Does Economic Success Reduce Corruption? Evidence from Egypt

Brian Lee
Advisor: Professor Giovanni Peri
Department of Economics
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1. Introduction and Motivation

Corruption has been identified as an obstacle to economic development in poor countries. Recently, the international community has encouraged countries to combat corruption, often defined as the 'abuse of public office for private gain' by the World Bank. Some examples of attempted solutions include the Organization for Economic Cooperation and Development's Anti-Bribery Convention and the United Nation's Convention Against Corruption, which are two prominent examples of legally binding international agreements aiming to stem corruption. However, despite these efforts and intentions, eliminating corruption has proven difficult for most developing countries.

Because of the prevalence of corruption, there is a robust body of literature that examines the causal effect of corruption on economic growth, although the consensus regarding the precise direction of this relationship isn't settled. For example, Méon and Sekkat (2005) summarize the two hypotheses pertaining to corruption when they write that it can either 'grease' or 'sand' the wheels driving economic development. Indeed, some of the literature has found that corruption can encourage economic growth by helping firms avoi[1]d political constraints that impede business. Recently, Ayaydin and Hayaloglu (2014) suggests that corruption could increase economic growth since illegal practices and payments also known as 'speed money' could increase firm productivity. However, the predominant findings of the literature suggest that corruption is likely to reduce economic growth by slowing efficiency, hampering productivity, and distorting market conditions. Usually, these problems manifest themselves in the form of monetary bribes to government officials or institutional challenges that affect business operations.

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While many papers investigate the causal effect of corruption on economic growth, the inverse question has received considerably less attention. What is the impact of *economic growth* on *corruption*? The literature focusing on this relationship remains sparser. Bardhan (1997) was among the first to hypothesize that economic growth reduces corruption, providing a theoretical framework that suggested that corruption would subside on its own as countries develop. According to Bardhan, one explanation is that a growing economy could afford to pay its civil servants well, reducing the incentives for corrupt practices.

This theory suggests that international agreements and policy efforts designed to reduce corruption are arbitrary. If true, Bardhan's theory has powerful implications for decision makers as countries and governments could reallocate the political and monetary resources used to combat corruption the issue subsided on its own. One country where this reallocation would be useful is Mexico, as the country recently approved an anti-corruption reform that required changing more than ten constitutional articles and modifying seven laws (Rios, 2016). Only six months later, independent analysts were already calling these reforms ineffective.

To answer whether economic success will reduce corruption, I focus on the case of a single country, which is Egypt. I chose Egypt because the country is among the few where the World Bank was successful in interviewing the same firms twice at two separate points of time. Another reason why I focus on Egypt is that the country's dependency on exports as a portion of GDP allows for the exploitation of exogenous trade shocks as an identification strategy.

2. Contribution to Literature

This research contributes to the literature surrounding development economics in several ways. First, to my knowledge, few papers explicitly focus on the causal effect of economic growth on corruption. Moreover, among these papers, there is only a select number that conducts the analysis at the microeconomic level. This lack of literature is because micro level survey datasets like the World Bank Enterprise Surveys and the Business Environment and Enterprise Performance Surveys (BEEPS) didn't begin until 2005. Furthermore, there are no papers that examine the relationship between economic growth and corruption considering the case of Egypt. Egypt is a highly relevant example as many developing countries face similar economic and political characteristics and challenges.

The other contribution of this paper is that it measures corruption by constructing an index based on firm-level responses. Prior papers in development economics have traditionally used aggregate indexes of corruption at the country level, such as Transparency International's Corruption Perceptions Index, which is scaled from 0 (representing no corruption) to 100 (representing high levels of corruption). However, these indexes have several problems. Most problematically, they predominantly rely on the opinions of experts and prominent businesspeople who are based overseas in global cities such as London, Hong Kong, and New York. This reliance could lead to a misleading bias in the actual level of corruption, resulting in inappropriate policy responses.

3. Background on The Modern Egyptian Economy

Egypt is a transcontinental country located in the northeast corner of Africa and the southwest corner of Asia, framed by a land bridge formed by the Sinai Peninsula. Some of the most notable changes, trends, and reforms that have affected the Egyptian economy are highlighted in this section. Egypt's economy is focused on relatively few industries, which include sectors such as beverages, food, machinery, metals, minerals, and textiles. Unsurprisingly, Egyptian exports are primarily composed of these very industries. More specifically, clothing, food, minerals, and textiles are sectors in which Egypt has a comparative advantage, according to a Balassa Index (MIT, 2017). The country also imports a broad range of goods, with some of the country's largest imports encompassing other sectors such as chemicals, and intermediary goods (MIT, 2017).

Three important macroeconomic indicators have been provided in Figure 1 to help frame Egypt at the macro level. For comparison, trends for the rest of the Middle East and North Africa (MENA) region are also included, excluding high-income countries. Figure 1 presents the annual percent growth rate for both Egyptian and the MENA Region's exports, imports, and GDP using aggregated data provided by the World Development Indicators. The most notable decrease in exports and imports occurred between the years of 2008 and 2009, where Egyptian exports and imports went from growing by 28 and 26 percent the previous year to contracting by 15 and 19 percent in the following year. In contrast, the MENA region's exports and imports went from

growing by 2 and 11 percent the previous year to contracting by only 3 and 0.15 percent in the following year.

Two factors primarily drove this exogenous trade shock. First, the global economic recession dramatically reduced demand for Egyptian commodities (Adly, 2016). The second and more significant factor is that oil prices collapsed in the second half of 2008, where the price of a crude barrel of oil peaked at 147 dollars in July and fell to 33 dollars in November (Adly, 2016). These changes demonstrate that Egypt's exports are incredibly susceptible to energy shocks, which is unsurprising given that energy is responsible for nearly 40 percent of the country's total exports (Adly, 2016). Further compounding these problems is the fact that the crisis has negatively impacted the capacity of the economy to attract foreign direct investment, as the energy sector has accounted for more than 60 percent of such investment in the last two decades (Adly, 2016).

Imports were also affected by these two exogenous shocks. The decrease in imports from 2008 to 2009 can be attributed to the Egyptian Central Bank's decision to defend foreign reserves and the national currency by enacting trade barriers to reduce imports intentionally. This deliberate policy change has affected the economy's ability to access essential products for production (Adly, 2016). Around two-thirds of Egyptian imports are made up of raw materials and capital goods, and restraints on capital mobility and the devaluation of the Egyptian pound has also reduced exports. Overall, this fall in exports and imports are significant factors that also explain the decrease in the growth rate of Egypt's GDP. One of the key points that Figure 1 demonstrates is that Egyptian exports and imports are sensitive, even in comparison to the rest of the region. This fact will prove critical later when discussing the empirical specification.

The effects of other important events in Egypt and the MENA region are also observed in Figure 1. This includes the Arab Spring, which began in December 2010 in Tunisia and spread throughout the area. The Arab Spring was a revolutionary wave of violent and non-violent demonstrations, protests, riots, coups, and civil wars, which resulted in major insurgencies and conflict in Iraq, Libya, Syria, and Yemen. Civil uprising and large demonstrations also occurred in Algeria, Egypt, Lebanon, Jordan, Kuwait, and Morocco, and much of the volatility in macroeconomic trends from 2010 to 2015 can be credited to the Arab Spring.

Egypt was dramatically impacted by the Arab Spring, which inspired millions of protesters from a range of socioeconomic and religious backgrounds with only one single

demand, which was the overthrow of President Hosni Mubarak. These protests began in January 2011 and photos of protesters gathering in Cairo's Tahrir Square were captured to demonstrate the widespread opposition to Mubarak. After Mubarak's resignation, the Muslim Brotherhood took control of the country, which culminated in the election of Islamist Mohamed Morsi to the presidency in June 2012. However, Morsi's government encountered fierce opposition after his attempt to alter the constitution to grant himself unprecedented presidential powers. In July 2013, the Minister of Defense, General Abdel Fattah El-Sisi deposed of President Morsi through a coup and eventually became Egypt's president through a popular election in 2014.

4.1 Literature Review: Causal Effect of Corruption on Economic Performance

Many papers have examined the causal effect of corruption on economic performance. Mo (2001) was among the first who quantified the impact of corruption on economic growth. By modifying the standard production function model and combining it with a panel dataset constructed by Barro (1991), he finds that a 1 percent increase in corruption reduces growth by 0.72 percent using his ordinary least squares specification. However, the most significant contribution that Mo makes is that he precisely identifies through which transmission channels corruption affects economic growth. From Mo's results, the most important channel is political instability, which accounted for 53 percent of the total effect. This identification is necessary for this paper, as it identifies some of the control variables that the regression needs to account for to avoid omitted variable bias.

Major breakthroughs occurred in the literature when the World Bank Enterprise Surveys began providing firm level data. The release of the surveys is significant because papers that focus on aggregate outcomes tell us little about the relationship between corruption and *individual* agents. Similarly, macro determinants by nature cannot explain within country variation in corruption. Sharma and Mitra (2016) use the enterprise surveys to examine the impact of bribe payments on firm performance in India. Their theoretical framework considers two sets of variables. The first set of variables in their model includes factors related to each firm's interaction with government agencies, while the second set of variables cover firm-specific characteristics. Using an ordinary least squares specification, they find that while bribes

work on a tax on profitability, the evidence is inconclusive regarding productivity. Sharma and Mitra also identify which firms are more liable to pay bribes by changing their empirical specification to a probit model. Their model finds that tax evading firms are much more likely to pay bribes to government officials. Moreover, less profitable enterprises or those that are struggling in the market are also more likely to pay more bribes to government officials. One possible explanation for this finding is that unprofitable firms need more support from government agencies to survive, even if this aid originates from an illegal channel.

4.2 Literature Review: Theory and the Causal Effect of Economic Performance on Corruption

As mentioned previously, significant inroads can be made when examining the impact of economic growth on corruption. One important point is that this thesis uses a perception based index of corruption to measure corruption. Thus, for this thesis to remain valid, it is necessary that perceptions of corruption are an accurate proxy for actual corruption. In other words, how accurate are perceptions of corruption in comparison to quantifiable metrics of corruption, such as bribes?

Olken (2009) examines this question in his paper entitled *Corruption Perceptions vs. Corruption Reality*. In this paper, Olken constructs a survey dataset using data from Indonesian villages comparing each village's perception of corruption in response to a local road project. Olken builds an empirical measure of corruption entitled 'missing expenditures' by comparing the official costs of the local road project released by the Indonesian government to his estimated cost of the project, based on interviews and consultations with engineers who worked on the project. Olken finds that the villagers' perception of corruption is accurate to the point where they can distinguish between general corruption, such as the type endemic with the Indonesian government in contrast to corruption at the localized level, such as the road project. These findings are significant as many economists have suggested that perception indices, such as Transparency International's Corruption Perception Index are not an ideal proxy for corruption. Olken's paper is an important theoretical component to this paper since we can now reasonably presume that the answers from competent business managers and owners regarding Egypt's business environment are accurate.

The paper that inspired this thesis also estimates the causal effect of economic performance on corruption. Bai, Jaychandran, Malesky, and Olken (2016) empirically test whether increased economic growth reduces corruption using the case of Vietnam. The authors utilize an instrumental variables approach to solve for endogeneity, which I follow in this paper. However, there are several distinctions between their paper and this thesis. First, instead of using a perception based index of corruption, Bai et al. (2016) use data on bribery amount and prevalence at the firm level. It is important to note that there are advantages and disadvantages to using bribery data as a measure of corruption. While data on bribes is less subjective to bias, it is reasonable to argue that corruption is more than simply a monetary amount. Bribes wouldn't account for other aspects of corruption under the commonly accepted definition of the term set by Transparency International. For example, bribes wouldn't capture the effect of political corruption, or the manipulation of policies, institutions, and rules of procedures in the allocation of resources and financing by political decision makers, who often abuse their position to sustain their power and influence (Transparency, 2016).

Other differences between this thesis and Bai et al. involve the empirical approach. Bai et al. use two instruments, with one based on the growth in a firm's industry in other Vietnamese provinces using data on the 13,000 firms interviewed by the Vietnamese Provincial Competitiveness Index (PCI). Their second instrument is based on the industry's growth in neighboring China. From these two instruments, Bai et al. can identify changes in corruption by comparing the firm's industry size to the aggregate size of the firm's industry in other provinces of Vietnam and China, excluding the native province as the base category comparison. Their key findings are that economic success does reduce corruption and that firms are more mobile face substantially fewer bribes. This secondary finding is explained by the fact that enterprise owners could just relocate their business operations to another province to avoid this economic constraint, in comparison to stationary firms who are forced to pay a bribe to continue operations.

I use data provided by the International Trade Center (ITC) to construct two instruments based on trade shocks, which are formed by taking the changes in the logs of exports and imports from 2014 to 2008. Later, I will elaborate on why Egypt is an excellent theoretical example to apply this exogenous instrument.

5.1 Data Section: World Bank Enterprise Surveys and International Trade Center

The primary data used in this thesis is the World Bank Enterprise Survey, and the variables used from the survey are seen in the variable appendix. The enterprise survey is a firm-level survey of a representative sample of a country's private sector. At the time of writing, these surveys have been completed in 139 countries, with a focus on the developing world. While these surveys have country-specific questions, they always cover a standardized set of topics as follows: finance, corruption, infrastructure, crime, competition, and performance measures. Additionally, the surveys also provide valuable information regarding firm-specific characteristics, such as age, ownership, employment figures, and competition within the market. Typically, 1,200 to 1,800 interviews are conducted in larger economies, 360 interviews are carried out in medium-sized economies, and 150 interviews take place in smaller economies.

Using the example of Egypt, there are two surveys are of interest, which is the 2008 and 2014 Enterprise Surveys. The World Bank interviewed 1,500 and 3,000 firms in each separate survey, where each firm was randomly selected using stratified sampling. Recall that this paper's main empirical question is whether *improved* economic performance reduces corruption. Therefore, we are interested in measuring both economic performance and corruption in changes. Apart from firm-specific characteristics such as legal status and ownership characteristics, most variables in the empirical specification are measured in changes, which are constructed by taking the value observed in the 2014 survey and subtracting the value observed in the 2008 survey. These survey questions are scored from 0 (no obstacle), 1 (minor obstacle), 2 (moderate obstacle), 3 (major obstacle), and 4 (very severe obstacle). One exception includes the economic performance variable, which will be further elaborated when discussing the first stage of the empirical specification.

As a result, the number of observations for the dataset decreases to 598 firms, which were interviewed in both 2008 and 2014. One consideration with the World Bank Enterprise Surveys is the lack of responses for some of the questions. Because the surveys are long and detailed, some questions were simply skipped by the respondent, such as the questions pertaining relating to obstacles in business operations. Moreover, responses to the survey questions are written to prevent bias, meaning that it is rather convenient for firms to avoid answering uncomfortable

questions. This lack of response is significant as these variables need to be used as a control to ensure that the corruption index remains unbiased, resulting in fewer observations than expected at 313 firms who answered every question relevant to this thesis.

The firms presented in the World Bank Enterprise Surveys were originally coded into different sectors based on their 'main economic activity' using the United Nation's Industrial Standard Industry Classification (ISIC) Version 3, which has 5,000 different codes. This classification is important, as the primary empirical specification involves using an exogenous shock to exports and imports as an identification strategy. Therefore, it is necessary to obtain trade data at the sector level to match the firms with the appropriate sector trade shock. To accomplish this, I turn to data from the International Trade Center (ITC), which is a joint agency of the World Trade Organization and the United Nations. I use the product concordance from the World Integrated Trade Systems to convert each firm's ISIC Version 3 Code into a Harmonized System (HS) 2 Classification. Next, I turn these codes into the HS 4 Classification, which I finally recode into the HS 6 Classification. Under the broadest definition of sectors, the ITC has 99 different categories. However, under the narrowest definition of export and import sectors, the ITC also has 5,000 different categories. For this thesis, I use the most restricted definition of export and import sectors for additional variation, which classifies each firm into sectors of economic activity based on their primary product.

The 313 firms are sorted into 170 different sectors, which range from furniture to machinery to pharmaceuticals. Figure 2 plots the difference in the log of exports and imports from 2014 to 2008 using the data provided by the ITC. This figure also visually displays the instruments that will be applied to each firm in the dataset. In Figure 2, each dot represents a sector. As we can see, there is a high degree of variation between sectors within the constructed instruments. As alluded to previously, these differences will be critical to the identification process and the empirical strategy.

5.2 Summary Statistics, Trends, and Explanations

Table 1 presents summary statistics for the key variables. Also, a variable appendix is also provided in the table above, which provides the description and the survey question used in

the enterprise surveys. Several interesting trends can be seen when examining the summary statistics.

First, annual sales for each firm increased from an average of 98,826 to 70,090,000 Egyptian Pounds. Many of the largest firms in the 2008 Enterprise Survey saw very high increases in sales over the six-year time gap in interviews. Because this increase is not directly attributable to one or two outliers, this variation can be controlled by using a principle component to combine these variables with other measures of economic performance as a single variable, which will be later discussed. However, while annual sales increased, we can see that the average number of employees decreased from 353 to 213 workers from 2008 to 2014. This decrease is the result of the collapse of oil prices that occurred in 2008 and the Egyptian Revolution that began in 2011, as firms were continued to lay-off workers (Adly, 2016). These trends coincide with the fact that while Egypt has achieved high economic growth, many of these gains have failed to be inclusive as they left about 45 million Egyptians trapped in the lower middle class (Adly, 2016).

Other macroeconomic trends that can be observed in the summary statistics is the increase in both exports and imports in the aggregate. The data for the 170 included sectors from the ITC shows that the average export sector increased from 14,904 thousand US dollars to 19,149 thousand US dollars. This trend is reflective of the country's economic growth over the 6-year period of high macroeconomic growth. The mean of the export and import instrument is 2.807 and 1.855, respectively, which was constructed by taking the difference of the log of the raw 2014 and 2008 dollar amount.

Table 1 also provides summary statistics for other perception-based variables from the survey. Except for political instability, these perception variables are constructed from taking the value scored in the 2008 enterprise survey from the value scored in the 2014 enterprise survey. From Table 1, we can see that most firms thought that access to finance, judicial efficiency, and crime posed a larger obstacle to business operations, with the greatest increase being 1.37 on a 4-point scale for crime. The mean of corruption is .134, suggesting that corruption increased slightly in Egypt between the six years.

6.1 Empirical Specification: Introduction of First Stage and Main Explanatory Variable

The empirical specification utilizes an instrumental variables regression in conjunction with a two-stage least squares estimator. The first stage of the empirical specification follows:

$$Economic\ Performance_{i,s} = \gamma_0 \Delta(lnexports)_s + \gamma_1 \Delta(lnimports)_s + \varepsilon_i$$

In both the first and second stages of the specification, the subscripts *i, s,* and *t* represent the individual firm, sector, and year, respectively. ε is the error term. The dependent variable of the first stage and the primary explanatory variable of the second stage, economic performance, was created using a statistical technique called the principle component analysis. This procedure uses an orthogonal transformation to convert a set of correlated variables into a set of linearly uncorrelated variables called principle components.

This technique is useful because it will simplify these set of variables measuring economic success by examining all conceivable linear combinations and creates a single component that summarizes the variables of interest. A principle component analysis accomplishes this by constructing new characteristics among the selected variables and transforms them into a single dimension, or the single variable of interest in this case. For this paper, I construct $Economic\ Performance_{i,s}$ out of six variables, which are sales, the total number of workers, and total costs from the 2008 and 2014 World Bank Enterprise Surveys. This data reduction technique is especially useful given that there is a correlation between all six of these variables. The mean of economic performance variable is -1.92e-09, with a standard deviation of 1.49. The minimum is -0.72 with a maximum of 10.60. This broad range of values reflects the fact that the firms of varying sizes are present in the dataset.

6.2 Empirical Specification: Identification Strategy and Instruments

One of the problems of estimating the causal effect of economic performance on corruption is endogeneity, which means that there is a correlation between the independent variables and the error term. This relationship stems from the consideration that the economic performance variable only uses six variables based on sales, costs, and the number of workers for each firm. In other words, there could be other endogenous firm characteristics that could affect

economic performance, other than sales, labor, and costs. More specifically, this would result in omitted variable bias, which would lead to inaccurate results. Some of these characteristics are fleshed out in the literature, as Bernard, Jensen, Schott, and Redding (2007) have found that across a wide-range of countries and industries, exporting firms are larger, more productive, and more skill intensive than non-exporting firms. Moreover, they find that these advantages exist even *before* firms begin exporting. As a result, the empirical specification needs to control for some of these unobserved differences among firms that export, which is also endogenous to the model. To control for the endogeneity located within the model, I use an exogenous trade shock at the sector level to account for this error.

I adopt an instrumental variables approach in conjunction with a two-stage least squares estimator to solve this issue. The instrumental variables used in this paper are sector level trade shocks, measured by the change in the log of exports and the log of imports from 2014 to 2008. I follow the approach taken by Autor, Dorn, and Hanson (2013), where they exploit the cross-market variation in import exposure to estimate the effect of Chinese imports on domestic labor markets. Like Autor, Dorn, and Hanson, I treat the difference in the sector level changes in exports and imports as an exogenous shock or something determined outside the model. There are two primary reasons why these sector level trade instruments are exogenous.

First, because of the global economic recession and the collapse in oil prices in 2008, it is unlikely that trade shocks will be correlated with the error term of the first stage of the empirical specification, especially since economic performance is constructed at the firm level. Moreover, overall trends in Egyptian exports and imports can also be attributed to the policy decisions made by the Egyptian Central Bank. This is because Egyptian government enacted trade barriers to protect the domestic currency and defend foreign reserves, which deliberately reduced imports and exports. This policy change is important as the instrumental variables will be uncorrelated with the error term, unlike economic performance, which is endogenous.

This empirical approach also solves for reverse causality. By using trade shocks to isolate the variation in economic performance that is uncorrelated with the error term, we also stop the simultaneous causality where the ordinary least squares estimators also pick up the effect of corruption on economic performance.

6.3 Empirical Specification: Results from the First Stage

Results from the first stage of the empirical specification are included in Table 2. From these results, we can see that the sign of the coefficient on exports and imports are positive and negative, respectively. This matches the hypothesis that firms matched to sectors that more heavily exported have higher levels of economic performance and that firms matched to sectors that more heavily import saw decreased levels of economic performance. Unfortunately, we can see that this effect is statistically insignificant. Similar results can be seen when looking at the results of the first stage of the oil instrumental variable, which is an alternative instrument that will be elaborated on in robustness checks.

Potential explanations for the weakness of the instruments includes the consideration that the ISIC Version 3 code assigned to the firms as their 'main economic activity' in the World Bank Enterprise Surveys didn't appropriately match firms into the appropriate sector. Proper matching is especially important, as I use these codes to convert them into the appropriate Harmonized Standard code. If there is a type mismatch between the ISIC Version 3 Code and the firm's sector, then this would result in weak instruments. Because of the weakness of the instruments, I will later run the empirical specification utilizing an ordinary least squares framework while including economic performance as an independent variable in conjunction with the rest of the controls. Typically, running a two-stage least squares regression with weak instruments could lead to further bias, which is further compounded by the fact that the sample size is quite small. I also solve for this bias by creating an interaction variable as the instrument, which will be more thoroughly detailed in the robustness checks and extensions.

6.4 Second Stage of Empirical Specification

The second stage of the empirical specification follows:

$$\Delta Corruption_{i,s} = \beta_1 (Economic\ Performance)_{i,t} + Controls + \varepsilon_i$$

In the second stage of the empirical specification, $\Delta Corruption_{i,s}$ or the change in corruption is the primary dependent variable. This variable is constructed by subtracting each firm's perceived level of corruption in 2014 to the perceived level in 2008, and many of the controls are constructed in the same manner. The precise question asked in both surveys asks firms to answer if any of the 'listed issues' are a problem for the growth and operation of your

business, with corruption being one of the listed issues. The exact question can be seen in the variable appendix. The survey then asks respondents to rate the severity of the issue from 0 (being no obstacle) to 4 (being a very severe obstacle). The mean of the corruption index is 0.13, with a standard deviation of 2.20. These values suggest that on average, corruption has slightly increased in Egypt. For firms who believe that corruption has *decreased*, we are interested in examining whether this is caused by their firm's improved levels of economic performance. $\beta_1(Economic\ Performance)_{i,t}$ is the primary explanatory variable, which has been regressed with the trade shock instruments.

Besides corruption, the World Bank also asks firms about other obstacles to business growth and observations in the same survey question. Some of these other barriers include access to finance, informal sector competition, judicial efficiency, and crime. These obstacles are also converted into changes by subtracting the observed value in 2014 to 2008. These variables are included as controls in the second stage of the empirical specification as they are correlated with perceived levels of corruption. For example, Mo (2001) found in his cross-country study that political instability and informal sector competition increases corruption. Therefore, these variables are included as controls in the second stage of the regression to avoid omitted variable bias and to help isolate the causal effect of economic performance on corruption. The second stage of the regression with the complete list of controls follows:

$$\Delta Corruption_{i,s} = \beta_1(Economic\ Performance)_{i,t} + \beta_2(\Delta Judical\ Efficiency)_{i,t} + \beta_3(\Delta Crime)_{i,t} + \beta_4(\Delta Finance)_{i,t} + \beta_5(\Delta Government\ Interaction)_{i,t} + \beta_6(\Delta Informal\ Sector)_{i,t} + \beta_7(Political\ Instability)_{2014} + \beta_8(Legal\ Status)_{i,t} + \beta_9(Ownership)_{i,t} + \beta_{10}(Locations)_{i,t} + \varepsilon_i$$

Recall that Table 1 presents the summary statistics. Many of these controls, except for informal sector competition have positive means, suggesting that firms also view these issues as an increased obstacle to business operations from 2008 to 2014. For example, access to finance as an impediment to business operations rose by 0.26 points, which is also scaled from -4 to 4. Other increases include the perception of crime, theft, and disorder as an obstacle to business, with the mean value being 1.37. This change is a significant increase considering that the maximum value of the variable is 4, which likely reflects the perception of a lack of law and order in the aftermath of the Egyptian Revolution.

Additionally, I also control for several specific firm characteristics that may not be captured by the economic performance instruments. These controls include ownership characteristics, the number of firm locations, and legal status. These additional controls are also used to control for omitted variable bias, especially because ownership characteristics and legal status are not captured in the economic performance variable. I also control for the change in the time spent interacting with government officials, as prior papers such as Svensson (2003) have shown that repeated interactions with government officers lead to a greater probability in bribe payments. The complete set of variables used to construct these indexes is included in the variable appendix. ε_i still represents an error term.

7 Discussion of Results

Table 3 presents the results from the IV 2SLS specification in Columns 1 to 3. Columns 4 to 6 show the results from the OLS specification. Under the current specification, important caveats need to be considered when interpreting the results due to the weakness of the instruments in the first stage. First, the standard errors on the IV estimates are significantly larger than the OLS estimates, largely since the purely exogenous trade shocks are only weakly correlated with economic performance. Even under the most generous definition of a valid instrument as outlined in Staiger and Stock (1997), the instruments are weak as the F-Statistic does not exceed 10 for both the primary or alternative specifications. While the IV estimates are likely to be biased, we can still carefully draw some conclusions based on the signs of the coefficients as well as the variables that remain significant even with such large standard errors. Furthermore, an important caveat when examining the OLS estimates is that they too could be biased because of endogeneity concerns for the same reasons why I employ an IV approach.

The interpretation of the results follows a standard linear-linear model, where a one-unit change in the independent variable *x* will induce a *b* change in the predicted value of *y*, ceteris paribus. However, because the dependent and independent variables are measured in changes, the interpretation of the results changes slightly, where a one unit change in the *shift of x* will induce a *b* unit change in the *change of y*, ceteris paribus. Column 1 is the reduced form of the regression, while Column 4 regresses economic performance to corruption. Columns 2 and 4 controls for other changes in perception along with a variable that measures the changes in how

often a firm interacts with the government. Finally, Columns 3 and 6 include firm-specific ownership characteristics, such as legal status, ownership status, and the company's number of locations, which are included since the economic performance variable won't precisely capture these characteristics.

We can see that economic performance has a negative coefficient in all three IV regressions. Unsurprisingly, this effect is statistically insignificant because of the weakness of the instruments. In the OLS specification, the sign for economic performance is positive in the baseline regression and the regression that controls for other changes in perception and government interaction, which are Columns 4 and 5, respectively. The sign becomes negative in the sixth regression that adds controls for firm-specific characteristics, which is what we expect. While there are several possible explanations for why the sign of the coefficient flips, the most likely culprit is omitted variable bias, especially since economic performance and corruption aren't collinear.

Several controls are significant in both regressions. The largest effect on corruption is crime, where the interpretation is that a one unit change in the change of crime as an obstacle results in a 0.335 to 0.446 change in the change of the corruption index, depending on the equation. Another significant effect is the change in informal sector competition, where the interpretation is that a one unit change in the change of informal sector competition will lead to a 0.262 to 0.399 change in the change of the corruption index, depending on the equation, *ceteris paribus*. Because we measure these variables in changes, we can see that changes in the corruption index are largely accounted for through issues that pose a problem for the operation and growth of businesses. For the regression in Column 2, which uses the IV 2SLS estimator, the change in access to finance leads to a 0.301 change in the change of the corruption index, *ceteris paribus*. While this effect isn't significant in Column 3, it is significant in the OLS regressions, although the effect is smaller with the coefficients ranging from 0.205 and 0.288.

Several of the firm-specific characteristics are significant. In the dataset, domestic ownership and foreign ownership are both dummy variables, where being owned by a domestic owner or foreign owner reduces the change in the corruption index by -0.02, which is a small, but significant effect. The excluded group is government ownership. Interestingly, larger firms saw increased levels of corruption, where the interpretation is that for every increase in the number of business locations, the change in the corruption index was 0.07 and 0.06 in the IV

2SLS and the OLS regressions, respectively. This finding corroborates many of the findings in the current literature, where dishonest government officials often target larger firms due to their increased ability to pay the bribe. Sharma and Mitra (2016) also found this to be the case when applying a probit model to estimate the probability of paying a monetary bribe in India.

8 Robustness Checks and Empirical Extensions

As a measure of robustness, I employ an alternative instrument like Acemoglu, Finkelstein, and Notowidigo (2013). In their paper, the authors use a time series variation in oil prices interacted with local oil reserves to examine whether rising income is responsible for the increase of health expenditures as a share of GDP. The alternative first stage of the empirical specification follows:

$$(Economic\ Performance)_{i,s} = \left(\frac{Oil\ Costs}{Total\ Costs}\right)_{2008} + \varepsilon_i$$

The intuition behind this instrument is that it treats the usage of oil as an input and output of the production process. Theoretically, this instrument should be strong as the usage of oil is firm-specific while remaining exogenous to the error term, which is correlated with economic performance. More specifically, oil usage, in theory, should be able to induce changes to economic performance through the channel of production, as more economically successful firms should have higher fuel costs. However, as we can see from Table 2, this instrument is still insignificant. One possible reason for this lack of explanatory power is that the surveyed firms simply aren't as reliant on oil as expected, especially sectors like textiles and food, where oil dependency is at a minimum.

As an additional measure of robustness, I create a dummy variable which is 1 if the firm's direct exports increased from 2008 to 2014 and is 0 otherwise. Next, I interact this dummy variable with the sector level trade shock variable to create an interaction term that serves as an instrument. While there are valid concerns that this instrument is endogenous, I argue that we can assume that it is exogenous because the primary value that this instrument takes is based on the sector level trade shocks, which are more likely to be determined by macroeconomic

outcomes and policies. This interaction alters the first stage of the empirical specification, which follows:

$$(Economic\ Performance)_{i,s} = (Export * lnexports)_{i,s} + \varepsilon_i$$

Table 4 presents the results from using this interaction as an instrument, and it fulfills the condition of relevancy as the instrument is strong with an F-Statistic of 20.05. This statistical significance is important because the instrument now induces enough change to economic performance to control for omitted variable bias and reverse causality. Table 5 presents the results from the second stage of the regression, which uses the same controls as the previous IV 2SLS and OLS regressions. The results from Table 5 are also interpreted in the same manner.

We can see that because the instrument is no longer weak, the standard errors in Table 5 are much lower than in Table 3. Furthermore, we can see that the signs of all the variables trend in the expected direction like in the original IV 2SLS regression. While there are some differences in the results from Table 3 and Table 5, this is primarily driven by the consideration that we can reasonably presume that the results from Table 5 are unbiased. In Column 2 of Table 5, increases to crime, informal sector competition, and finance as an obstacle to operations are statistically significant at the 1 percent value. The coefficients on crime and informal sector competition are identical, with the interpretation being a 1 unit change in the change of crime/informal sector competition induces a 0.386 increase in the change of corruption. Similarly, an increase in the change of access to finance induces a 0.297 shift in the change of corruption.

Column 3 presents the results from the regression with additional controls for additional firm-specific characteristics, where there are several other important variables. First, crime remains highly significant, with the coefficient increasing to 0.437 and gaining additional significance. Increases in informal sector competition remain significant in Column 3. Like the IV 2SLS and OLS specifications that were presented in Table 3, the number of locations for a firm is highly significant in determining changes to corruption, as every 1 unit increase in the number of firm locations resulted in a 0.074 change in the change of corruption. Across all three regression specifications, larger firms could observe increased levels of corruption. One explanation for this finding that has been corroborated in the literature is that government

officials seem to target larger firms with more locations to extract bribe payments, as these enterprises are more likely to have the financial ability to pay these bribes.

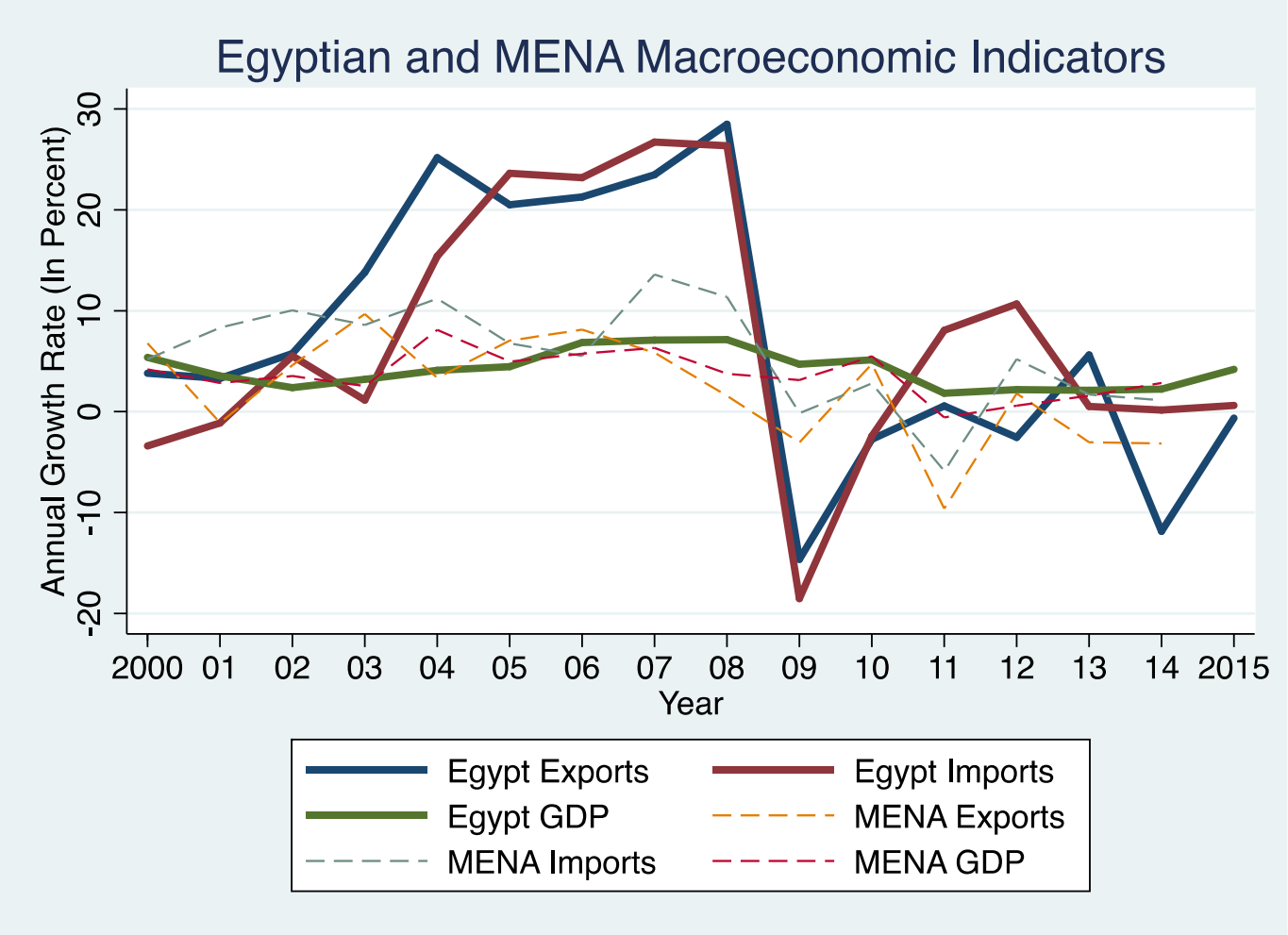
9 Conclusions and Future Research

Corruption has always been a problem throughout history, with differing consequences for different countries. Moreover, the damage that corruption inflicts on developing countries often compounds themselves into additional institutional problems that create economic, political, and social obstacles that extend far beyond business. As a result, discussing possible policy measures to stem corruption should remain a priority for the international community as a whole. Specifically, examining whether increased economic performance reduces corruption is an important question, as sometimes, legal and political solutions can be even worse than the actual problem. When governments publically enact failed reforms, this often leads to further grievances and mistrust between citizens and their governments.

While increased economic success had no significant impact on corruption, this paper can serve as an important start to a broader conversation. One priority for organizations like the World Bank as they continue to conduct enterprise surveys is to increase the number of firms interviewed over multiple periods of time to increase the number of observations used in future datasets. Another important policy consideration is that for fragile states such as Egypt, it may still be worthwhile for governments to enact more stringent laws and regulations designed to curb corruption. However, this thesis still contributes to the literature as I identify some of the other factors that increase perceived levels of corruption, such as increasing crime, informal sector competition, and the number of firm locations. These findings suggest that developing countries need to tackle other obstacles to development in addition to protecting larger firms to end the perennial problem of corruption.

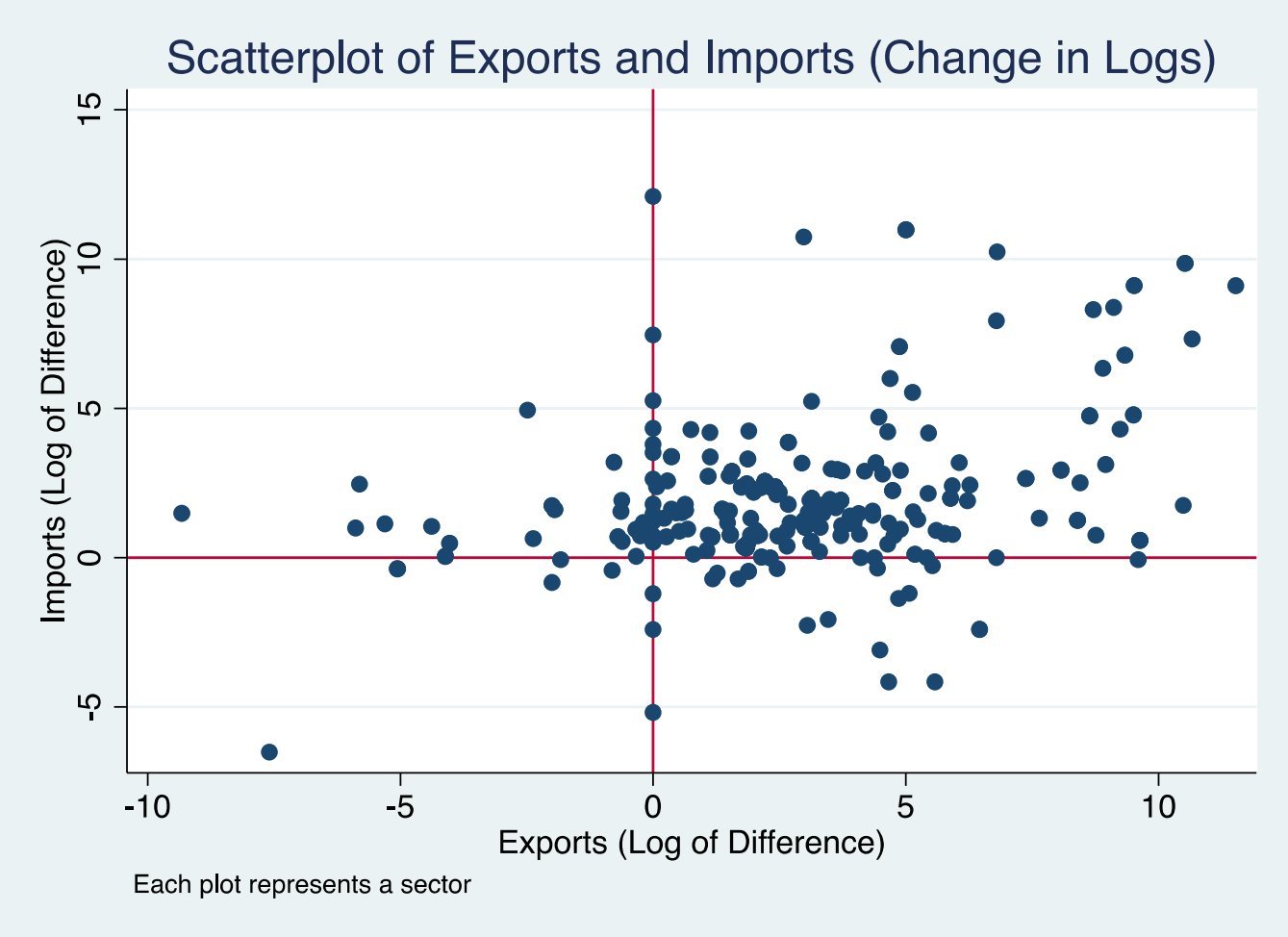
Appendixes, Figures, and Tables

Figure One: Egyptian and MENA Macroeconomic Indicators



Note: Data on macroeconomic indicators provided by the World Development Indicators. MENA indicators exclude high income countries.

Figure Two: Scatterplot of Trade Shock Instruments (Exports and Imports)



Note: This scatterplot is constructed by taking the log of exports in 2014 and the log of exports in 2008. These two values are then subtracted from each other and then scattered with imports, which has been treated the same manner. Data is provided by the International Trade Center for 170 different sectors at the HS6 Level. The specific unit of observation is at the product level.

Variable Appendix

Variable Appendix of Survey Questions from the World Bank Enterprise Surveys

Variable Name	Description	Survey Question
Total Annual Sales (2008)	Total annual sales (measured in Egyptian Pounds)	What were this establishment's total annual sales for all products and services?
Number of Employees (2008)	Total number of employees	What were this establishment's total number of employees?
Total Annual Costs (2008)	Total annual costs (measured in Egyptian Pounds)	From this establishment's income statement, what are the firm's total annual costs?
Total Annual Sales (2014)	Total annual sales (measured in Egyptian Pounds)	What were this establishment's total annual sales for all products and services?
Number of Employees (2014)	Total number of employees	What were this establishment's total number of employees?
Total Annual Costs (2014)	Total annual costs (measured in Egyptian Pounds)	From this establishment's income statement, what are the firm's total annual costs?
Economic Performance	Variable measurng economic performance at firm level	None, variable constructed by using total annual sales, employees, and costs from 2008 and 2014
Corruption	Variable measuring corruption as an obstacle to operations	To what degree is corruption an obstacle to current operations to this establishment?
Judicial Effciency	Variable measuring courts as an obstacle to operations	To what degree are courts an obstacle to current operations to this establishment?
Crime, Theft, and Disorder	Variable measuring crime, theft, and disorder as an obstacle to operations	To what degree is crime, theft, and disorder an obstacle to current operations of this establishment?
Finance	Variable measuring access to finance as an obstacle to operations	To what degree is access to finance an obstacle to the current operations of this establishment?

Government Interaction	Variable measuring time spent interacting with government	What percentage of senior management's time was spent dealing with requirements imposed by government regulations?
Informal Sector Competition	Variable measuring informal sector competition as an obstacle to operations	To what degree is informal sector competition an obstacle to the current operations of this establishment?
Political Instability	Variable measuring political instability as an obstacle to operations	To what degree is political instability an obstacle to the current operations of this establishment?
Legal Status	Variable measuring the legal status of operating firms	What is the current legal status of your firm?
Arabic Ownershp	Variable measuring Arabic ownership of operating firms	What percentage of your firm is owned by Arabic owners?
Domestic Ownership	Variable measuring domestic ownership of operating firms	What percentage of your firm is owned by domestic owners?
Foreign Ownership	Variable measuring foreign ownership of operating firms	What percentage of your firm is owned by foreign owners?
Number of Locations	Number of firm locations	How many establishments (stores or service outlets) does your firm have in Egypt?

Note: Variables and data provided by the 2008 and 2014 World Bank Enterprise Surveys. One important note is that corruption, judicial efficiency, crime, finance, informal sector competition, and political instability are measured on a scored scale from 0 to 4. 0 represents no obstacle to operations, 1 represents minor obstacle to operations, 2 represents moderate obstacle to operations, 3 represents major obstacle to operations, and 4 represents very severe obstacle to operations.

Table 1: Summary Statistics of Key Variables

Summary Statistics of Key Variables

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Total Annual Sales (2008)	310	98826.45	707976	36	1.17E+07
Number of Employees (2008)	313	353.3642	1218.909	8	14839
Total Annual Costs (2008)	291	51909.03	232704.1	92.3	2833417
Total Annual Sales (2014)	310	7.09E+07	3.34E+08	6200	5.00E+09
Number of Employees (2014)	313	213.4249	466.0761	2	3500
Total Annual Costs (2014)	292	3402839	9411008	1000	6.48E+07
Economic Performance	269	-1.92E-09	1.493156	-0.72661	10.60438
Size of Export Sector (2008)	313	14904.54	41774.93	0	349971
Size of Import Sector (2008)	313	19149.95	79058.32	0	971527
Size of Export Sector (2014)	312	25631.29	59267.31	0	408728
Size of Import Sector (2014)	312	31818.47	137749.5	0	1942736
Size of Export Instrument (2014 - 2008)	312	2.807587	3.242161	-9.3267	11.53089
Size of Import Instrument (2014 - 2008)	312	1.855099	2.42526	-6.51174	12.09908
Political Instability (2014)	313	3.063898	1.124782	0	4
Corruption (2014 - 2008)	313	0.1341853	2.203119	-4	4
Access to Finance (2014 - 2008)	187	0.2673797	2.158543	-4	4
Judicial Efficiency (2014 - 2008)	249	0.248996	1.362757	-4	4
Informal Sector Competiton (2014 - 2008)	263	-0.3840304	2.154538	-4	4
Crime, Theft, and Disorder (2014 - 2008)	301	1.375415	1.749836	-4	4
Number of Firm Locations	311	1.327974	5.466185	0	73

Note: Total annual sales and costs are measured in Egyptian Pounds. The size of export and import sectors are measured in thousands of US dollars. The exogenous export and import instruments were constructed by taking the log of size of export and import sectors in 2014 and subtracting the log of the size of export and import sectors in 2008. Political instability, corruption, access to finance, judicial efficiency, informal sector competition, and crime are measured from a scale of 0 to 4. Access to finance, judicial efficiency, informal sector competition, and crime are also constructed by taking the difference from 2014 to 2008.

Table 2: Instrumental Variables First Stage Results

Instrumental Variables First Stage Results		
	Main Specification	**Alt. Specification**
	Economic Performance	**Economic Performance**
Exports	0.0272	
	(0.0321)	
Imports	-0.0116	
	(0.0420)	
Oil		0.499
		(0.657)
Observations	269	269
F-Test (2, 266)	0.36	
F-Test (1, 267)		0.58
Standard Errors in Parentheses		
* p<0.05, ** p<0.01, *** p<0.001		

Note: Data provided by the World Bank Enterprise Surveys and International Trade Centre (ITC). Economic performance is the variable constructed using the principle component analysis using annual sales, costs, and workers from 2008 and 2014.

Table 3: Instrumental Variables and Ordinary Least Squares Regression Results

Instrumental Variables Second Stage and Ordinary Least Squares Regression Results

	I. IV 2SLS Corruption	II. IV 2SLS Corruption	III. IV 2SLS Corruption	IV. OLS Corruption	V. OLS Corruption	VI. OLS Corruption
Economic Performance	-0.380	-1.084	-0.716	0.027	0.087	-0.061
	(1.726)	(1.639)	(1.109)	(0.109)	(0.076)	(0.096)
Judicial Efficiency		0.096	0.042		0.008	0.052
		(0.181)	(0.107)		(0.09)	(0.091)
Crime, Theft, and Disorder		0.405*	0.446**		0.335***	0.379***
		(0.177)	(0.170)		(0.093)	(0.096)
Finance		0.301*	0.165		0.288***	0.205*
		(0.127)	(0.115)		(0.082)	(0.087)
Government Interaction		0.013	0.004		0.010	0.006
		(0.010)	(0.009)		(0.008)	(0.008)
Informal Sector Competition		0.399**	0.262*		0.348***	0.299***
		(0.129)	(0.103)		(0.082)	(0.083)
Political Instability		0.075	0.027		0.354*	0.271
		(0.686)	(0.487)		(0.154)	(0.159)
Legal Status			0.0840			0.011
			(0.124)			(0.014)
Arabic Ownership			-0.012			-0.004
			(0.022)			(0.012)
Domestic Ownership			-0.028			-0.020*
			(0.0175)			(0.008)
Foreign Ownership			-0.014			-0.027**
			(0.0284)			(0.009)
Number of Locations			0.0762*			0.061**
			(0.0307)			(0.022)
Observations	269	101	100	269	101	100
Adjusted R Squared			0.361	-0.003	0.457	0.491

Standard Errors in Parentheses

* p<0.05, ** p<0.01, *** p<0.001

Note: Data provided by the World Bank Enterprise Surveys and the International Trade Centre (ITC)

Table 4: Instrumental Variables First Stage Results (Extension for Robustness)

Instrumental Variables First Stage Results (Extension)	
	Robustness Extension Economic Performance
Export Dummy * Export Instrument	0.201***
	(0.0449)
Observations	269
F-Test (1, 267)	20.05

Standard Errors in Parentheses

* p<0.05, ** p<0.01, *** p<0.001

Note: Interaction created by using a dummy variable (1 if firm saw increased direct exports, 0 if otherwise) and interacted using the exogenous export instrument using data provided by the ITC

Table 5: Instrumental Variables Second Stage Results (Extension for Robustness)

Extensions for Robustness
Instrumental Variables Second Stage Regression Results

	I. IV 2SLS Corruption	II. IV 2SLS Corruption	III. IV 2SLS Corruption
Economic Performance	-0.0708	-0.771	-0.634
	(0.346)	(0.955)	(0.696)
Judicial Efficiency		-0.069	0.046
		(0.134)	(0.101)
Crime, Theft, and Disorder		0.386**	0.437***
		(0.126)	(0.115)
Finance		0.297**	0.170
		(0.109)	(0.100)
Government Interaction		0.012	0.004
		(0.01)	(0.009)
Informal Sector Competition		0.386**	0.267**
		(0.132)	(0.084)
Political Instability		0.0399	0.057
		(0.352)	(0.293)
Legal Status			0.075
			(0.079)
Arabic Ownership			-0.012
			(0.017)
Domestic Ownership			-0.027*
			(0.013)
Foreign Ownership			-0.015
			(0.023)
Number of Locations			0.074***
			(0.022)
Observations	269	101	100
Adjusted R Squared		0.093	0.466

Standard Errors in Parentheses
* p<0.05, ** p<0.01, *** p<0.001

Note: Second stage of IV 2SLS regression using interaction term as instrument.
Data provided by the World Bank Enterprise Surveys and the ITC

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