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ARE WE SURE ABOUT THE EFFECTS OF THE EGYPTIAN UPRISINGS? A SURE APPROACH

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Abstract

Four years after the historic uprising of the Egyptians in January 2011, we aim to understand whether the Egyptian revolution has had a different impact on different sectoral investments in the economy. Using data over the 2002Q1-2014Q2 period and a seemingly unrelated regressions (SURE) approach that allows for contemporaneous correlation across sectors of the economy, we find that the revolution's effect on sectoral investments has been adverse, on average, but heterogeneous across sectors. Results hold under a number of robustness checks.

JEL Classification: O2, N15

Keywords: Egyptian revolution, seemingly unrelated regressions

ملخص

بعد أربع سنوات من الانتفاضة التاريخية للمصريين في يناير 2011، نهدف إلى فهم ما إذا كان للثورة المصرية تأثير مختلف على الاستثمارات القطاعية المختلفة في الاقتصاد. باستخدام البيانات خلال الفترة من الربع الأول لعام 2002 الى الربع الثانى لعام 2014 ونهج الانحدارات التي تبدو على غير علاقة ولكنه يبظهر علاقة معاصرة في جميع قطاعات الاقتصاد، نجد أن تأثير الثورة على الاستثمارات القطاعية كان سلبيا، في المتوسط، ولكن غير متجانس في جميع القطاعات. تظهر النتائج في إطار عدد من ضوابط المتانة.

1. Introduction

The historic uprising of the Egyptian population in January of 2011 has raised many questions regarding its potential *causes*. Many discussions have been raised regarding the underlying causes of the so-called "Arab Spring" revolutions in many countries of the Arab World. A number of studies, including Sorenson (2011) and Diwan (2012a and 2012b), among others, have attributed the uprisings to the rise of political Islam, crony capitalism, corruption, as well as political and social stagnation and a general loss of faith in the electoral systems. Other studies, including Amine et al (2012) and Campante and Chor (2012) among others, argue that economic reform failures were at the center of events in the region, including the mismatch between education and economic opportunity, and the more general failure of governments in the region to generate inclusive, fair, and equitable growth. In the specific case of Egypt, Ghanem (2014) argues that Egyptians revolted due to the lack of progress in democratization during Mubarak's time as well as the regime's unconvincing economic efforts in areas of inequality and inclusive growth despite growing at a healthy 5 percent rate in 2009-2010. Hassine (2011) argues that inequality of income and opportunity worsened in the years preceding the revolution, especially in rural areas and among women and the youth.

Despite its importance, little work has been done on the *effects* of the revolution on the Egyptian economy. Although some studies in the literature aim at offering an understanding of the underlying causes of the revolts in the Arab world, there exist little studies on the potential effects of such revolts on economies of the region. In the case of Egypt, the Gallup (2011) survey reported that Egyptians after the revolution became less satisfied with their standards of living, as the availability and quality of necessities like healthcare, housing, and jobs were eroded. In a recent study, close in spirit to ours, Hosny, Kandil and Mohtadi (2014) found that the revolution has had adverse effects on the Egyptian economy. More specifically, using quantile regression and difference-in-difference methodologies, they find that faster growing sectors before the revolution are the ones that have been most adversely affected by the revolution, as they have been more vulnerable to deterioration in economic policies compared to historically slower growing sectors that have established more resilience.

To the best of our knowledge, this is the first paper to study the effects of the Egyptian revolution on investments at the sectoral level. In this paper, we examine the potential effect of the revolution on sectoral investments in Egypt. This is especially important in the Egyptian economy where private sector investments are an important driver of economic growth. Specifically, our objective is to answer two questions: 1) Has the revolution had a different effect on public versus private investments across sectors of the economy?, and 2) Are effects of the revolution symmetric across all private sectors?

The main finding of the paper is that the revolution's effect on sectoral investments has been adverse, on average, but heterogeneous across sectors. Specifically, 1) Using a pooled OLS approach, results indicate that the revolution has had, on average, a negative effect on total investments at the sectoral level in Egypt. The same result holds when we break down total investments into private and public investments. 2) Using a SURE approach, we find evidence of a contemporaneous relationship between the sectors of the Egyptian economy and find that the revolution has had a different impact on different sectors of the economy. This is especially true in investments in the private sector. Empirical results in this paper hold under a number of robustness checks.

2. Specification, Methodology and Results

2.1 Literature review

At the regional level, existing studies have focused their attention to the events leading up to the political uprising. Galal and Selim (2012), for example, review Arab development experiences since World War II, and attribute the region's underdevelopment to the extractive nature of political and economic institutions. Amine et al. (2012) argue that two interrelated political and economic reform failures were at the center of events in the region. Politically, the governments' inability to develop pluralistic and open systems has limited citizens' participation in civic and political life and increased the divide between the ruling elites and the public. Economically, governments in the region were not successful in generating economic growth that is inclusive, fair, or equitable. Campante and Chor (2012) attribute the uprisings to the mismatch between education and economic opportunity, while Sorenson (2011) argues that factors such as political stagnation, corruption, and loss of faith in the electoral system were the driving forces behind the political unrests across many countries in the region. Studies by Diwan (2012a and 2012b) argue that the changing interests of the middle class, the rise of 'political Islam' and 'crony capitalism' have collectively led to the uprisings. He shows that the evolving middle class structure and related class preference for economic and social policies in many countries of the Arab world have led to these revolts.

A few studies examine the underlying causes of the revolution in the specific case of Egypt. Diwan (2012b), for example, looked at the corporate performance of connected firms in Egypt in the five years before the revolution to directly ascertain how they may have benefited from their connections. His findings suggest that connected firms had a larger market share than their non-connected competitors (an average advantage of 8% of the market), and were able to borrow much more than their competitors (with an extra leverage of 25 points on average over the period). At the macro level, Ghanem (2014) argues that the lack of progress in democratization and inclusive growth, despite growing at healthy growth rates in the years preceding the revolution, have ultimately caused Egyptians, especially the youth, to revolt. Hassine (2011) presents empirical evidence that inequality of opportunity worsened in the years preceding the revolution, especially in rural areas and among women and the youth.

Existing studies offer an understanding of the underlying *causes* of the revolts in the Arab World, but not the *effects*. In this paper, we aim to offer such a study using the Egyptian 2011 revolution as a case study. Specifically, our focus will be on the effects of the revolts on public and private investments in Egypt at the sectoral level, as explained in the following section.

2.2 Model specification

We adopt the following specification, with data from the Ministry of Economic Development in Egypt and the IMF International Financial Statistics. The model covers the period 2002Q1-2014Q2.

$$\Delta investment_{i,t} = \beta_0 + \beta_1 \Delta money\ supply_{i,t-1} + \beta_2 \Delta lending\ rate_{i,t-1} + \beta_3 \Delta inflation_{i,t-1} + \beta_4 \Delta exchange\ rate_{i,t-1} + \beta_5 \Delta global\ prices_{i,t-1} + \beta_6 \Delta foreign\ reserves_{i,t-1} + \beta_7\ revolution\ dummy$$

$$+ \beta_8 \Delta inflation\ volatility_{i,t-1} + \beta_9 \Delta exchange\ rate\ volatility_{i,t-1} + \eta_{it} \qquad (1)$$

Specifically, building on existing papers in the literature, we include a number of macroeconomic determinants of sectoral investments. The dependent variable, growth in investments (total/public/private), is modeled as a function of changes in money supply, lending rates, inflation and exchange rates (see Bayraktara and Fofackb (2011) and Abiad et al. (2008)). Hosny, Kandil

and Mohtadi (2014) also have a similar specification for the determinants of sectoral GDP growth in the Egyptian economy. We also include the volatility of inflation and exchange rates following Guimaraes and Unteroberdoerster (2006) who study the determinants of sectoral investments in Malaysia. Exchange rate and inflation volatility are important determinants of investments because, besides their role as direct investment risks, they also capture the overall role of macroeconomic stability in providing an environment conducive for investment. Additionally, we include lagged public investments in the private sector equations to account for possible crowding out effects.

The main purpose of this model is to ask what effect has the revolution had on investments in different sectors of the economy, controlling for the effects of other macroeconomic and financial variables that may influence investments. Our variable of interest is the *revolution dummy* taking a value of one since 2011Q1 and zero otherwise,[1] while all other RHS variables are lagged to avoid endogeneity problems.[2]

The focus on private investments is particularly important for Egypt. The model focuses on private investments as their share in total investments has progressively increased over time, in contrast to declining shares in the public sector (see Figure 1). Kandil (2012) shows that the private sector in Egypt shows similar trends in terms of the share in GDP and employment, reflecting an increasing job content of growth in the private sector, on average, over time. Table 1 presents summary statistics of growth rates of private sector investments in Egypt, before and after the revolution.

2.3 Estimation methodology

We first use a pooled OLS approach to estimate the impact of the revolution on the economy. We start by running pooled OLS regressions on total, public and private sectoral investments, with the variable of interest being the revolution dummy.

We then use a Seemingly Unrelated Regression Equations (SURE) approach to estimate the heterogeneous effects of the revolution on sectoral investments in Egypt. Given that our objective is to test the value, sign and statistical significance of the revolution dummy across the different sectors, we adopt a SURE approach that makes use of common shocks across all sectors and allows for the simultaneous estimation of the above specification for every sector of the economy.

Estimations using SURE have several econometric advantages. Although a separate estimation of each equation using OLS will yield consistent results, the potential relation between the equations brought forward by the contemporaneous correlation between the error terms can help us gain a more efficient estimator by estimating the equations jointly using FGLS, as was shown by Zellner 1962, Zellner and Huang 1962, and Zellner 1963. Another advantage of the SURE technique in this context is the ability to test the null hypothesis that the RHS variables (most importantly the revolution dummy) have had a similar impact on all sectors of the economy. For illustration, equation i of the SUR model can be written as:

[1] One can argue that there were presumably two revolutions rather than one in the case of Egypt, with political uncertainty and instability between the two; and subsequent to the second one the country entered a phase of limited, but disruptive, civil conflicts and violence. The revolution dummy is intended to capture the cascading episodic effects of the entire period.

[2] It is worth mentioning that throughout the paper we only focus on sixteen sectors of the Egyptian economy since private sector investments are only available in these sixteen sectors, although data for total and public investments for twenty sectors is available from the Egyptian Ministry of Economic Development.

$y_i = x_i\ \beta_i + \varepsilon_i, \quad i = 1, \ldots, N$

where y_i is the ith equation dependent variable and x_i is the $T \times k_i$ matrix of observations on the regressors for the ith equation. The disturbance process $\varepsilon = (\varepsilon_1', \varepsilon_2', \ldots . \varepsilon_N')$ is assumed to have an expectation of zero and an $NT \times NT$ covariance matrix Ω. The compact representation is:

$Y = \mathrm{X}\,\beta + e$

Properties and assumptions of the SURE estimator. The SURE estimator is based on the large-sample properties of large T, small N datasets, and applying SURE requires that the T observations per unit exceed N, the number of units to render the covariance matrix Ω full rank and invertible. Assumptions on the errors are as follows:

$E[e_i\ e_j' \mid \mathrm{X}] = \sigma_{ij}\mathrm{I}_T$

$\Omega = \Sigma \otimes \mathrm{I}_T$

where $\Sigma = (\sigma_{ij})$ is the $N \times N$ contemporaneous covariance matrix of the equations' disturbance processes, and $\otimes$ is the Kronecker matrix product. The GLS estimation is:

$\hat{\beta}_{GLS} = (\mathrm{X}'\Omega^{-1}\mathrm{X})^{-1}(\mathrm{X}'\Omega^{-1}\mathrm{Y})$

$\Omega^{-1} = \Sigma^{-1} \otimes \mathrm{I}_T$

Computation of the SURE estimator. Computation of the Feasible GLS (FGLS), or Zellner's (1962) SURE estimator, is done in two steps. First, each equation is estimated using OLS, and the residuals from the N equations are used to estimate Σ. Second, $\hat{\Sigma}$ is substituted for Σ to obtain the FGLS estimator $\hat{\beta}_{FGLS}$. The SURE estimator will reduce to equation-by-equation OLS if errors are uncorrelated across equations (i.e., if Σ is diagonal). We use the *LM* statistic proposed by Breusch and Pagan (1980) to test the dependence of the errors in the different equations, with a null hypothesis of diagonality of Σ (i.e., zero contemporaneous covariance between the errors across equations).

2.4 Empirical results

Pooled OLS results indicate that the revolution has had, on average, an adverse effect on sectoral private investments in Egypt, but not on the public sector. Pooling the sixteen sectors of the Egyptian economy together, and running a simple OLS reveals an interesting finding. Specifically, empirical results (see estimations in table 2) indicate that the revolution dummy variable has a negative and statistically significant coefficient only in the case of private investments at the sectoral level, but not in total or public investments.

Is pooled OLS a valid technique? Results so far using pooled OLS have indicated that the revolution has had an average negative effect on sectoral investments, both at the private and public sector levels. But, as explained above, the pooled OLS approach assumes that errors are not correlated across sectors. The SURE technique allows a test of such relationship between the different sectors of the economy, and therefore serves as a test of the validity of pooled OLS in this context.

Using the SURE technique, results indicate that a contemporaneous relationship exists between sectors of the Egyptian economy. Estimations in table 3 imply that the Breusch-Pagan (1980) test rejects its null hypothesis of independence of the residuals across equations, indicating that there is indeed a contemporaneous relationship (common shocks) across all sectors of the Egyptian

economy. These results show that estimations using the SURE technique provide higher efficiency over pooled OLS.

Has the revolution had a homogenous effect on all sectors of the economy? Results (see estimations in table 3) show that the null hypothesis of the test of a restriction across the equations is rejected at the 1% significance level, indicating that the coefficients on the revolution dummy are statistically different from each other in the sixteen sectors of the Egyptian economy. A related question on which sectors were positively or negatively affected by the revolution – in terms of their output growth – was addressed in Hosny, Kandil and Mohtadi (2014). They find that all sectors of the economy, with the exception of energy-related sectors (namely Mining-crude oil, Mining-natural gas, and Manufacturing-oil products) were affected by the revolution in a negative and statistically significant manner.[3] The question we pose in this paper, however, goes beyond this and asks whether there are differences within the negatively affected sectors.

Other variables mostly show expected signs. Results from other variables in the regression mostly show the expected signs. Findings (not shown here for space considerations) indicate that lending rates and inflation negatively affect investments in many sectors of the Egyptian economy. Exchange rate changes report mixed effects. Higher money supply is associated with higher investments. Exchange rate volatility is not found to be statistically significant from zero in many cases. Guimaraes and Unteroberdoerster (2006) also report that exchange rate volatility is not found to have a statistically significant impact on short-run investment growth in Malaysia, especially after the crisis dummy is included. They explain that the lack of evidence of a link between exchange rate volatility and investment in the case of Malaysia may also reflect the declining importance of FDI, which could be relatively more exposed to exchange-rate risk or due to an ambiguous theoretical relationship (see for example, Nicolas, 2004).

2.5 Robustness checks

Results are also robust to including different independent variables. Empirical results are robust to including different definitions of money supply (using M1 instead of M2, with results in column 2 in Table 3), the exchange rate (using nominal instead of real exchange rate, with results in column 3), and inflation (using the producer instead of the consumer price index, with results reported in column 4). The SURE modeling technique allows each equation to have a different set of independent variables. For robustness, we also experiment by including the lagged volatilities of exchange rates and inflation (column 5). Then, we include lagged public investments in the private investment equations to account for possible crowding out effects (column 6). Again, results from Table 3 above indicate that our findings are robust to such specifications.[4]

Allowing for heteroskedastic errors does not change the results. As a robustness check, we use a bootstrapping technique to allow for heteroskedasticity-robust standard errors. Results reported in Table 3 (column 7) above reveal that our findings are unchanged and that the basic message holds.

[3] The same paper, by Hosny, Kandil and Mohtadi (2014), also considers the revolution as a treatment effect, estimates a probit model, and uses that in the performance equation as is done in the modified control group literature. This is to address the fact that the incidence of the revolution may not be a random process and thus provides the closest measure to an examination of the "causal effect" of the revolution in terms of variation in sectoral growth. Results using the treatment effect are very similar to the OLS results.

[4] Other robustness checks (not included for space considerations) include adding and dropping variables such as global commodity prices and foreign reserves, as well as experimenting with different combinations of the different definitions of money supply, the exchange rate, and inflation.

3. Conclusion

This paper fills an important gap in the literature on the economic effects of the Arab Spring. By using the Egyptian revolution as a case study, we examine the effect of the revolts since 2011Q1 on sectoral investments, with a special focus on private sector investments. Our findings are twofold. First, using a pooled OLS approach, we show that the revolution has had, on average, a negative effect on sectoral investments in the private sector, while the effect on public sector investments is statistically insignificant. Second, using a seemingly unrelated regression approach, we find evidence of a contemporaneous relationship between the sectors of the Egyptian economy, so we make use of these common shocks across all sectors and estimate the model simultaneously to gain efficiency in our estimations. By doing so, we find that the revolution has had a different impact on different sectors of the economy, especially in investments in the private sector. These empirical results hold under a number of robustness checks.

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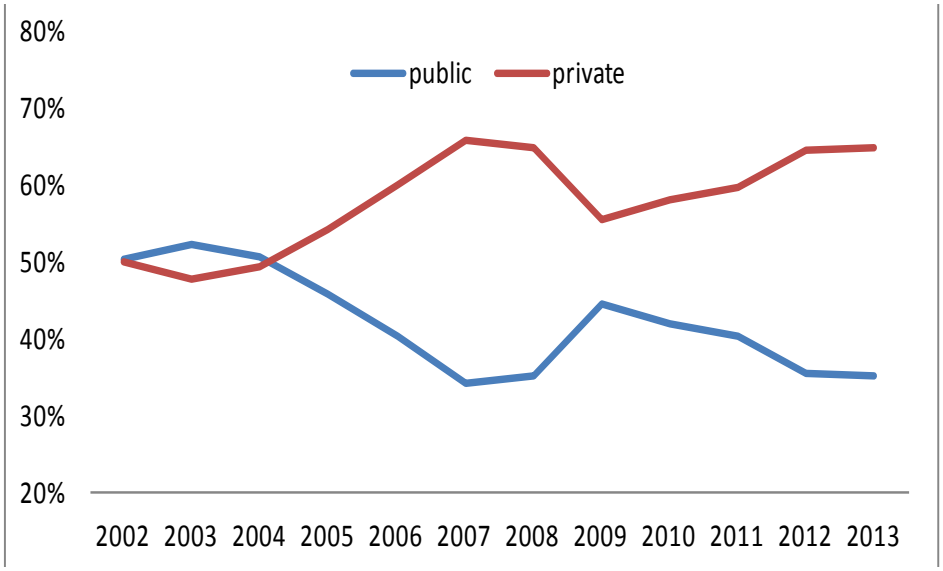
Figure 1: Pubic vs. Public Shares in Total Investments



Source: Calculations based on data from the Ministry of Economic Planning.

Table 1: Summary Statistics of Sectoral Investment Growth Rates

	Mean	Std. Dev.	Min	Max
Before Revolution: 2002Q4-2010Q4				
Sector 1: Agriculture	-0.001	3.058	-11.922	12.173
Sector 2: Mining-Crude Oil	0.019	0.661	-1.619	1.684
Sector 3: Mining-Natural Gas	0.034	0.998	-3.351	2.911
Sector 4: Other Mining	-0.229	0.945	-5.102	0.499
Sector 5: Manufacturing-Oil Products	0.003	0.436	-0.908	1.168
Sector 6: Other Manufacturing	0.046	0.928	-1.751	2.489
Sector 7: Electricity	-0.313	1.598	-9.116	0.118
Sector 8: Construction Building	0.034	0.567	-1.782	1.834
Sector 9: Transportation	0.029	0.618	-1.067	1.634
Sector 10: Communication & Information	0.059	0.389	-0.709	0.997
Sector 11: Internal Trade	0.079	0.697	-1.808	2.248
Sector 12: Restaurants & Hotels	0.028	0.613	-1.894	1.149
Sector 13: Real Estate Activities	0.003	0.544	-1.114	0.862
Sector 14: Education	0.021	0.492	-1.214	1.643
Sector 15: Health	0.017	0.393	-0.842	0.734
Sector 16: Other Services	0.008	2.551	-10.862	8.540
After Revolution: 2011Q1-2014Q2				
Sector 1: Agriculture	0.022	0.212	-0.350	0.365
Sector 2: Mining-Crude Oil	-0.167	0.466	-1.117	0.575
Sector 3: Mining-Natural Gas	-0.001	0.616	-1.431	1.230
Sector 4: Other Mining	1.051	3.557	0	12.345
Sector 5: Manufacturing-Oil Products	-0.946	5.997	-11.45	12.045
Sector 6: Other Manufacturing	-0.021	0.996	-2.197	1.280
Sector 7: Electricity	0	0	0	0
Sector 8: Construction Building	-0.127	0.643	-1.643	0.825
Sector 9: Transportation	-0.032	0.286	-0.478	0.595
Sector 10: Communication & Information	-0.042	0.306	-0.555	0.396
Sector 11: Internal Trade	-0.091	0.481	-1.391	0.560
Sector 12: Restaurants & Hotels	-0.135	0.352	-0.721	0.241
Sector 13: Real Estate Activities	0.028	0.3702	-0.489	0.738
Sector 14: Education	-0.001	0.418	-0.720	0.550
Sector 15: Health	-0.009	0.398	-0.874	0.535
Sector 16: Other Services	0.010	0.480	-1.255	0.556

Source: Author calculations based on data from the Egyptian Ministry of Economic Development.

Table 2: Pooled OLS Regressions

	dinvprivate	dinv	dinvpublic
revdummy	-1.474	-0.349	4.941
	(0.742)**	(1.152)	(3.205)
R^2	0.06	0.13	0.20
N	820	840	827

Notes: * p<0.1; ** p<0.05; *** p<0.01. All regressions include all the variables as in equation (1), plus time dummies.
Source: Author estimations based on data from the Egyptian Ministry of Economic Development and the IMF International Financial Statistics.

Table 3: Estimations of Seemingly Unrelated Regressions for Total, Public and Private Sectoral Investments

	Basic specification	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
	Total Investments						
Breusch-Pagan test of independence	616.963***	610.890***	620.468***	591.544***	598.329***		601.839***
Test of cross-equation constraints	33.93**	32.34**	35.06***	30.18**	55.41***		57.91***
	Public Investments						
Breusch-Pagan test of independence	984.619***	989.370***	987.507***	985.744***	953.843***		923.874***
Test of cross-equation constraints	11.18	8.77	10.75	11.01	11.81		9.20
	Private Investments						
Breusch-Pagan test of independence	296.736***	316.894***	294.496***	301.779***	285.008***	289.971***	324.761***
Test of cross-equation constraints	29.78***	26.19**	29.89***	25.22**	34.32***	28.16**	30.76***

Notes: * p<0.1; ** p<0.05; *** p<0.01.
Source: Author estimations based on data from the Egyptian Ministry of Economic Development and the IMF International Financial Statistics.