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***Econometric project report***

# The effect of Arab Spring on MENA Countries – ESG performance


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# 1. Introduction

The Arab Spring is a series of protests and uprisings that swept the Middle East and North Africa (MENA) region in 2011, leading to significant political, social, and economic changes in the affected countries. The impact of the Arab Spring on various aspects of the region's economy has been studied extensively over the past decade, and one area of interest has been the effect on environmental, social, and governance (ESG) performance.

In this paper, we will explore the impact of the Arab Spring on ESG performance using ordinary least squares (OLS) and panel models. ESG factors have become increasingly important in recent years as investors and companies recognize the importance of sustainability and responsible governance. The MENA region, home to some of the world's largest oil reserves, has traditionally been associated with environmental degradation and poor social and governance standards.

Using data from the Arab World Bank's Global Governance Indicators, we will construct our own ESG index using Propensity Component Analysis (PCA) and analyze the impact of the Arab Spring on ESG performance in the MENA region. We will also examine these results by adding some covariates to observe the behavior of our models.

Our findings will contribute to the growing body of literature on the impact of political events on ESG performance and highlight the challenges and opportunities facing the MENA region in its quest for sustainable development. Ultimately, we hope that our analysis will inform policymakers, investors, and other stakeholders in the MENA region.

# 2. Methodology

This section introduces the method and explains how we estimate the ESG index. Further, we analyse and discuss the result of this method.

As you may know following the explanations above, the ESG index mainly depends on three principal components which are the environmental component, the social component, and the governance component. Those three components are aggregated to construct the ESG index. This methodology is proposed in the study on sovereign bond yield spreads and sustainability: An empirical analysis of OECD countries. The high lines of the method consist in first to compute a principal component analysis to find the different component which represent the most those three components we mentioned before. This leads us to a second step in which we built the ESG by a simple aggregation of the components and finally make some regressions to identify the effect of Arab spring on middle east and north Africa countries.

## 2.1. Data

To tackle this question, our baseline dataset should contain a survey on our three components. Thus, to deal with this condition, we use the World Development Indicators (WDI) dataset proposed by the World Bank Group through their website. This dataset gives us access to a relevant measure of a country's environmental performance. It contains information on air quality, water and sanitation, forests, and renewable energy. Countries that perform well in this regard do their best to maintain and improve the environment. They show long-term commitment, which may positively relate to their willingness to pay off their debt. We also use the WDI dataset to obtain informations on education, demography, health, employment, and gender equality. Here, countries performing well show commitment to their stock of human and social capital, which is regarded as long-term commitment as well. The data on democratic institutions and safety policy are also from WDI. The dataset presents estimates of many indicators of governance: political stability and absence of violence/Terrorism, Control of corruption, Government effectiveness and so on.… The dataset covers all the middle east and north Africa's countries and data are scaled from 2000 and 2022. Since the Arab spring occurred in late 2010 and ending in early 2011, the data gives us access to useful informations that will help us to analyse the effect of Arab spring.

## 2.2 Principal Component Analysis

Principal Component Analysis (PCA) is a statistical technic used for reducing the dimensionality of a data set while retaining as much of the original variation as possible. The technic accomplishes this by transforming the original variables into a new set of variables, called principal components, which are uncorrelated and ordered in terms of the amount of variation they explain. The first principal component explains the largest amount of variation in the data, the second principal component explains the second largest amount of variation, and so on.

PCA can be used for a variety of purposes, including data visualization, feature selection, and noise reduction. One common use of PCA is in data visualization, where it can be used to plot high-dimensional data in a two-dimensional scatterplot. This is accomplished by projecting the data onto the first two principal components, which capture the most important variation in the data, and since the axes that represent the principal components are orthogonal, then the multicollinearity problem will disappear. For example, suppose that we have 200 explanatory variables in our dataset. Since we have several variables, some multicollinearity problems or high correlation problem may arise. So, a solution could be to do a PCA, and use some components resulting from the PCA as explanatory variables.

To run our principal component analysis, we first started by selecting in our dataset, a share of variables which are highly correlated. These variables are: Poverty headcount ratio at national poverty lines (% of population), Gini index, Government expenditure on education, total (% of government expenditure), Life expectancy at birth, total (years), Labor force participation rate,

total (% of total population ages 15-64) (modelled ILO estimate), Mortality rate, under-5 (per 1,000 live births), People using safely managed sanitation services (% of population), Land Surface Temperature, Cooling Degree Days, Forest area (% of land area), Energy imports, net (% of energy use), Political Stability and Absence of Violence/Terrorism: Estimate, Control of Corruption: Estimate, Government Effectiveness: Estimate, Heat Index 35, and Level of water stress: freshwater withdrawal as a proportion of available freshwater resources. This way, we created a subset to run the PCA function on.

The results of this computation will be presented in the result section. But, to continue with the methodology, we notice that we obtain many components in which we chose the three principals based on the eigenvalue. Those three components are renamed as environmental index, social index, and governmental index.

After getting the component, we aggregate them using their weight to calculate the final ESG index.

### 2.3 Econometrics models

This step is about identify the effect of Arab spring on MENA countries. To do so, we used a simple Ordinary Least Squares and a panel Method. For all these methods, we create a binary variable "Crisis" that explains whether we are in the crisis period. After compiling the simple OLS, we tried to add some control variables to improve the precision and the reliability of our model and capture the effect of factors other than the independent variable of interest on the ESG index.

## 3 Results

### 3.1 Principal components

After running the PCA, we got 16 components with their cumulative of variance as you can see in the following table.

*Table 1: Component eigenvalue*

| | eigenvalue | percentage of variance | cumulative percentage of variance |
|---|---|---|---|
| comp 1 | 5.69966655 | 35.6229160 | 35.62292 |
| comp 2 | 3.20568525 | 20.0355328 | 55.65845 |
| comp 3 | 1.64700851 | 10.2938032 | 65.95225 |
| comp 4 | 0.98342381 | 6.1463988 | 72.09865 |
| comp 5 | 0.89087203 | 5.5679502 | 77.66660 |
| comp 6 | 0.82303189 | 5.1439493 | 82.81055 |
| comp 7 | 0.70666157 | 4.4166348 | 87.22718 |
| comp 8 | 0.65107700 | 4.0692312 | 91.29642 |
| comp 9 | 0.49645840 | 3.1028650 | 94.39928 |
| comp 10 | 0.30864805 | 1.9290503 | 96.32833 |
| comp 11 | 0.18689222 | 1.1680764 | 97.49641 |
| comp 12 | 0.13193776 | 0.8246110 | 98.32102 |
| comp 13 | 0.09244861 | 0.5778038 | 98.89882 |
| comp 14 | 0.07786376 | 0.4866485 | 99.38547 |
| comp 15 | 0.05795412 | 0.3622132 | 99.74768 |
| comp 16 | 0.04037049 | 0.2523156 | 100.00000 |

In order to know which pattern is relevant and more important for the construction of our ESG index, we analyse the eigenvalue of each component and then we take those that have eigenvalue higher than 1. So comp1, comp2 and comp3 will be used to build the ESG. Before doing that, we identify the contribution of each variable on each component, this step aimed to have an index of different field such as Environment, Government and Social.

## 3.2 Most important variables

In the table below, we record the contribution of each variable for the most important component. For the dimension 1, political stability and absence of violence/Terrorism (9.14), Control of corruption (12.71), Government effectiveness (10.24) and Heat index (11.04) are variables that can be used to implement an index we named GOVI (Governmental Index).

Dimension 2 is essentially about environmental field by considering Land Surface Temperature (21.01), Cooling Degree Days (15.69), Forest Area (% of land area) contribution is about (19.94) and finally Energy Import net (% of energy used) (11.94).

For the last dimension, we made the same reflexion and we found that it is about social sector with variables Gini Index (16.75), Government expenditure on education, total (% of government expenditure) (24.44), life expectancy at birth (9.18) and mortality rate under –5(per 1000 live births) (11.15).

*Table 2: Contribution table of each variable*

| | Dim.1 |
|---|---|
| Poverty headcount ratio at national poverty lines (% of population) | 0.05409241 |
| Gini index | 0.08061473 |
| Government expenditure on education, total (% of government expenditure) | 1.15626933 |
| Life expectancy at birth, total (years) | 7.92643856 |
| Labor force participation rate, total (% of total population ages 15-64) (modeled ILO estimate) | 12.56969613 |
| Mortality rate, under-5 (per 1,000 live births) | 6.07919131 |
| People using safely managed sanitation services (% of population) | 10.59945256 |
| Land Surface Temperature | 2.97224201 |
| Cooling Degree Days | 6.55650441 |
| Forest area (% of land area) | 0.69008278 |
| Energy imports, net (% of energy use) | 2.28034707 |
| Political Stability and Absence of Violence/Terrorism: Estimate | 9.14635214 |
| Control of Corruption: Estimate | 12.71612090 |
| Government Effectiveness: Estimate | 10.24249910 |
| Heat Index 35 | 11.04717211 |
| Level of water stress: freshwater withdrawal as a proportion of available freshwater resources | 5.88292445 |
| | Dim.2 |
| Poverty headcount ratio at national poverty lines (% of population) | 0.838044043 |
| Gini index | 0.009605678 |
| Government expenditure on education, total (% of government expenditure) | 0.940287832 |
| Life expectancy at birth, total (years) | 6.903214647 |
| Labor force participation rate, total (% of total population ages 15-64) (modeled ILO estimate) | 0.010071682 |
| Mortality rate, under-5 (per 1,000 live births) | 8.381726204 |
| People using safely managed sanitation services (% of population) | 0.280628162 |
| Land Surface Temperature | 21.010807070 |
| Cooling Degree Days | 15.620053264 |
| Forest area (% of land area) | 19.948470872 |
| Energy imports, net (% of energy use) | 11.941380602 |
| Political Stability and Absence of Violence/Terrorism: Estimate | 1.670781786 |
| Control of Corruption: Estimate | 2.003109735 |
| Government Effectiveness: Estimate | 6.982065414 |
| Heat Index 35 | 2.362103712 |
| Level of water stress: freshwater withdrawal as a proportion of available freshwater resources | 1.097649297 |
| | Dim.3 |
| Poverty headcount ratio at national poverty lines (% of population) | 3.2344083 |
| Gini index | 16.7511704 |
| Government expenditure on education, total (% of government expenditure) | 24.4463052 |
| Life expectancy at birth, total (years) | 9.1880552 |
| Labor force participation rate, total (% of total population ages 15-64) (modeled ILO estimate) | 1.6610423 |
| Mortality rate, under-5 (per 1,000 live births) | 11.1574271 |
| People using safely managed sanitation services (% of population) | 0.4754432 |
| Land Surface Temperature | 0.1150020 |
| Cooling Degree Days | 1.0191545 |
| Forest area (% of land area) | 2.5888391 |
| Energy imports, net (% of energy use) | 0.9872805 |
| Political Stability and Absence of Violence/Terrorism: Estimate | 13.3227351 |
| Control of Corruption: Estimate | 5.6846825 |
| Government Effectiveness: Estimate | 4.7241650 |
| Heat Index 35 | 0.1232111 |
| Level of water stress: freshwater withdrawal as a proportion of available freshwater resources | 4.5210786 |

## 3.3. Different components of ESG index

Here it is about the weight of each variable on the component. To do that, we normalize each contribution, and we got the following results:

*Table 3: Different field of our ESG index*

| | VARIABLES | VALUES |
|---|---|---|
| DIM1=GOVI | Political Stability and Absence of Vilence/Terosim: Estimate | 0.21 |
| | Control of Corruption: Estimate | 0.29 |
| | Government Effectiveness | 0.24 |
| | Heat Index 35 | 0.26 |

| | VARIABLES | VALUES |
|---|---|---|
| DIM2=ENVI | Land Surface Temperature | 0.31 |
| | Cooling Deegree Days | 0.23 |
| | Forest Area (%of land area) | 0.29 |
| | Energy Import net (%of Energy used) | 0.17 |

| | VARIABLES | VALUES |
|---|---|---|
| DIM3=SOCI | Gini Index | 0.27 |
| | Government expenditure on education, total (%of government expenditure) | 0.40 |
| | Life expectancy at birth | 0.15 |
| | Mortality rate under –5(per 1000 live births) | 0.18 |

## 3.4 ESG index

After all, we are now able to construct the ESG index. We need to have the weight of each dimension and to that, we normalise the eigenvalue of each dimension and we found:

**ESG = 0.54*GOVI + 0.30*ENVI + 0.16*SOCI**

## 3.5 Regression

*Table 4- Simple OLS with no impact on ESG*

| | Dependent variable: |
|---|---|
| | ESG |
| crise | 32.946 |
| | (24.489) |
| Constant | 288.810*** |
| | (7.221) |
| Observations | 414 |
| R2 | 0.004 |
| Adjusted R2 | 0.002 |
| Residual Std. Error | 140.398 (df = 412) |
| F Statistic | 1.810 (df = 1; 412) |
| Note: | *p<0.1; **p<0.05; ***p<0.01 |

*Table 5- Add some control variables and impact on ESG*

| | Dependent variable: |
|---|---|
| | ESG |
| crise | 26.802* |
| | (14.231) |
| temps | -0.802 |
| | (1.206) |
| `GDP growth (annual %)` | 0.051 |
| | (1.157) |
| `Net migration` | 0.0001*** |
| | (0.00003) |
| `Prevalence of undernourishment (% of population)` | 2.316** |
| | (0.895) |
| Constant | 282.902*** |
| | (18.464) |
| Observations | 265 |
| R2 | 0.066 |
| Adjusted R2 | 0.048 |
| Residual Std. Error | 112.900 (df = 259) |
| F Statistic | 3.635*** (df = 5; 259) |
| Note: | *p<0.1; **p<0.05; ***p<0.01 |

*Table 6- Panel Method with impact on ESG after the crisis*

| | Dependent variable: |
|---|---|
| | ESG |
| avant | -42.265** |
| | (18.148) |
| apres | 35.960** |
| | (18.148) |
| Constant | -17.188*** |
| | (3.960) |
| Observations | 396 |
| R2 | 0.022 |
| Adjusted R2 | 0.017 |
| F Statistic | 4.465** (df = 2; 393) |
| Note: | *p<0.1; **p<0.05; ***p<0.01 |

# 4 Analysis of the results

As we seen in our results, we compute first the simple OLS to evaluate the impact of the Arab Spring on The ESG of MENA countries. We can conclude that the Simple OLS is not relevant to evaluate this effect. Then, we try adding some covariates (Control variables) and this allow us to switch the results and get a significant impact on the ESG index with our variables Crises, Net Migration and Prevalence of undernourishment. After that we compute a new method: Panel Model by creating 3 variables (before, during and after the crisis). We get a positive significant impact after the Arab spring.

# 5 Discussion

The Arab Spring was a significant event that swept through several Middle Eastern and North African (MENA) countries, starting in Tunisia in 2010 and spreading to Egypt, Libya, Syria, and other countries. This event had a profound impact on the political, economic, and social landscape of the region and had a ripple effect on the region's environmental, social, and governance (ESG) performance. **We can justify the positive impact that we obtain in the Model because after this period, we observe major improvements in the countries**.

One of the most notable effects of the Arab Spring on the ESG performance of MENA countries was a shift in governance. Prior to the Arab Spring, many MENA countries were governed by authoritarian regimes that prioritized stability over democracy and human rights. The protests that swept through the region forced many of these regimes to either make significant reforms or fall entirely, leading to a shift in governance structures that placed greater emphasis on transparency, accountability, and respect for human rights.

This shift in governance had a significant impact on the social and environmental aspects of ESG performance in the region. Governments began to prioritize social programs aimed at reducing inequality and improving access to healthcare, education, and other basic services. Environmental regulations were also strengthened, with many countries introducing new laws aimed at reducing pollution and protecting natural resources.

However, despite these positive developments, the Arab Spring also had some negative impacts on the ESG performance of MENA countries. The instability that followed the protests led to a sharp decline in economic performance, with many countries experiencing significant drops in GDP growth and rising levels of unemployment. This economic downturn had negative impacts on the social and environmental aspects of ESG performance, as governments were forced to cut spending on social programs and environmental initiatives.

Overall, the Arab Spring had a mixed impact on the ESG performance of MENA countries. While it led to some positive developments, such as improved governance and strengthened social and environmental regulations, it also had some negative impacts, such as an economic downturn that undermined progress on social and environmental issues. Nonetheless, the event was a watershed moment in the region's history and has led to significant changes in the way MENA countries approach ESG issues.

# Conclusion

In conclusion, the analysis of the impact of the Arab Spring on the ESG Index using the OLS and Panel models revealed interesting results. The results indicate that there is a positive impact of the Arab Spring on the ESG Index, suggesting that the events of this period have led to significant improvements in environmental, social, and governance practices in MENA countries.

These results are particularly relevant for all MENA countries took together but could differ for each country individually.

It should be noted, however, that these results should not be interpreted simplistically. The Arab Spring had complex and varied effects on different countries and sectors, and ESG improvements are likely to have been influenced by many factors, such as government policies and stakeholder pressure.

In sum, analyzing the impact of the Arab Spring on the ESG index using OLS and Panel models is an important contribution to understanding the implications of major political events for corporate ESG performance. This is an evolving area of research that offers exciting prospects for future research.