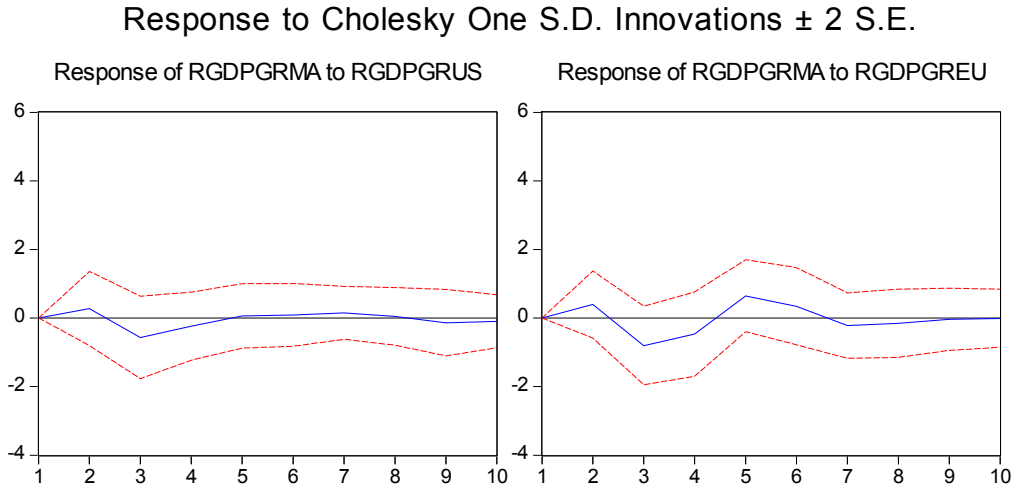


Figure 5: Impulse Response Functions Showing the Response of Real GDP Growth in Morocco to Shocks in U.S. and EU Real GDP Growth, Annual Data, 1981-2015

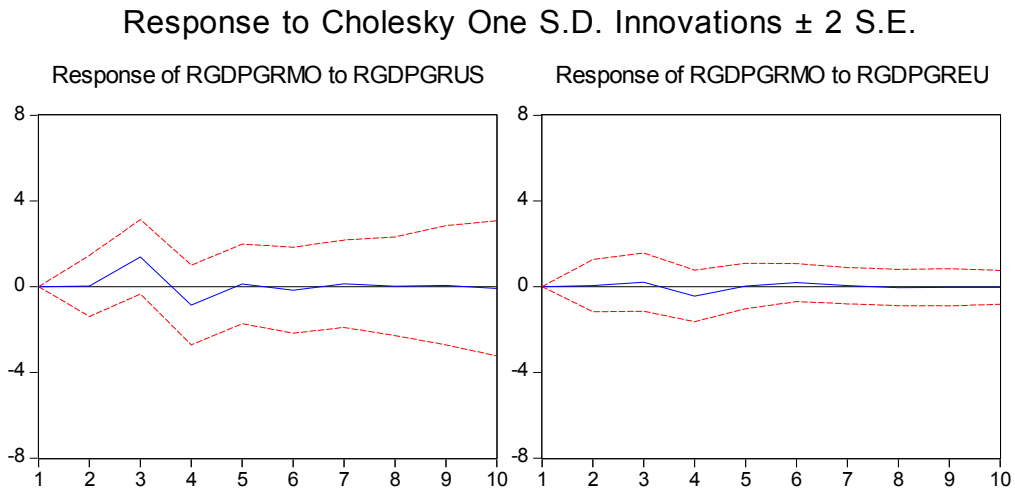


Figure 6: Impulse Response Functions Showing the Response of Real GDP Growth in Tunisia to Shocks in U.S. and EU Real GDP Growth, Annual Data, 1981-2015

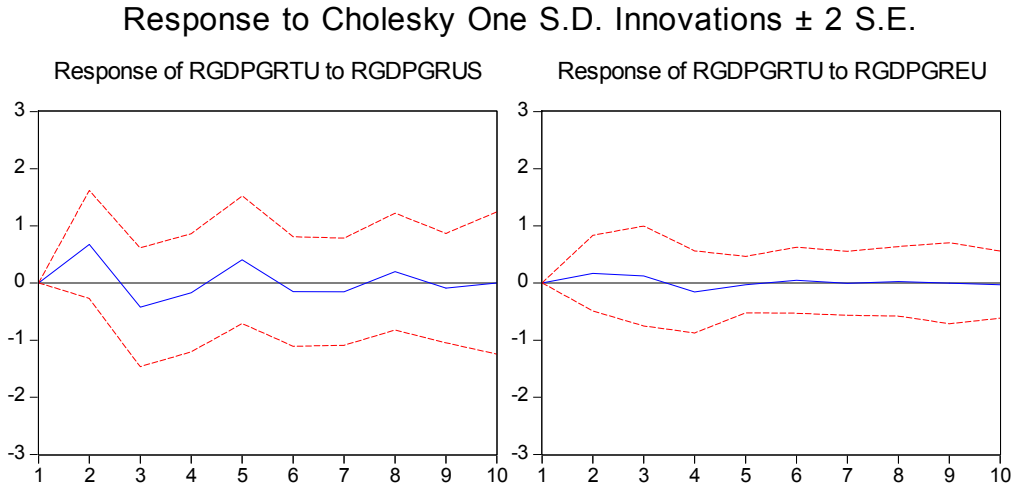


Figure 7: Impulse Response Functions Showing the Response of Real GDP Growth in Egypt to Shocks in EU Real GDP Growth, Annual Data, 1981-2015

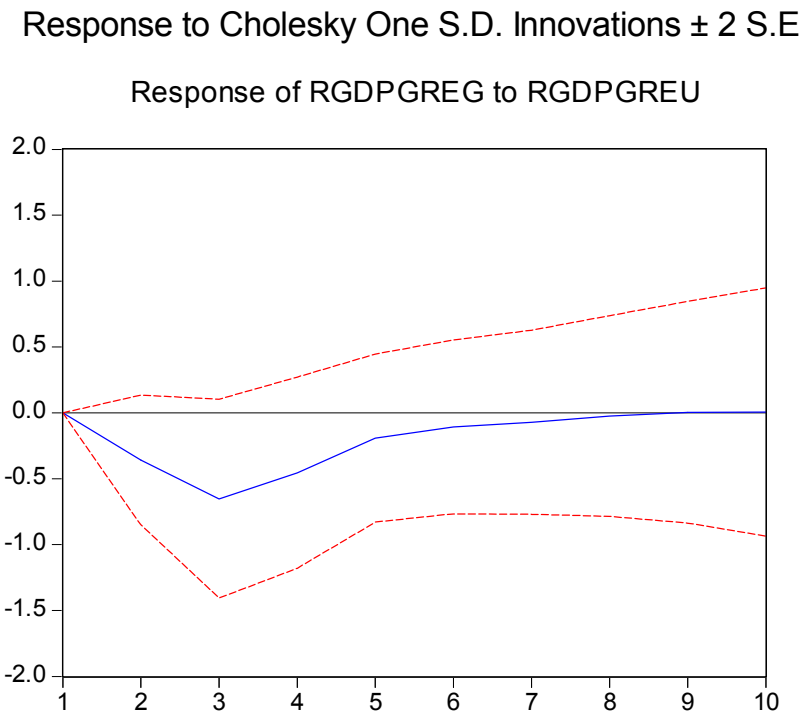


Figure 8: Impulse Response Functions Showing the Response of Real GDP Growth in Mauritania to Shocks in EU Real GDP Growth, Annual Data, 1981-2015

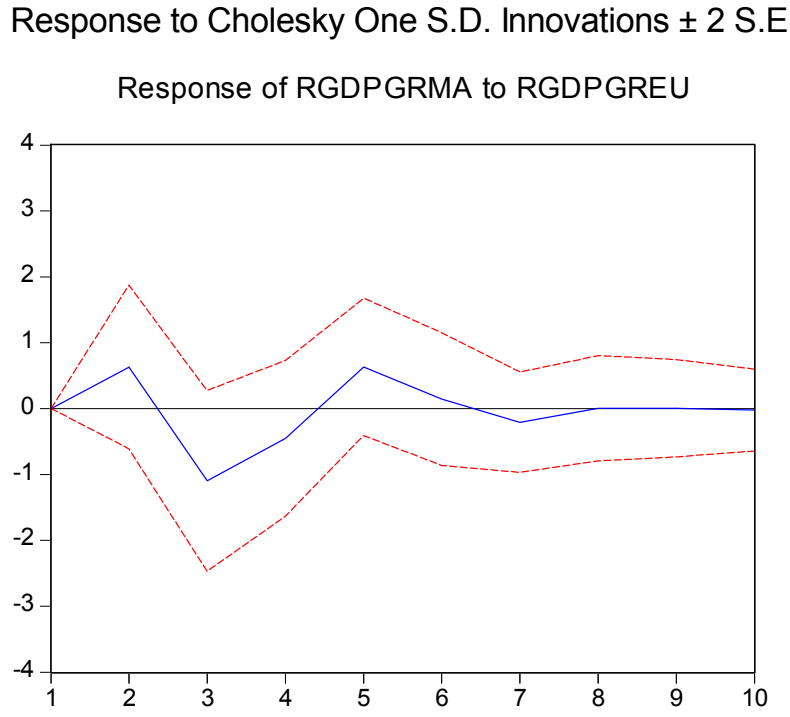


Figure 9: Impulse Response Functions Showing the Response of Real GDP Growth in Morocco to Shocks in EU Real GDP Growth, Annual Data, 1981-2015

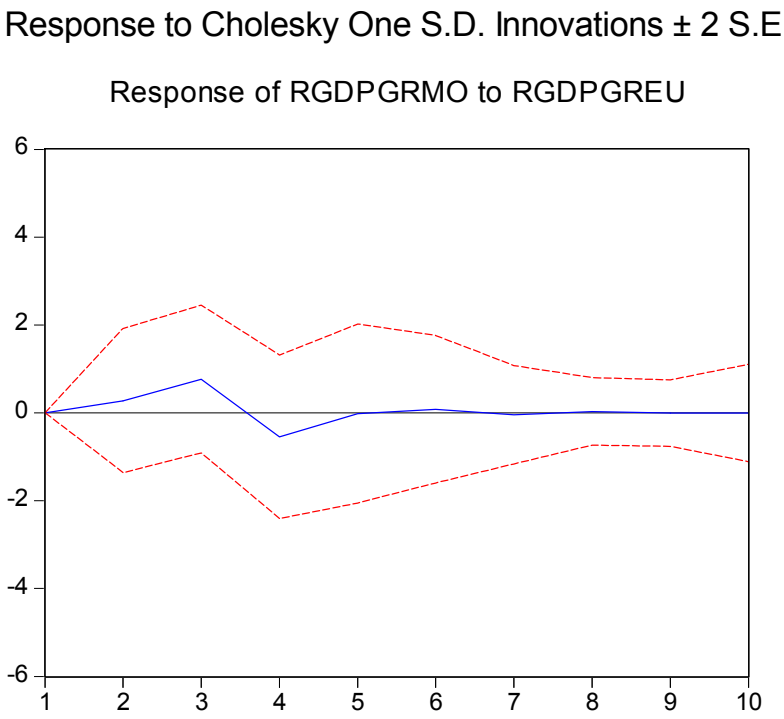


Figure 10: Impulse Response Functions Showing the Response of Real GDP Growth in Tunisia to Shocks in EU Real GDP Growth, Annual Data, 1981-2015

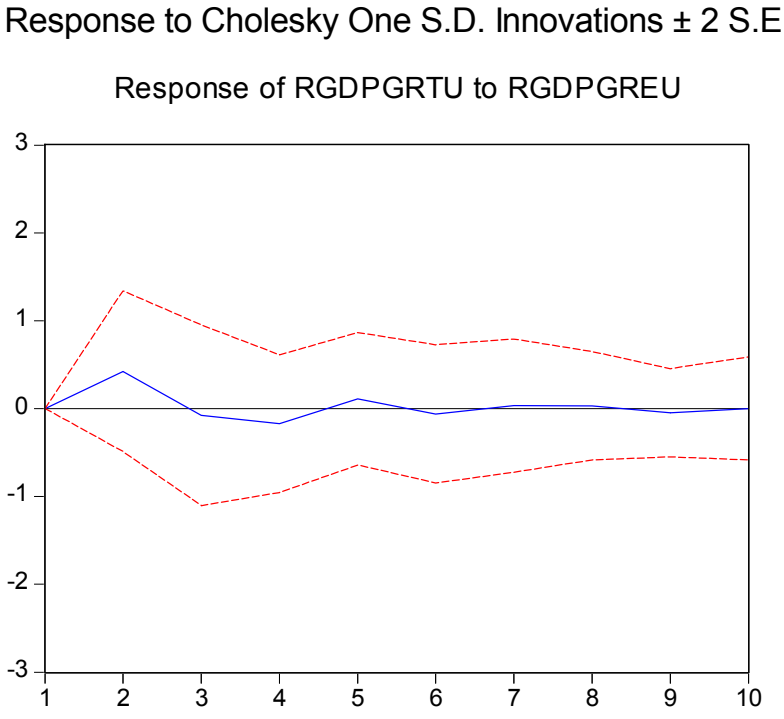


Table 1: Real GDP Growth Rates, 2007-2010

Countries	2007	2008	2009 (e)	2010 (p)
Algeria	3.0	2.4	2.2	3.9
Egypt *	7.1	7.2	4.7	5.4
Libya	6.0	3.8	2.1	5.2
Mauritania	1.0	3.7	-1.1	4.5
Morocco	2.7	5.6	5.0	4.3
Tunisia	6.3	4.6	3.1	4.0
North Africa	---	5.4	3.8	4.8
Middle East and North Africa	5.6	5.1	2.4	4.5
Sub Sahara Africa (SSA)	6.9	5.7	1.6	4.3
Central and eastern Europe	5.5	3.0	-3.7	2.8
Developing Asia	10.6	7.9	6.6	8.7

Notes: ADB, Mars 2010 estimation and World Economic Outlook, IMF April 2010 estimation.

Table 2: Unemployment Rate

Country	2003	2004	2005	2006	2007	2008	2009	2010
Algeria	23.711	17.679	15.3	12.3	11.8	11.295	10.21e	10.034e
Egypt	11.275	10.526	11.468	10.917	9.205	8.13	9e	9.2e
Morocco	11.422	10.831	11.058	9.663	9.795	9.568	9.1	9.6e
Tunisia	14.514	14.237	12.8	12.5	12.4	12.6	13.3	13.2e

Source: Total unemployment rate, International Monetary Fund (IMF), World Economic Outlook Database, October 2010. e denotes estimated by the IMF. Data on the total unemployment rate was not available for Libya and Mauritania.

Table 3: North Africa Basic Economic Indicators

Country	GDP (Current Prices million US$)	GDP per capita (current US$)	Population total in Million	Real GDP growth (annual %)	Consumer prices index (2000 = 100)	Life expectancy at birth total (years)
Algeria	137,059.03	3,927.70	34.90	2.17	131.95	72.67
Libya	69,986.70	10,901.48	6.42	2.07	98.37	74.28
Mauritania	3,890.95	1,182.43	3.29	-1.14	184.88	56.99
Morocco	95,731.50	2,992.30	31.99	4.97	118.91	71.58
Tunisia	38,896.12	3,786.80	10.27	3.06	133.31	74.15
Egypt	186,585.02	2,248.03	83.00	4.70	199.65	70.34
North Africa	532,149.32	3,132.69	169.87	AVE=2.64	AVE=144.511	AVE=70.00

*Source: ADB platform 2009 and 2010, CIA - The World Factbook, available for download at: https://www.cia.gov/library/publications/the-world-factbook.

Table 4: Index of Financial Openness in 2007

Algeria	Egypt	Libya	Mauritania	Morocco	Tunisia	U.S.
-1.136	2.500	-1.136	-1.136	-1.136	-1.136	2.500
Saudi Ar.	Kuwait	U.A.E.	Qatar	Bahrain	Oman	Germany
1.667	1.667	2.500	2.500	2.233	2.500	2.500

Source: Chinn-Ito Financial Openness Index, 2008 Update, Ito, Hiro, and Menzie Chinn, 2010. Saudi Ar. denotes Saudi Arabia. The index measures the degree of capital account openness and ranges from 2.5 (most open) to -1.83 (least open). The data is available at the website: http://web.pdx.edu/~ito/Chinn-Ito_website.htm.

Table 5: Composition of GDP 2008 (as % of GDP)

	Final Consumption		Gross Capital Formation			External Sector	
	Private	Public	Private	Public	Exports	Imports	Net Export
Algeria	30.3	13.4	20.3	16.2	48.9	29.2	19.7
Egypt*	72.3	10.9	15.0	7.3	33.0	38.6	-5.6
Libya	17.7	11.8	6.4	16.1	73.6	25.7	47.9
Mauritania	78.1	14.7	22.9	6.5	54.4	76.6	-22.2
Morocco	59.7	18.5	33.0	3.3	36.9	51.3	-14.5
Tunisia	62.0	13.9	22.7	4.9	60.8	64.3	-3.4

*Source: ADB platform 2009 and 2010, CIA - The World Factbook, available for download at: https://www.cia.gov/library/publications/the-world-factbook.

Table 6: Exports and Imports in North Africa

Table 6-A:	North African countries exports by partner 2009 (%)						
EXPORT	Algeria	Egypt	Libya	Morocco	Mauritania	Tunisia	Region Average
Europe	50.20	31.10	74.20	61.90	27.1	71.60	52.68
USA	23.00	7.90	5.20	3.60	1.9	2.20	7.23
ASEAN	1.00	1.40	0.90	1.80	43.8	0.50	8.22
SSA	0.51	3.20	0.20	3.50	14.1	1.20	3.77
Intra-trade	3.50	3.10	2.70	2.20	1.2	10.50	3.87

Note: shaded cell indicate total exports to all developing Asia and not only ASEAN

Table 6-B:	North African countries imports by partner 2009 (%)						
IMPORT	Algeria	Egypt	Libya	Morocco	Mauritania	Tunisia	Region Average
Europe	57.80	33.40	49.90	58.70	44.4	67.90	52.16
USA	3.10	10.00	3.70	5.70	2.9	2.70	4.69
ASEAN	2.00	4.20	2.30	1.20	21.2	1.20	5.34
SSA	0.90	1.20	0.10	0.60	5.4	0.30	1.42
Intra-trade	1.40	1.20	6.60	3.80	3.2	8.30	4.08

Note: shaded cell indicates total imports from all developing Asia and not only ASEAN
Source: Union European DG Trade Statistics (2009) * Comtrade.

Table 7: Minimum LM Unit Root Test Results: Annual Percentage Change in Real GDP, 1980-2015

Time Series	k	$\hat{T}_B$	Test Statistic	Critical Value Break Points	Model
Algeria	4	1990, 2002	-5.3227*	λ = (0.4, 0.6)	C
Egypt	8	1994	-5.1966***	λ = (0.4)	C
Libya	7	2002, 2008	-9.6185***	λ = (0.6, 0.8)	C
Mauritania	8	1993, 2008	-8.0121***	λ = (0.4, 0.8)	C
Morocco	0	-	-12.2427***	-	
Tunisia	6	1990	-4.9036***	λ = (0.4)	C
U.S.	8	1990, 2008	-4.9728	λ = (0.4, 0.8)	C
EU	7	1992, 2008	-6.774***	λ = (0.4, 0.8)	C

Notes: *k* is the number of lagged first-differenced terms included in the unit root test to correct for serial correlation. *k* was determined by a general-to-specific procedure beginning with a maximum of eight lagged terms and dropping the maximum lagged term until the remaining maximum lagged term was significant at the 10% level. $\hat{T}_B$ denotes the estimated break point(s). The critical values depend on the location of the breaks $\lambda = (T_{B1}/T, T_{B2}/T)$ and are symmetric around λ and (1-λ). Model C denotes the model with level and trend break(s). *, **, and *** denote significant at the 10%, 5%, and 1% levels, respectively. The critical values come from Lee and Strazicich (2003, 2004). The results for Morocco are shown for the conventional ADF test, since no significant breaks were identified.

Table 8: Minimum LM Unit Root Test Results: Annual Percentage Change in the Nominal Exchange Rate, 1981-2015

Time Series	k	$\hat{T}_B$	Test Statistic	Critical Value Break Points	Model
Algeria	4	1999, 2011	-5.4327*	λ = (0.6, 0.8)	C
Egypt	0	1992, 2001	-6.1599**	λ = (0.4, 0.6)	C
Libya	0	1999, 2006	-9.6756***	λ = (0.6, 0.8)	C
Mauritania	0	2003	-7.1164***	λ = (0.6)	C
Morocco	7	1994, 2005	-7.2581***	λ = (0.4, 0.8)	C
Tunisia	8	1991, 1999	-11.2625***	λ = (0.4, 0.6)	C

Notes: *k* is the number of lagged first-differenced terms included in the unit root test to correct for serial correlation. *k* was determined by a general-to-specific procedure beginning with a maximum of eight lagged terms and dropping the maximum lagged term until the remaining maximum lagged term was significant at the 10% level. $\hat{T}_B$ denotes the estimated break point(s). The critical values depend on the location of the breaks $\lambda = (T_{B1}/T, T_{B2}/T)$ and are symmetric around λ and (1-λ). Model C denotes the model with level and trend break(s). *, **, and *** denote significant at the 10%, 5%, and 1% levels, respectively. The critical values come from Lee and Strazicich (2003, 2004). The results for Morocco are shown for the conventional ADF test, since no significant breaks were identified.

Table 9: Augmented Dickey-Fuller Unit Root Test Results: Annual Percentage Change in Real GDP, 1980-2015

Time Series	k	Test Statistic	Trend Term
Algeria	8	-2.6476	Yes
Egypt	1	-3.1807**	No
Libya	7	-3.9687**	Yes
Mauritania	0	-7.2610***	Yes
Morocco	0	-12.2427***	Yes
Tunisia	8	-2.1183	No
U.S.	0	-4.7201***	Yes
EU	0	-3.6807**	Yes

Notes: *k* is the number of lagged first-differenced terms included in the unit root test to correct for serial correlation. *k* was determined by a general-to-specific procedure beginning with a maximum of eight lagged terms and dropping the maximum lagged term until the remaining maximum lagged term was significant at the 10% level. The trend term was omitted if the unit root null could not be rejected and the trend was not significant at the 10% level. All regressions include an intercept term. *, **, and *** denote significant at the 10%, 5%, and 1% levels, respectively. The critical values come from McKinnon (1996).

Table 10: Augmented Dickey-Fuller Unit Root Test Results: Annual Rate of Currency Depreciation, 1981-2015

Time Series	k	Test Statistic	Trend Term
Algeria	8	-5.6271***	Yes
Egypt	6	-3.8749**	Yes
Libya	2	-1.6694	No
Mauritania	0	-5.6140***	Yes
Morocco	0	-4.0690**	Yes
Tunisia	0	-8.0314***	Yes

Notes: *k* is the number of lagged first-differenced terms included in the unit root test to correct for serial correlation. *k* was determined by a general-to-specific procedure beginning with a maximum of eight lagged terms and dropping the maximum lagged term until the remaining maximum lagged term was significant at the 10% level. The trend term was omitted if the unit root null could not be rejected and the trend was not significant at the 10% level. All regressions include an intercept term. *, **, and *** denote significant at the 10%, 5%, and 1% levels, respectively. The critical values come from McKinnon (1996).