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**„Corruption and the Shadow Economy in the European Union from
2003-2012: A Structural Review of the Causes and Consequences“**

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ABSTRACT

This study employs a quantitative Structural Equation Model (SEM) approach with observed variables to test the relationship between the shadow economy and corruption in the 28 European Union countries. It differs from its predecessors, as it employs a recent and more specific dataset and applies a new approach to testing the interrelationship between the shadow economy and corruption and its determinants. Additionally, the primary focus is to assess the possible causes and consequences of corruption and the shadow economy in the European Union, and to test their interrelationship. Moreover, unlike previous studies this research utilizes clustered standard errors to account for correlated errors within countries for a more reliable analysis and the full maximum likelihood estimation procedure. The results highlight that the shadow economy reduces the level of corruption in the EU, while corruption increases the size of the shadow economy. The chief contributor to growing corruption in the EU are high bureaucracy costs, in that governments are more stringent on their regulations (but not necessarily more effective), while the primary enabler of the shadow economy is the level of corruption itself followed by the tax burden partly measured by tax revenue.

Key Words: Shadow economy; Corruption; Structural Equation Modeling (SEM); European Union; Full Maximum likelihood Estimation; Clustered Standard Errors

ABSTRACT (IN GERMAN)

Diese Arbeit wendet das quantitative Strukturgleichungsmodell auf beobachtete Variable an, um die Beziehung zwischen der Schattenwirtschaft und der Korruption in den 28 Ländern der Europäischen Union zu untersuchen. Sie unterscheidet sich von ihren Vorgängern insofern, als sie aktuelle und spezifischere Datensätze heranzieht und einen neuen Ansatz zur Erforschung der Wechselbeziehung von Schattenwirtschaft und Korruption samt deren Determinanten verwendet. Der primäre Fokus ist zudem die Einschätzung möglicher Gründe und Konsequenzen von Korruption und Schattenwirtschaft in der Europäischen Union inklusive deren Wechselbeziehung. Des Weiteren verwendet diese Arbeit, anders als bisherige Studien, (1) geclusterte Standardfehler zur Erklärung von korrelierten Fehlern innerhalb der Länder, um eine Analyse mit hoher Reliabilität zu garantieren, und (2) die volle Maximum-Likelihood-Schätzung. Die Ergebnisse zeigen, dass die Schattenwirtschaft den Grad der Korruption in der EU reduziert, während die Korruption die Größe der Schattenwirtschaft erhöht. Die wichtigsten Determinanten der wachsenden Korruption innerhalb der EU sind hohe Bürokratiekosten, da Regierungen immer strikter (aber nicht notwendigerweise effektiver) bei ihren Regierungen werden. Gleichzeitig ist der primäre Faktor, der Schattenwirtschaft ermöglicht, der Grad der Korruption selbst, gefolgt von der zum Teil am Steuerertrag gemessenen Steuerbelastung.

Key Words: Schattenwirtschaft; Korruption; Strukturgleichungsmodell (SEM); Europäische Union; volle Maximum-Likelihood-Schätzung; geclusterte Standardfehler

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ABBREVIATIONS AND ACRONYMS

CDA:	Currency Demand Approach
CPI:	Corruption Perceptions Index
DV:	Dependent Variable
DYMIMIC:	Dynamic Multiple-Indicators Multiple Causes
EU:	European Union
FMLE:	Full Maximum Likelihood Estimation
ILO:	International Labour Organization
IV:	Independent Variable
MAR:	Missing at Random
MCAR:	Missing Completely at Random
MIMIC:	Multiple Indicators Multiple Causes
ML:	Maximum Likelihood
PA:	Path Analysis
SEM:	Structural Equation Modeling
SiEM:	Simultaneous Equation Modeling
TI:	Transparency International
UN:	United Nations
UNGP:	United Nations Global Programme
UNODC:	United Nations Office on Drugs and Crime

CHAPTER 1: INTRODUCTION

1.1 OVERVIEW

To date, the study of corruption and the shadow economy, as interrelated variables, has been neglected in the quantitative literature. By definition, both variables are intrinsically clandestine and problematic to quantify. Corruption, for one, mainly occurs behind closed doors and thus it is impossible to directly observe and verify. Additionally, what behavior that may be acceptable in one society, may be viewed as criminal behavior in another. To alleviate the difficulty of defining, measuring, and studying corruption, scholars have taken various approaches to synthesizing it into studies which often result in best-practice policy recommendations and has led to the proliferation of an entire field in academia in general, and in economics in particular. Likewise, the study of the shadow economy, and its many synonyms (black market, gray economy, etc.), has at best resulted in noble attempts at estimation. In recent decades, however, there has been a growing field in quantitative studies, which has confidently enumerated the shadow economy and shed insights into policy recommendations and best practices for policy makers and academics alike. Friedrich Schneider (1994; 2000; 2012) has been at the forefront of this and has advocated for a structural equation model (SEM) approach to quantifying and estimating the shadow economy, in particular its relation to its clandestine counterpart, corruption.

This thesis seeks to build upon the foundation Buehn and Schneider (2012) set in terms of the interrelationship between corruption and the shadow economy, and more importantly their causes and consequences. More specifically, by applying a new approach to Buehn and Schneider's (2012) typology to the case of the European Union (the 28 current member states, as of 2014), I seek to contribute to the every-growing literature on corruption and the shadow economy in terms of quantitative economic and econometric studies. Along the way I hope to shed insight on two of the most malicious forces facing modern states that has contributed to

stagnant economies, stalled growth, and the reproduction of underdevelopment around the world.

1.2 RESEARCH QUESTION

It can be confidently said that there does not exist a unified agreement on the relationship between the shadow economy and corruption and what true effect they have on all countries around the world. While all countries suffer some forms of corruption and exhibit shadow economies, the degree to which it affects the official economy and the state's ability to govern differs from country to country. While other studies have been conducted on particular countries and regions, I seek to conduct an analysis specifically into the European Union, which presents an interesting empirical study covering a wide range of economies. To truly understand the effect that corruption and the shadow economy have on the state, it is vital to understand how particular causes (independent variables) affect particular reactors (dependent variables), how those variables (corruption and the shadow economy in my case) affect particular outcomes, and what the interrelationship is between these variables. Accordingly, I present three overarching research questions to be answered through my case study:

- 1. What is the impact of particular causes on the shadow economy and corruption, respectively?**
- 2. What effects do the shadow economy and corruption, respectively, have on particular outcomes?**
- 3. What is the impact of corruption on the shadow economy and vice versa?**

In addition to these overarching research questions, I will seek to answer additional sub-research questions that provide insight into a deep relationship necessary for effective policy making. These questions delve into how particular causes (IVs) affect corruption and the shadow economy respectively, and how corruption and the shadow economy affect particular economic

factors. This is the core of my thesis and an integral part of the SEM approach. To see how these variables are incorporated in the SEM model framework, see **Figure 3**.

1.3 RELEVANCE OF STUDY: BUEHN AND SCHNEIDER'S TYPOLOGY

The study of the shadow economy and its interrelationship with corruption is of utmost importance in today's world. As mentioned, every single country in the world faces varying degrees of each phenomenon, whose synergy often creates a vicious cycle leading to economic stagnation and underdevelopment. It is imperative to study these variables, their relationship, and what their potential causes and consequences are. While studies have been conducted on a global scale, seldom has the case of the EU as a whole been looked at. With the European Union continuously expanding and moving towards a continental European organization above and beyond the current 28 member states, it is necessary to conduct such a study to avoid one size fits all policies. **Chapter 4** looks at the case of the European Union in depth, and in particular its relation to the shadow economy and corruption from a more qualitative perspective.

Buehn and Schneider (2012) served as a critical starting point for my study, in particular their use of SEM to delve into this complex relationship. They used the MIMIC method, whereby they applied the shadow economy and corruption as latent variables. To my knowledge, Schneider (1994; 2000; 2002; 2003; 2006; 2012) has replicated this study six times, in addition to other scholars who have replicated the study to particular regions, countries, and groupings of countries. The following sections provide a more in depth analysis into SEM and its characteristics.

1.4 CONTRIBUTION

My thesis seeks to build upon the ever-increasing literature on the analysis of the shadow economy, corruption, and their interrelationship. As far as my research has shown, no attempts have been made to treat the shadow economy and the level of corruption as *observed* variables. Since Schneider (1994; 2000; 2002; 2003; 2006; 2012) has created a way to quantify the shadow economy, which has been replicated and developed further by other studies, I will use those measures to apply the shadow economy as an observed variable. I will also use the Freedom from Corruption Index from Miller (2013) as a measure for corruption. This will allow me to apply the shadow economy and corruption as observed variables in my model, as opposed to latent variables.

To my knowledge, this will be the first study to apply the shadow economy and corruption as observed variables using the SEM approach to study their impacts, effects, and interrelationship. This is advantageous over previous studies, as the literature has expanded dramatically in the past decade, allowing us to visualize the shadow economy and corruption confidently and accordingly provide more reliable results. Another advantage of my method over Buehn and Schneider's (2012) is that I am using clustered standard errors to account for correlated errors within countries, leading to more consistent and applicable results. I will empirically test various hypotheses regarding the causes of both the shadow economy and corruption, and in addition their interrelationship, using the maximum likelihood estimation procedure. Furthermore, I am also looking at the consequences the shadow economy and corruption could have on various economic variables. Unlike the MIMIC approach that treats the shadow economy and corruption as latent variables, my method, once again, will allow for a more consistent and empirically confident study to be undertaken.

More specifically, I believe it is more suitable to use the total unemployment rate as a cause of the shadow economy instead of the male unemployment rate only, as Buehn and Schneider (2012) did in their analysis. My decision for this is simply based on the presence of

more modern cultural choices in the EU rather than those of the countries that Buehn and studied (which included underdeveloped and developing economies). Moreover, there is a plethora of information from the European Union and World Bank on this particular data set, so leaving it out would be negligible.

In addition to the abovementioned changes, I also used more direct measures for the shadow economy like tax and social security contributions, credit regulations, and labor regulations instead of the indirect measures that Buehn and Schneider (2012) used. Having more recent data and applying the simultaneous equations approach with clustered standard errors and using the full maximum likelihood estimation procedure, I am confident I can contribute greatly to the controversial shadow economy and corruption discussion, and pave the way for additional studies.

1.5 LIMITATIONS OF STUDY

As mentioned, corruption and the shadow economy are inherently clandestine phenomena. Consequently, any study looking into their relationship will encounter limitations, in particular with quantification. Since you cannot tangibly observe and enumerate the size of corruption and the shadow economy in any particular country, scholars must rely on proxy data. Regardless, the quantification of corruption and the shadow economy (See **Chapter 3**) has improved in recent decades, and scholars may now estimate their respective sizes confidently. Nonetheless, it is a vital part of academic integrity to note that these phenomena are not tangibly observables, and accordingly any results may present limitations.

Additionally, while scholars such as Buehn and Schneider (2012) conducted similar studies including massive data sets, my study will be a more controlled and limited study, focusing on the European Union. It is important to note that results will not generalize to the phenomenon on a global scale, but will be rather limited to the 28 EU member states. However,

the EU's economic diversity does present an excellent approach to delve into the interrelationship, causes and consequences of the two.

1.6 OUTLINE OF THESIS

The rest of the thesis will unfold as follows: **Chapter 2** will lay the foundation of the study, by underpinning the study with Andreas Buehn and Friedrich Schneider's SEM approach to the interrelationship between corruption and the shadow economy (2012). Most importantly I will lay out my methodology and model design, whereby I will discuss SEM along with the causes and consequences of corruption and the shadow economy. This will serve as the foundation of my thesis, and will provide the necessary framework to conduct my study. **Chapter 3** will serve as my literature review, whereby I will conduct a rigorous review of the variables of corruption and the shadow economy in addition to various outcome variables. Through this, I will uncover key definitions, phrases, and terms necessary for a thorough understanding of the concepts that will be discussed throughout the thesis. Next, **Chapter 4** will provide the contextualization to the overall study, by giving a brief overview of the case of the European Union, in particular with regards to corruption and the shadow economy. In **Chapter 5**, I will present the overall empirical analysis between corruption and the shadow economy in the European Union during the 2003-2012 period. I will provide the micro and macro data which I have chosen and have used for the model to ascertain if any relationship exists between the variables in the EU and what their impact is. Most important, I will present and interpret the results, discussing if the hypothesis have been confirmed, denied, or if they are unreliable. Additionally, I will discuss the implications of the results, the opening up of additional avenues for relevant research, and finally I will offer policy recommendations from a quantitative standpoint stance in regards to the fight against corruption and the shadow economy in general.

CHAPTER 2: METHODOLOGY, MODEL AND DESIGN

2.1 METHODOLOGY: MODEL AND DESIGN

In 2012, Friedrich Schneider (Department of Economics, Johannes Kepler University) developed a well-calculated method to estimate the shadow economy, and included an appendix where he estimated the shadow economy for 31 European and 5 other OECD countries between 2003 and 2012. The calculations were done using the Multiple Indicators and Multiple Causes (MIMIC) approach with the help of the Currency Demand Approach (CDA) for some countries. Between this and the corruption index taken from the “2013 Index of Economic Freedom Report” (Miller et al. 2013), it is possible to run this analysis without any latent variables. The main difference between my model and Buehn and Schneider’s (2012) model is that I am taking a structural only approach where there is no measurement model and no real indicators in the sense of how Buehn and Schneider (2012) used them. I essentially swapped out the indicators and latent variables and substituted the observed variables for the shadow economy and corruption instead. As mentioned, up to this point, the use of latent variables is found most in the literature, however due to the well-developed nature of the subject, I will test the relationship with observed variables.

In regards to my model, what I have are essentially eight regression equations, all threaded together in one “simultaneous equation”. In sum, one equation predicts the impact of exogenous variables on the shadow economy; one predicts the impact of exogenous variables on the level of corruption; three predict the impact of the shadow economy on three different outcomes; and three that predict the impact of corruption on three different outcomes. Aside from being able to see the relationships present in the model, the full maximum likelihood estimation procedure and clustered standard errors will be employed to make causal inferences and give insight into the consequences that corruption and the shadow economy pose to other economic factors.

When analyzing and graphing the data for the shadow economy and the level of corruption between 2003 and 2012, there exists a positive relationship between the two in the aggregate (See **Figure 5, Section 3.4**). This bivariate relationship is worthy at identifying correlations, but not causations. Thus, the relationship between the shadow economy and corruption is positive, but the graphs cannot explain whether the shadow economy causes corruption, corruption causes the shadow economy, or some other factor or factors are causing both of them. This study seeks to remedy this and explain their causation. To accomplish this, my SEM model will identify: 1) how much the shadow economy causes the level of corruption after partialing out the variance associated with common causes of corruption; and 2) how much the level of corruption causes the size of the shadow economy after partialing out the variance associated with common causes of the shadow economy. Specifically, Buehn and Schneider (2012) did not test hypotheses in regards to the overarching connection between corruption and the shadow economy. With my model and design in mind, and in regards to the relationship between my two main variables, I am able to hypothesize that¹:

Hypothesis 1: Increases in the level of corruption are corresponded with increases in the size of the shadow economy, *ceteris paribus*.

Hypothesis 2: Increases in the size of the shadow economy are corresponded with increases in the levels of corruption, *ceteris paribus*.

For definitions and a detailed overview of the literature regarding the shadow economy and corruption see **Chapter 3**.

2.2 STRUCTURAL EQUATION MODELING (SEM) WITH OBSERVED VARIABLES

Structural Equation Modeling (SEM) is a widely used statistical modeling technique in the social and behavioral sciences (Hox and Bechger 2007, 354). SEM, one of its many

¹ The following eleven hypotheses presented in this thesis, with minor alterations to some, as mentioned previously are based from Buehn and Schneider's (2012) research, to fit the case of my thesis specifically.

synonyms, is also often referred to as Simultaneous Equation Modeling (SiEM) (Fox 2006, 1) or Path Analysis (PA) (Kaplan 2001, 15215). Accordingly, the literature often uses these terms interchangeably. SEM is a broader form of PA, which was first developed by Sewall Wright in the 1920's and has since become what is perhaps the most powerful contribution in econometrics (Hausman 1983, 392). These models can be viewed as being an extension of multiple regression models because they deal with more complex and realistic models (Streiner 2005, 115).

The primary purpose of simultaneous equations is to look at reciprocal relationships, as I am doing in my analysis with the shadow economy and corruption. Specifically, contradictory to the traditional multivariate regression framework, the dependent variable in SEM (i.e. response variable) may appear as an independent variable (i.e. predictor variable) in another equation within that particular system of equations (Fox 2006, 1). It is precisely this reciprocal, or bi-directional, relationship that enables SEM to *infer* causal relationships (Gunzler 2013, 390). In the context of my research, it will allow me to test multiple variables and their impact on my dependent variables, net of other factors. Moreover, SEM allows for the testing of the reciprocal relationship between the shadow economy and corruption, which allows for a complex analysis into their directional influences or causal relations.

I will use Kaplan's (2000) definition of SEM to be defined as:

“...A class of methodologies that seeks to represent hypotheses about the means, variances, and covariances of observed data in terms of a smaller number of structural parameters defined by a hypothesized underlying conceptual or theoretical model.”

With this, a common misperception about SEM modeling is that if the model fits well, one can prove *causation* (Bollen 1989, 38). In the theoretical literature regarding SEM modeling, a debate has consequently emerged on whether SEM is able to prove causation, or merely suggest that there are particularly nuanced relationships. Specifically, a group of Bayesians spearheaded by Judea Pearl (2009) emphasize that you can represent causal associations in a SEM framework,

but the researcher needs to make certain assumptions before making any trusted conclusions about their particular analysis. On the contrary, orthodox philosophers of science tend to suggest that no cause can be proven, only dis-proven. Bollen (1989), for one, made it clear that it is impossible to know with certainty that one variable is a cause of another, and what SEM aims to do is merely *represent* causation. Further, he notes three components that make up a “cause”: 1) Isolation; 2) Association; and 3) Direction of influence (1989, 41). The most difficult component to fulfill is isolation, which is done through maintaining “control” variables within models. The idea is that if you account for all other spurious relationships (through control variables), you can conclude that a variable A implies (or causes) variable B. The way I am facilitating the research in my model is to simply look at the “impact” of my independent variable (x) on the dependent variable (y), net of other variables (x2, x3, etc.). Next in line of Bollen’s three components, association refers to the calculated covariance matrix, which may be the most simple to prove via mathematics. Finally, the direction of influence can often be established by using various statistical tests, which utilize automatic search procedures to identify directional influences amongst variables (Gates et al. 2010, 1118). Simply looking at established relationships through previous research could also do this.

Under the assumption that the model fits the data well, a better interpretation is that SEM helps determine if the *causal inferences* (i.e. hypotheses made by the researcher) are *consistent* with the data (Bollen 1989, 38). This still does not prove *causation*, but rather that the researchers assumptions for this specific model “*may be valid*” (39). I aim not to enter the debate on whether you are able to ascertain causation through this modeling, but instead will make the assumption that, if my data fits well, the causal inferences I make may be valid. Thus, I will employ a

Structural Equation Modeling approach with observed variables². Refer to **Section 2.7** for further information on the notation and empirical model.

2.3 CAUSES OF THE SHADOW ECONOMY: DEFINITIONS, DATA, AND HYPOTHESES

The literature on the shadow economy is particularly well defined in regards to the variables that impact the size of shadow economies around the world. Schneider (2009) conducted an extensive study looking at the literature and how prevalent those variables are in other studies on the shadow economy. His findings show that tax and social security contributions influence the size of the shadow economy on average by 35%-38% according to 12 general studies and at 45%-52% on average according to 22 empirical studies. Following the tax burden as a crucial factor in determining sizes of the shadow economy is the tax morale, quality of state institutions, and labor market regulations, amongst others. **Table 1** below summarizes Schneider's (2009) findings:

Table 1: Main Causes of the Increase of the Shadow Economy

<i>Variable</i>	<i>Influence on the shadow economy (in %)*</i>	
	<i>(a)</i>	<i>(b)</i>
Tax and social security contribution burdens	35–38	45–52
Quality of state institutions	10–12	12–17
Labour market regulation	7–9	7–9
Transfer payments	5–7	7–9
Public sector services	5–7	7–9
Tax morale	22–25	–
Influence of all factors	84–98	78–96

(a) Average values of 12 studies

(b) Average values of empirical results of 22 studies

*This is the normalised or standardised influence of the variable average over 12 studies (column a) and 22 studies (column b)

Source: Schneider (2009)

Source: Taken from Schneider and Williams (2013)

² Structural Equation Modeling (SEM) is a vast subject and includes many different sub-models and estimation procedures, most of which will not be discussed here due to limitations. Refer to Bollen (1989) for a more detailed explanation of the various methods.

Correspondingly, the main causes of the shadow economy that I am using in this analysis will be presented in more detail in the forthcoming section.

2.3.1 REGULATION

Burdensome regulations are widely believed to be one of the main drivers of the shadow economy, which force businesses and consumers to do work underground. Regulations may, for instance, often interfere with the freedom to do work in the official sector as businesses may try to avoid administrative and compliance costs (Friedman et al. 2000, 481). Additionally, individuals may find themselves trying to overcome low minimum wages and certain restrictions that hinder their entry for work in the official sectors.

One of the prime examples of burdensome business regulations is license regulation, which leads to increased costs and increased incentives for firms and individuals to move out of the official economy (Schneider 2006, 7; Singh, Jain-Chandra, Mohommad 2012, 8). Additionally, since firms may be required to provide health insurance and other labor related benefits, there may be an incentive to hire undeclared workers, thus contributing to the shadow economy (Singh, Jain-Chandra, Mohommad 2012, 8). Similarly, regulations may lead to high labor costs imposed on employers in the official economy, which consequently could lead to the shifting of the burden onto employees in the form of wage or benefit cuts (Schneider and Williams, 2013). Thus the consequences from burdensome regulations may cause individuals to pursue work in the unofficial economy, where the costs could entirely be avoided (Schneider and Williams, 2013).

In line with this reasoning, I am using extensive business, credit, and market regulations in my study to test and verify that those indeed do impact the shadow economy and to ascertain how robust this cause is on the shadow economy, in the case of the EU. To meet this goal, I will be adopting the index of business regulations, credit regulations, and labor regulations from the

Fraser Institute (Gwartney et al. 2014). This index is provided by the annual “*Economic Freedom of the World*” report and takes into account various different factors that are all averaged and contribute to a final index, which measures business regulation, credit regulation, and labor regulation (Gwartney et al. 2014, 6). A score from 1 to 10 is assessed, whereby a higher score indicates open markets, the avoidance of regulatory activities that hinder the entry of businesses into the market, and the avoidance of bias by providing certain businesses with rewards and not others (6). This leads me to the third hypothesis I will test in regards to the impact of regulations on the shadow economy:

Hypothesis 3: “The higher the intensity of regulation, the larger is the shadow economy, *ceteris paribus*” (Buehn and Schneider 2012, 179).

2.3.2 TAX BURDEN

A high tax burden caused by taxes and social security contributions is widely considered to be the largest contributor to the shadow economy (Schneider 2006, 6). A countries’ tax revenue and social security contributions make up the tax burden component of my thesis. When tax burdens are high, individuals have an incentive to work in the shadow economy because his/her net income (after taxes) will be higher than they would otherwise in the official economy. Accordingly, if the income from working in the shadow economy is higher than the income received in the official economy, the individual is more likely to stay in the shadow economy and supply their labor there. Consequently, the choice to move to the shadow economy is greatly impacted by the existence of a high tax burden or more specifically high tax rates and social security contributions (Buehn and Schneider 2012, 178). There are numerous theoretical and empirical studies that confirm that the main contributor to an increasing shadow economy is a high tax burden (Dell’Anno 2003, 9). Some of the empirical studies in line with this come from Giles and Tedds (2002), Schneider and Enste (2000), and Lippert and Walker (1997). In addition to this, Johnson et al. (1998a) believes that a high tax burden as well as regulation and

corruption, all play a significant role in the existence of the shadow economy (Dell’Anno 2003, 9)³.

For the purpose of my study I will impose that total tax revenues and social security contributions, taken from the World Bank (2014), make up the tax burden. Total tax revenues and social contributions are both measured as the percentage of official GDP. Buehn and Schneider (2012) were unfortunately restricted to using more indirect measures that determined the tax burden because of the lack of data available for the wide range of countries they were studying, which were composed of developing and underdeveloped countries. However, I was able to access the direct measures for 2003-2012 of all 28 EU countries through the World Bank. In regards to the tax burden and its relationship with the shadow economy, I will test that:

Hypothesis 4: “... the higher the burden caused by taxes and social security contributions, the larger the shadow economy, *ceteris paribus*” (Buehn and Schneider 2012, 178).

2.3.3 UNEMPLOYMENT RATE

Although few studies focus on the relationship of the unemployment rate and the shadow economy, I think it is a key nexus to investigate since it could be a large contributor to the size of the shadow economy from a macroeconomic standpoint. According to Okun’s Law,⁴ the output of an economy is negatively correlated with the unemployment rate. Therefore, as summarized in Wen and Mingyu’s (2012) short essay titled “Okun’s Law: A Meaningful Guide for Monetary Policy?”, when the growth rate of GDP positively impacts the shadow economy, it will consequently create a negative relationship between unemployment and the shadow economy. Bajada and Schneider (2009) argue that the unemployment rate moves opposite from movements of the official economy - if the official economy is booming then the unemployment rate tends to be lower, and if the official economy is shrinking then the unemployment rate tends

³ For an additional discussion into the causes of the shadow economy, in particular the theoretical and empirical studies into the issue, see **Chapter 3, Section 4**.

⁴ Okun’s Law states that the “total employment equals the labor force minus the unemployed, so there is a negative relationship between output and unemployment (conditional on the labor force)” Wen and Mingyu (2012).

to be higher (1035). In the latter case, the unemployed labor force may find refuge in the shadow economy and thus contributing to its growth. Giles and Tedds (2002) similarly believe this line of reasoning, since unemployed persons have more spare time than employed persons, whereby they are more likely to seek for work in the shadow economy. Thus, lower disposable income combined with cheaper goods and services available in the shadow economy, leads to a higher demand of those goods and services supplied in the shadow economy (Buehn and Schneider 2012, 179). All of this, consequently, would expand the shadow economy.

However, according to Buehn and Schneider (2012), one cannot exclude the possibility of a *positive* relationship that may prevail due to the fact that unemployed persons in the official economy will have less money and may not be able to buy goods and services in the unofficial economy (179). Although there exists a disconnect between contributing to the shadow economy by either working in it or buying goods and services from it, I essentially see both activities making up the shadow economy. It ultimately comes down to two opposing forces; the “income effect” and the “substitution effect” (Bajada and Schneider 2009, 1046-1049). The effect that dominates in the official sector will determine the relationship of the unemployment rate with the shadow economy. Since the relationship between unemployment and the shadow economy has been ambiguous in the literature thus far, I will hypothesize about their relationship. It is, nevertheless, important to study and I will accordingly delve into the data in an attempt to extrapolate a relationship in the EU.

2.4 CAUSES OF CORRUPTION: DEFINITIONS, DATA, AND HYPOTHESES

2.4.1 GOVERNMENT EFFECTIVENESS

Government effectiveness and the rule of law make up what can be described as the *political* causes of corruption. The effectiveness of governments and their abilities to fulfill their responsibilities to their citizens is a crucial driver of corruption. The ability to deliver quality

public services, effective social and economic policies, and maintain solid institutional frameworks all simultaneously work to minimize corruption and eliminate the need for individuals to seek to partake in corruption. For the purposes of my study, government effectiveness is defined as “capturing perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies” (Kaufmann 2009).

In addition to the ability to function efficiently and effectively, political systems also have a hand in the causes of corruption. For instance the degree of decentralization plays a critical role according to Shleifer and Vishny (1993), as decentralized governmental systems allow room for various agencies and departments to seek bribes (615). Shleifer and Vishny, along with Buehn and Schneider (2012), additionally emphasize the fact that political competition forces transparency and has a critical role to play in the minimization of corruption within governments.

2.4.2 RULE OF LAW

In addition to government effectiveness, the rule of law plays a critical role in making up the *political* determinants of corruption. It is defined by Kaufmann (2009) as “capturing perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.” Under this definition, the focus is on institutional frameworks to maintain societal, economic, and political stability. Once this stability is present in countries along with strong judicial systems and legal frameworks, it allows for the market to operate and minimizes individuals’ incentives to partake in activities equating to corruption.

In line with this, according to Traisman (2000, 404), one of the main causes of corruption is a weak judicial framework in which individuals can operate without impunity. In democratic, open political systems with solid rule of law frameworks, individuals have a very low incentive to partake in corrupt activities, as the likelihood of being caught and punished is very high. Paldam (2003) comes to a similar conclusion, noting that corruption is lower in democratic societies, which place high values on the rule of law and accordingly guarantee property rights and equitable law enforcement. Thus, political determinants of corruption have a critical role to play in the prevalence of corruption within countries. Accordingly, I will test that:

Hypothesis 5: “The lower the quality of the political system and policy formulation and the lower the respect for the rule of law, the higher is the level of corruption, *ceteris paribus*” (Buehn and Schneider 2012, 181).

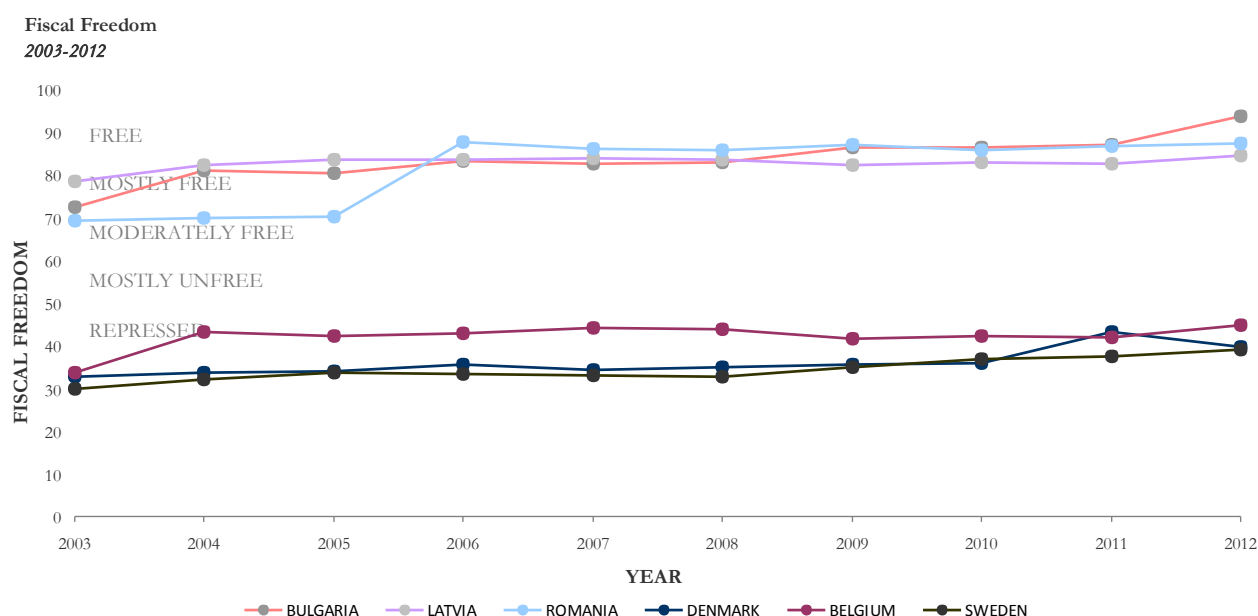
2.4.3 FISCAL FREEDOM

When governments impose a high fiscal burden on individuals and businesses, it may have an influence on corruption. Therefore, I used fiscal freedom as a cause of the level of corruption as it is a measure of the fiscal burden imposed by governments on individuals and businesses (Miller et al. 2013). The Heritage Foundation takes three quantitative factors into account and combines them to calculate a weighted final score based on a 100-point scale. The three factors taken into account for the final score are the “top marginal tax rate on individual income”, “the top marginal tax rate on corporate income”, and “the total tax burden as a percentage of GDP” (Miller et al. 2013, 479).

When fiscal freedom is high, businesses and individuals have more freedom to distribute their income however they choose, which consequently could increase the level of corruption. They may, theoretically, decide to use their income to bribe officials, which accordingly creates an avenue to use the additional income illicitly, instead of giving it to the government for taxes. An individual or business may be more inclined to use that additional income to bribe bureaucrats or government officials, thus contributing to the level of corruption. The data

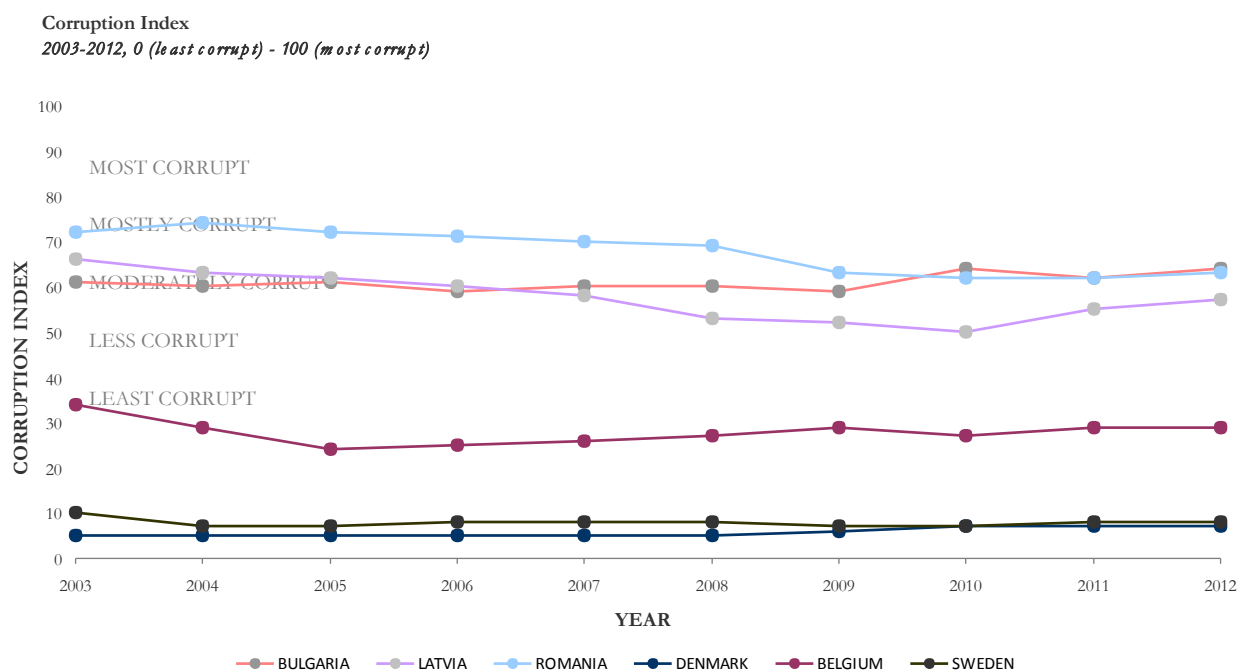
present highlights that higher fiscal freedom is typically present in lower-income countries, which may provide an empirical explanation for the increase in corruption. Bulgaria, Latvia, and Romania, for example, are amongst the newer EU countries and not considered to be between the higher-income countries, yet all three have scored fairly high on the fiscal freedom component (lower fiscal burden) over the last ten years. At the same time, they rank high on the corruption index. Denmark, Belgium, and Sweden, on the contrary, who are some of the higher-income countries in the EU scored very low on the fiscal freedom index (high fiscal burden), yet are amongst the cleanest in the corruption index. **Figure 1** and **figure 2** underscore this connection between levels of fiscal freedom and levels of corruption:

Figure 1: Fiscal Freedom Score: Bulgaria, Latvia, Romania, Denmark, Belgium, Sweden



Source: Data taken from Miller et al. (2013), chart author's rendition

Figure 2: Corruption Index: Bulgaria, Latvia, Romania, Denmark, Belgium, Sweden



Source: Data taken from Miller et al. (2013), chart author's rendition

According to the corruption perceptions index supplied by Transparency International, Bulgaria, Latvia, and Romania are seen as being moderately corrupt. At the same time, Denmark, Belgium, and Sweden are ranked as being some of the cleanest countries in the world. It is important to note that the arguments presented above are theoretically viable, yet it cannot be ruled out that fiscal freedom is directly contributing to the lower or higher corruption index as there exists no empirical evidence suggesting the latter. This brings me to believe that the lack of empirical evidence present in the literature, provides a significantly ambiguous relationship and accordingly I cannot hypothesize one way or the other.

2.4.4 BUREAUCRACY COSTS

I take bureaucracy costs as a causal variable of the level of corruption because higher bureaucracy costs mean that a government is more stringent on their regulations. On the contrary, it does not mean that they are necessarily more efficient, which in turn could make

bribery seem as an appealing strategy for an individuals' private gain. Since bureaucracy costs measure the stringency of standards on products or services, energy, as well as other regulations, high bureaucracy costs would entail stricter regulations and quality of products or services (Gwartney et al. 2014, 242). For instance an entrepreneur might seek to skirt particular regulations, which further incentivizes them to collude with corrupt authorities and bypass the regulations of the official economy.

For the purposes of this thesis, I will be adopting the Index of Bureaucracy costs from the Fraser Institute. This index is provided by an annual Economic Freedom of the World report and is based on the Global Competitiveness Report question, which was instituted by the World Economic Forum: "Standards on product/service quality, energy and other regulations (outside environmental regulations) in your country are: (1 = Lax or non-existent, 7 = among the world's most stringent)" (Gwartney et al. 2014). The sixth hypothesis I will test is as follows:

Hypothesis 6: The higher bureaucracy costs – i.e. “the higher the level of government interference – the higher is the level of corruption, *ceteris paribus*” (Buehn and Schneider 2012, 182).

2.5 EFFECTS OF THE SHADOW ECONOMY: DEFINITIONS AND DATA

In addition to the causal variables discussed in the preceding section, the following section attempts to provide some insight on possible relationships the shadow economy may have on certain economic factors. The economic factors that I take into account here are growth rate of real GDP, labor force participation rate, and the ratio of money supply 0 (M0) to money supply 1 (M1). Although this is not the main focus of my analysis, I would like to provide some intuition on the impact of the shadow economy on these three outcome variables, as economists may find their relationship intriguing.

2.5.1 GROWTH RATE OF GDP

Since the supply of goods and services amongst other activities in the shadow economy are not accounted for in the GDP of the official economy, it is natural to believe that there exists a negative relationship between the shadow economy and the growth rate of real GDP. Buehn and Schneider (2012) concur with this notion and tested it in their study. However, it is my belief, that there exists a positive relationship between the shadow economy and real GDP growth. It is likely that some income earned in the shadow economy will be spent in the official economy and thus contributing to the GDP in the official economy. Another reasoning is that since entry costs in the shadow economy are low and the enforcement of taxes is non-existent, entrepreneurs may have an increased demand for shadow economy activities and furthermore spend their untaxed income in the official economy. Through an empirical analysis done by Schneider and Enste (2000) it is believed that at least 75% of income earned in the shadow economy is spent in the official sector. The growth rate of real GDP, calculated as annual percentage, is taken from the World Bank for the year 2003-2012 for the EU. I hypothesize as follows:

Hypothesis 7: As the shadow economy grows (increases in size), the official growth rate of real GDP will accordingly increase, *ceteris paribus*.

2.5.2 LABOR FORCE PARTICIPATION RATE

Another interesting relationship to test is how the shadow economy impacts the labor force participation rate. Unfortunately, there is no unified agreement in the literature as to what the relationship between the labor force participation rate and the shadow economy is. I believe, however, it is worthwhile to test it in the case of the European Union, as it could give some insight into possible policy changes to avoid high participation in the shadow economy. Due to the ambiguity and lack of theoretical and empirical evidence provided in the literature, I will not form a hypothesis about the labor force participation rate. The labor force participation rate

calculated as percentage of total population ages 15 and up, is taken from the World Bank for the year 2003-2012 in the EU.

2.5.3 RATIO OF M0 TO M1

Since some activities in the shadow economy are deemed as illegal, transactions will typically be done in cash for the safety and security of all parties involved (Buehn and Schneider 2012, 180). In order to test the impact of the shadow economy on the amount of cash circulation, I take into account the ratio of M0 to M1. According to the definition from the World Bank (2015), M0, also known as quasi money, refers to “time, savings, and foreign currency deposits of resident sectors other than the central government” while M1 is the “sum of currency outside banks and demand deposits other than those of central government” (World Bank). The ratio of M0 to M1 thus reflects the percentage of cash that circulates in the official economy. Hence, the more activities that take place in the shadow economy, the more cash circulates in the official sector. I will test that:

Hypothesis 8: “The larger the shadow economy, the more cash circulates, *ceteris paribus*” (Buehn and Schneider 2012, 180).

2.6 EFFECTS OF CORRUPTION: DEFINITIONS, DATA, AND HYPOTHESES

It is hardly disputable that corruption is most commonly seen as a distinguishing characteristic in poorer countries rather than richer ones (Paldam 2002, 220). When fraud, embezzlement, and bribery prevail it disrupts the economic development of a country and hence could be one of the main contributors for a stagnating nation, leading to a vicious circle of underdevelopment. To delve into the economic-political-corruption nexus, I will investigate the impact that the level of corruption has on GDP per capita, bribery, and judicial independence.

2.6.1 GDP PER CAPITA

According to Paldam (2002), the level of corruption has a tendency to shift from being fairly high in low-income countries to declining when going through the transition phase into becoming a high-income country. Since governments in low-income countries may not be as effective and anti-corruption policies may not be implemented, the level of corruption will increase. This could be due to cultural and social differences as individuals or businesses from poorer countries do not deem activities that contribute to corruption as being morally wrong or because of low accountability (lack of the implementation of rules and regulations) (Paldam 2002).

All things considered, the level of economic development will be lower in those countries where corruption is high. It is critical to note that the EU is not a solitary example of high-income countries, but rather there exists inequalities between countries. For example, based on World Bank data, 11 of the 28 EU countries have an income of less than €20,000 per year (Slovakia, Greece, Portugal, Lithuania, Estonia, Poland, Latvia, Hungary, Croatia, Romania, and Bulgaria – in order from richest to poorest). At the same time, they rank higher on the corruption index as opposed to their high-income EU counterparts. Accordingly, I will assess whether there exists a negative relationship between corruption and low economic development in the EU.

Hypothesis 9: “The higher the level of corruption, the lower the level of economic development – as measured by per capita GDP, *ceteris paribus*” (Buehn and Schneider 2012, 182).

2.6.2 INDEX OF BRIBES, EXTRA PAYMENTS & FAVORITISM

Bribery and corruption are obvious complements as it is by definition believed to be one of the primary activities contributing to a high level of corruption. To measure the level of bribery, the Fraser Institute developed an index of bribes, extra payments, and favoritism. It was

derived from the World Economic Forum, *Global Competitiveness Report* from answers to three questions:

“In your industry, how commonly would you estimate that firms make undocumented extra payments or bribes?”; “Do illegal payments aimed at influencing government policies, laws or regulations have an impact on companies in your country?”; “To what extent do government officials in your country show favoritism to well-connected firms and individuals when deciding upon policies and contracts?” (Gwartney et al. 2014, 243)

The responses to the three questions above were aggregated and weighted into one index where a low score indicates a high level of bribery and a low score indicates a low level of bribery.

Hypothesis 10: Increases in the level of corruption are corresponded with higher levels of bribery, *ceteris paribus*.

2.6.3 JUDICIAL DEPENDENCE

The last outcome variable that will be tested against the impact of a high corruption level is how dependent a countries’ judiciary is. When a countries’ judiciary system does not have much power to enforce laws or resolve certain disputes, this could be due to widespread corruption and bribery seeking/taking, which erodes the system. Appropriately, I will test the nexus between judicial dependence and level of corruption, from which I will be using an index developed by the Fraser Institute to measure how independent a countries’ judicial system is. This index was derived from the World Economic Forum from the answers to the *Global Competitiveness Report* question: “Is the judiciary in your country independent from political influences of members of government, citizens, or firms?” (Gwartney et al. 2014, 233). A low score indicates that the judiciary in the respective country is heavily dependent and a high score indicated that the judiciary is independent from individuals, businesses, or members of

government. In response to the *Global Competitiveness Report* as presented above, I hypothesize as follows:

Hypothesis 11: Increases in the level of corruption are corresponded with dependence of the judiciary on “political influences of government officials, citizens, or firms” (Gwartney et al. 2014, 233), *ceteris paribus*.

Table 2 and **Table 3** present a synthesis of the aforementioned hypotheses and their predicted relationships. For a detailed description of the overall interrelationship between corruption and the shadow economy, see **Chapter 3**:

Table 2: Summary of Hypotheses for the Shadow Economy

Dependent Variables	Hypothesis	Relationship
Shadow Economy	Increases in the level of corruption are corresponded with increases in the size of the shadow economy , <i>ceteris paribus</i> .	+
	“The higher the intensity of regulation, the larger is the shadow economy , <i>ceteris paribus</i> ” (Buehn and Schneider 2012, 179).	+
	“... the higher the burden caused by taxes and social security contributions, the larger the shadow economy , <i>ceteris paribus</i> ” (Buehn and Schneider 2012, 178).	+
GDP Growth	As the shadow economy grows (increases in size), the official growth rate of real GDP will accordingly increase, <i>ceteris paribus</i> .	+
Ratio M0/M1	“The larger the shadow economy, the more cash circulates , <i>ceteris paribus</i> ” (Buehn and Schneider 2012, 180).	+

Table 3: Summary of Hypotheses for Corruption

Dependent Variables	Hypothesis	Relationship
Corruption	Increases in the size of the shadow economy are corresponded with increases in the levels of corruption , <i>ceteris paribus</i> .	+
	“The lower the quality of the political system and policy formulation and the lower the respect for the rule of law, the higher is the level of corruption , <i>ceteris paribus</i> ” (Buehn and Schneider 2012, 181).	-
	The higher bureaucracy costs – i.e. “the higher the level of government interference – the higher is the level of corruption , <i>ceteris paribus</i> ” (Buehn and Schneider 2012, 182).	+
Real GDP per Capita	“The higher the level of corruption, the lower the level of economic development – as measured by per capita GDP , <i>ceteris paribus</i> ” (Buehn and Schneider 2012, 182).	-
Index of Bribes, Extra Payments, & Favoritism	Increases in the level of corruption are corresponded with higher levels of bribery , <i>ceteris paribus</i> .	+
Judicial Dependence	Increases in the level of corruption are corresponded with dependence of the judiciary on “political influences of government officials, citizens, or firms” (Gwartney et al. 2014, 233), <i>ceteris paribus</i> .	+

2.7 EMPIRICAL MODEL: MODEL SPECIFICATION AND NOTATION

For the purpose of my thesis, in the following two pages, I am using Bollen’s (1989) notation and model specification of SEM models with observed variables. Structural Equation Models are often simplified in matrix notation, so accordingly please refer to the **Appendix** for my model written in matrix form. I will begin this section with the fundamental and most general assumption that holds for Structural Equation Models, which is that the “covariance matrix of observed variables is a function of a set of parameters” (Bollen 1989, 1). The covariance matrix would be produced only if the model were correct and if the parameters were known (1). The equation that validates this hypothesis is:

$$\Sigma = \Sigma(\theta)$$

where Σ is the population covariance matrix of observed variables, and θ is a vector that contains the model parameters (1). It follows that $\Sigma(\theta)$ is the covariance matrix written as a

function of the model parameters (2). A general representation of structural equations with observed variables is⁵:

$$y = \mathbf{B}y + \mathbf{\Gamma}x + \xi$$

whereby:

$\mathbf{B} = m \times m$ coefficient matrix

$\mathbf{\Gamma} = m \times n$ coefficient matrix

$y = p \times 1$ vector of endogenous variables

$x = q \times 1$ vector of exogenous variables

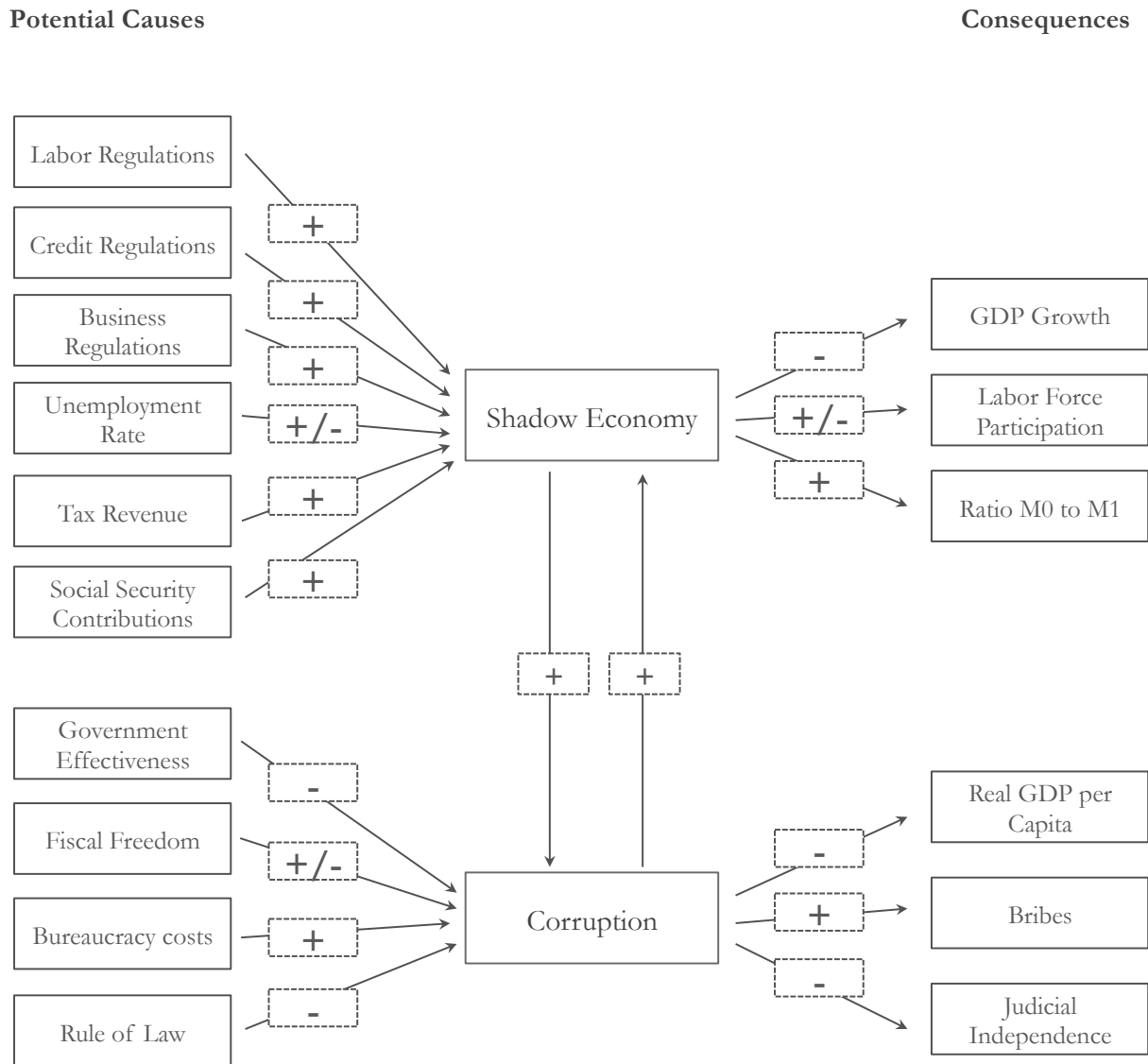
$\xi = p \times 1$ vector of random errors in the relationships between y 's and x 's

Note: Errors are uncorrelated with x

Additionally, Structural Equation Models are often represented with a *path diagram* for a visual representation of the relationship between the dependent variables and their relation to a particular set of causes and consequences. Since I prefer to write my model out in mathematical equations I will first present the model through a *path diagram*, which aims to visualize the hypothesized directions between the independent and dependent variables as seen in **Figure 3**:

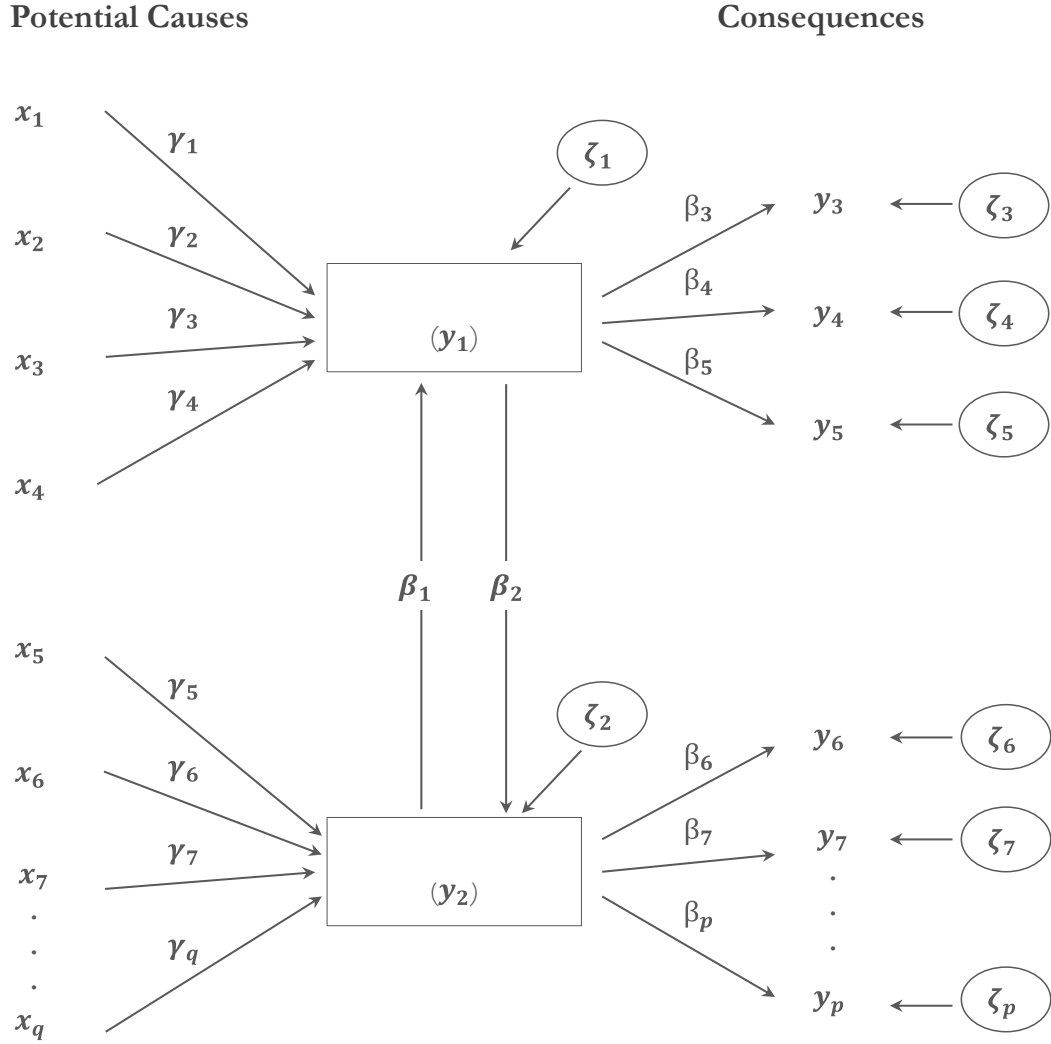
⁵ Please refer to Kenneth A. Bollen, "Structural Equations with Latent Variables" (1989), chapter 4, for a detailed explanation on the notation for a model with observed variables.

Figure 3: Path Diagram of Baseline Model



In a general context, a path diagram as a mathematical representation can be found in **Figure 4** below. One-headed arrows ($\rightarrow$) indicate direct effects and two one-headed arrows going opposite directions ($\uparrow\downarrow$) indicate reciprocal effects. The observed variables are found enclosed in the larger squares whereby the smaller dotted squares indicate the expected signs of my hypothesized relationship. Disturbance terms are portrayed in oval figures.

Figure 4: Path Diagram in Mathematical Form



Source: Buehn and Schneider (2012, 177)

Next, I will use the path diagram to write eight regression equations that play a crucial part when estimating the model. Correspondingly, the **figure 3** from above, with the help of **figure 4**, can be translated into eight formal simultaneous equations as:

$$(1): \quad \mathcal{Y}_1 = \gamma_{11}\mathcal{X}_1 + \gamma_{12}\mathcal{X}_2 + \gamma_{13}\mathcal{X}_3 + \gamma_{14}\mathcal{X}_4 + \gamma_{15}\mathcal{X}_5 + \gamma_{16}\mathcal{X}_6 + \beta_{12}\mathcal{Y}_2 + \varsigma_1$$

$$(2): \quad \mathcal{Y}_2 = \gamma_{27}\mathcal{X}_7 + \gamma_{28}\mathcal{X}_8 + \gamma_{29}\mathcal{X}_9 + \gamma_{210}\mathcal{X}_{10} + \beta_{21}\mathcal{Y}_1 + \varsigma_2$$

$$(3): \quad \mathcal{Y}_3 = \beta_{31}\mathcal{Y}_1 + \varsigma_3$$

$$(4): \quad \mathcal{Y}_4 = \beta_{41}\mathcal{Y}_1 + \varsigma_4$$

$$(5): \quad \mathcal{Y}_5 = \beta_{51}\mathcal{Y}_1 + \varsigma_5$$

$$(6): \quad \mathcal{Y}_6 = \beta_{62}\mathcal{Y}_2 + \varsigma_6$$

$$(7): \quad \mathcal{Y}_7 = \beta_{72}\mathcal{Y}_2 + \varsigma_7$$

$$(8): \quad \mathcal{Y}_8 = \beta_{82}\mathcal{Y}_2 + \varsigma_8$$

where

$\mathcal{X}_1, \mathcal{X}_2, \dots, \mathcal{X}_{10}$ - Observable exogenous causes (i.e. predictors)

$\mathcal{Y}_1, \mathcal{Y}_2, \dots, \mathcal{Y}_8$ - Observable endogenous outcome variables (i.e. effects)

Structural parameters relating an endogenous variable to an exogenous variables by γ 's :

$\gamma_{11}, \gamma_{12}, \gamma_{13}, \gamma_{14}, \gamma_{15}, \gamma_{16}$ - Structural parameters for endogenous variable $\mathcal{Y}_1$

$\gamma_{27}, \gamma_{28}, \gamma_{29}, \gamma_{210}$ - Structural parameters for endogenous variable $\mathcal{Y}_2$

Structural parameters relating one endogenous variable to another endogenous variable by β 's :

$\beta_{i,j}$ - Structural parameter relating one endogenous variable to another, where $i \neq j$

$\varsigma_1, \varsigma_2, \dots, \varsigma_8$ - Disturbances

2.8 ESTIMATION PROCEDURE

In this section I will introduce the methods that will be deployed to estimate my simultaneous equations model and attempt to delve into some basic details about each method. Although there are many different statistical methods presented in all of the literature on estimation procedures, I believe that the most appropriate procedure to use in this case is full maximum likelihood estimation using clustered standard errors.

2.8.1 FULL MAXIMUM LIKELIHOOD ESTIMATION (FMLE)

Maximum likelihood estimators are not only flexible to use, but also the most common estimators presented much of the empirical works in terms of SEM (Quinn 2013, 1). Since the purpose of SEM is to tie a theoretical model to an empirical one, using maximum likelihood estimation is essential (Quinn 2013, 1). A full maximum likelihood estimation procedure (FMLE) estimates the means and covariance matrix of the entire model and for all variables involved (Allison 2002, 193).

It is important to note that since there is some missing data (very little, but nonetheless worth mentioning) in my model, using standard maximum likelihood techniques is the preferred method of estimation (Allison 2002, 194). Enders and Bandalos (2001) analyzed the performance of four missing data estimation techniques in structural equation models: Full information maximum likelihood, listwise deletion, pairwise deletion, and similar response pattern imputation. They examined the effects of three independent variables on four outcome variables (Enders and Bandalos 2001, 430). Enders and Bandalos (2001) were interested in convergence failures, parameter estimates bias, parameter estimate efficiency, and model goodness of fit using the aforementioned four estimation techniques. Their results indicated that full maximum likelihood estimation, by far, resulted in more superior results as point estimates were unbiased, efficient, and the process had an overall lower convergence failure rate compared to the other techniques (Enders and Bandalos 2001, 430).

Enders and Bandalos (2001), Enders (2006) and Rubin (1976) spent a great deal of time throughout their literature discussing the importance of the causes of the missing data. Crucially, it is important to adopt certain assumption about “how” the data is missing (Enders 2006, 428). According to Rubin (1976), data is either *missing at random (MAR)*, *missing completely at random (MCAR)* or *missing not at random (MNAR)*. In regards to my model, I can come to the conclusion that my data is **not** MNAR because that would mean that the data was analytically mishandled in some way leading it to be missing, which is not the case. MCAR is a strict assumption and rarely

used in practice because for data to be missing completely at random means that “missingness is unrelated to the observed data” (Enders 2006, 428) or in other words constitutes to planned randomization, and therefore is also not applicable in my analysis. I believe that the root cause of my missing data is a case of MAR, moreover, that the “probability of a missing value on variable x is unrelated to the values of x itself” (Enders 2006, 428). Utilizing the full maximum likelihood estimation technique when missing data is missing at random, the point estimates will be unbiased and more efficient than when using a different estimation technique (Enders and Bandalos 2001, 430; Enders 2006, 428).

To reiterate, the aim of this analysis is to estimate a linear model under the assumption that some data is missing at random. “The basic goal of FMLE is to identify the population parameter values that are most likely to have produced a particular sample of data” (Enders 2006, 429). The likelihood can be thought of as a probability, which measures the difference between each data parameter and the estimated parameters (Enders 2006, 429). Moreover, the key to FMLE estimation is the use of iterative algorithms that essentially test different values for the unknown parameters until they converge to a single set of parameters, which ultimately maximize the log likelihood function (Enders 2006, 429). I align with Enders’ (2006) simplified explanation that underscores what this means: “Parameters are found that produce the highest probability or ‘match’ the observed data”. It is important to note that the iterative algorithm that is being used in this case is the Newton-Raphson algorithm⁶.

In order to outline the key concepts of FMLE, in the following 3 pages I will introduce a simple model from Quinn (2013)⁷ that has a single outcome variable (y) for instance size of the

⁶ The proof for maximum likelihood is rigorous and it involves taking derivatives of the likelihood function. My thesis will not cover such a proof as it is merely a calculus review. The full technical explanation of ML is found in Allison (1987) “Estimation of Linear Models with Incomplete Data.”

⁷ Please refer to the lecture notes “Maximum Likelihood and Structural Models in Microeconometrics” by Simon Quinn (2013) for a detailed explanation for the following four pages of this thesis.

shadow economy and a single explanatory variable (x) for instance the level of corruption with a cross-section of N countries where $i = 0, \dots, N$.

$$y_i = \beta x_i + \varepsilon_i$$

There is a simple linear relationship between x and y and what we are interested in is estimating the β ⁸. In order to do that, a crucial is to make some assumptions about the true population probability distribution of the unobservable ε before one can use FMLE (this is not a requirement when using OLS). For simplicity (and this is also the case for the shadow economy and corruption model in this thesis), I will assume that ε has a normal distribution with mean 0 and variance σ^2 for all observations. In order to derive the $\hat{\beta}_{ML}$, we need to make a few more simplifying assumptions.

“Assumption 1: The unobservable ε , has an identical normal distribution with mean (μ) 0 and variance σ^2 .”

$$\varepsilon_i \sim N(0, \sigma^2)$$

Following the probability density function of the standard normal distribution, the p.d.f for ε is:

$$f(\varepsilon_i; 0, \sigma^2) = \frac{1}{\sqrt{2\pi\sigma^2}} \cdot \exp\left(-\frac{\varepsilon_i^2}{2\sigma^2}\right)$$

Furthermore,

“Assumption 2: The variables ε_i and x_i are independent.”

$$\varepsilon_i / x_i \sim N(0, \sigma^2)$$

⁸ Naturally, this linear model can be estimated with OLS as well, but for the purpose of demonstration in regards to FMLE, I will discuss the derivation of the maximum likelihood estimator.

This assumption is a strong one and states that everything affecting the shadow economy, apart from corruption, is independent of the level of corruption a country has.

“Assumption 3: The unobservable ε is independent between observations. That is, for any $i \neq j$, we would learn nothing about the probability of observing any particular value for ε_i if we could observe ε_j .”

$$\varepsilon_i / \varepsilon_j \sim N(0, \sigma^2)$$

This assumption leads me to the joint probability density function across multiple observations, which can be written as:

$$\begin{aligned} f(y_1, \dots, y_N | x_1, \dots, x_N; \beta, \sigma^2) &= f(y_1 | x_1; \beta, \sigma^2) \times f(y_2 | x_2; \beta, \sigma^2) \times \dots \times f(y_N | x_N; \beta, \sigma^2) \\ &= \prod_{i=1}^N f(y_i; x_i, \beta, \sigma^2) \\ &= \left(\frac{1}{\sqrt{2\pi\sigma^2}} \right)^N \cdot \prod_{i=1}^N \exp\left(-\frac{(y_i - \beta x_i)^2}{2\sigma^2} \right) \\ &\vdots \\ &= \left(2\pi\sigma^2 \right)^{-\frac{N}{2}} \cdot \exp\left(-\frac{\sum_{i=1}^N (y_i - \beta x_i)^2}{2\sigma^2} \right) \end{aligned}$$

9

Next, the likelihood function can be written as:

$$L(\beta, \sigma^2; y_1, \dots, y_N, x_1, \dots, x_N) = \left(2\pi\sigma^2 \right)^{-\frac{N}{2}} \cdot \exp\left(-\frac{\sum_{i=1}^N (y_i - \beta x_i)^2}{2\sigma^2} \right)$$

⁹ The intermediary step above consists of squaring out the denominator bringing the summation inside

Finally, in order to arrive to the estimator, I have to maximize this log likelihood function so

$\hat{\beta}_{ML}$ can now be written as:

$$\hat{\beta}_{ML} = \arg \max_{\beta} L(\beta, \sigma^2; y_1, \dots, y_N, x_1, \dots, x_N)$$

To restate, $\hat{\beta}_{ML}$ is the most likely value of β that maximizes the likelihood function given the data that has been observed. Since this maximization problem tends to get disordered, one can alternatively maximize any *monotonically* increasing function of $L(\cdot)$. Thus, since $L(\cdot)$ is a monotone increasing transformation and $L(\beta, \sigma^2; y_1, \dots, y_N, x_1, \dots, x_N) > 0$ the log-likelihood function can be written as:

$$\hat{\beta}_{ML} = \arg \max_{\beta} \ln L(\beta, \sigma^2; y_1, \dots, y_N, x_1, \dots, x_N)$$

After optimizing this function (differentiating with respect to β) we can find the global maximum, which is the optimal solution¹⁰.

Finally, as Quinn (2013) summarized, what FMLE does in general, and in the purpose of my SEM model:

1. Accepts a “likelihood function” specified by the author
2. Does some “limited checking” on this function
3. Chooses values that maximize this function of the relevant parameters using a clever algorithm (Newton-Raphson algorithm in my case) analytically rather than numerically as done above
4. “Estimates confidence intervals and performs hypothesis testing”

¹⁰ I can state that $\hat{\beta}_{ML}$ is the same as $\hat{\beta}_{OLS}$, which this is not a coincidence. Under the assumption that ε is taken from a normal distribution, OLS is a maximum likelihood estimator. Please refer to Quinn (2013, 7) for additional proofs and details.

2.8.2 CLUSTERED STANDARD ERRORS

When performing statistical inferences in regression models, it is important to make sure no assumptions are being violated. This includes, but is not limited to assumptions about the disturbance terms. In most empirical studies, much of the attention is focused towards the point estimates to ensure they are consistent and unbiased, and less effort is put towards making sure the standard errors obtained are accurate (Cameron and Miller 2013, 2). The basic assumption of a SEM is that each observation is independent from one another. In a simple form as usually assumed, $E[u_{ig} | x_{ig}] = 0$ where u_{ig} is the standard error and x_{ig} is a $K \times 1$ vector of non-stochastic (observable) independent variables, for individual (i.e. country in my case) i in cluster g (Cameron and Miller 2013, 5). It is crucial here to assume that errors are uncorrelated across clusters, while the errors are correlated within the clusters (Cameron and Miller 2013, 2). This means, $E[u_{ig}, u_{jg'} | x_{ig}, x_{jg'}] = 0$, unless $g = g'$ (Cameron and Miller 2013, 5).

This assumption is violated in a case where multiple data points actually are the same country, but in different years. It is understandable that observations, which share certain characteristics, such as geographical location, industry, occupation, or years, may share some unobservable characteristics that could result in the correlation of errors among them (Moulton 1990, 334; Moulton 1986, 385). To account for this problem, one can use “clustered standard errors” to make sure that the error structure is more accurate. Clustered standard errors account for violations of the independent and identically distributed assumption of the error terms (Cameron and Miller 2013, 2). As presented in the model for this thesis, data points are grouped into “clusters” (i.e. country clusters), and errors are correlated within clusters but not correlated across clusters (Cameron and Miller 2013, 2). Neglecting to control for the shared error within clusters may result in small standard errors, narrow confidence intervals, large t-statistics, and misleadingly low p-values (Cameron and Miller 2013, 2). According to empirical studies done by the UCLA: Statistical Consulting Group (2015), implementing the use of clustered standard

errors does not change the point estimates in a model. Packages in STATA have an easy way of applying these methods by simply using the *vc* (*cluster*) option (Cameron and Miller 2013, 3). To summarize, I am adjusting for the fact that many of the data points are from the same country and thus, share error. There is no need to run any diagnostics on this since I know *a priori* that they share commonalities from one year to the next, and thus have some common error.

CHAPTER 3: LITERATURE REVIEW & DEFINITIONS OF CORRUPTION AND THE SHADOW ECONOMY

3.1 INTRODUCTION

The following chapter will lay the foundation for the rest of this study by underpinning my empirical research with the current literature on corruption and the shadow economy. In particular, I will define the most important terminology and discuss various theoretical and empirical approaches to studying corruption and the shadow economy. As discussed in **Chapter 1**, I will build upon Andreas Buehn and Friedrich Schneider's (2012) groundbreaking approach to the relationship between the shadow economy and corruption and their causes, which is the typology I have retained for this thesis. I will then delve into the literature of studying and measuring corruption and the shadow economy as solitary variables, and finally both corruption and the shadow economy as interrelated variables.

3.2 CORRUPTION

3.2.1 DEFINING AND MEASURING CORRUPTION

Since corruption inherently occurs in a clandestine environment, it has not only been difficult to observe and quantify, but it has been just as difficult to solidify a universal definition of what *corruption* actually is. One of the underlying causes for this difficulty in nailing down a definition of corruption, according to Eugen Dimant (2013) is because what may be seen as unacceptable behavior in one society may be a part of everyday life in another (due to socialization and everyday norms). For this thesis, however, I will cast a wide net and adopt an overarching definition of corruption, in line with the United Nations' Global Programme against Corruption (2001). The EU has also adopted this definition in their legislation through their comprehensive 'EU Policy Against Corruption' (EUComm 2003, 317). In short, corruption can be defined as, "abuse of power for private gain" (Transparency International). This definition is

the most all-encompassing and covers various aspects of corruption, from bribery to high-level political corruption in the public sector. Under this open definition, there are two important facets to consider: (1) there is an aspect of rule breaking on the part of administrative or governmental officials for private gain; and (2) it occurs clandestinely (Serra and Wantchekon 2012, 1).

In regards to channeling corruption into measurable data, the most prevalent and frequently used approaches to quantifying corruption have been ‘perceptions’ indices. While Charles Sampford et al. (2006) examines various quantitative and social science approaches to measuring corruption, I will focus on the most common - Transparency International’s (TI) (2014) corruptions perceptions index (CPI). This popular and widely used index ranks countries on how corrupt their public sector is perceived to be by experts of that particular country. Through this widely used index, TI lays out the perceived level of corruption from a scale of 0 (highly corrupt) to 100 (not corrupt at all), allowing the quantification of countries’ corruption indices as compared to other countries. Similarly, the Freedom From Corruption Index developed in 1995 and published annually by the Heritage Foundation, combines TI’s CPI with other macro economic factors for an overall “*Index of Economic Freedom*” (Miller et al. 2013). In addition to the widely accepted definition of corruption, the Heritage Foundation notes that corruption itself erodes economic freedom by introducing insecurity and uncertainty into economic relationships which accordingly, the higher the level of corruption, the lower the level of overall economic freedom and the lower a country’s score (Miller et al. 2013, 478).

3.2.2 APPROACHES TO STUDYING CORRUPTION

Next, in terms of how corruption has been studied and what has been researched thus far, it is important to note that corruption as a core theme in academia has traditionally been regarded as a staple of political science, sociology, psychology and criminology and was

considered unmentionable in the realm of quantitative studies until the 1970s and 1980s (Abed and Gupta 2004, 3). At this time, Susan Rose-Ackerman (1975) broke through the mold and applied an economic study of corruption, which paved the way for the explosion of economic and quantitative corruption studies in the 1980s and onward. During these early years, most corruption studies focused on theoretical models, which sought to explain corruption through economic rational-actor models (Granovetter 1985). These studies not only looked at the economic behaviors of individuals and organizations involved in corruption, but also looked at what makes up the act of corruption itself. In terms of what determines and causes corruption, Tanzi (1998) distinguished direct and indirect factors, including variables that are central to this thesis, such as regulations and taxation that may hinder government and administrative efficiency (565). To add onto this, studies emerged that sought to tease out best-practice models out of corruption studies. In particular, Robert Klitgaard (1998) used the principal-agent-client framework to emphasize the ‘why, what, and how’ in understanding the phenomenon of corruption from a policy standpoint. In terms of factors that cause corruption, the literature is divided into three factors: Economic, legal, and social.¹¹ For the purpose of this thesis, I will focus economic factors, which are directly quantifiable and subject to a quantitative analysis, as I will present in subsequent chapters.

Quantitative studies into corruption exploded in the 1990s with the emergence of data sets and cross-country studies, which looked at proxies for corruption as consistent measures of corruption (Sequeira 2012, 148). In particular by those scholars focusing on international development, have also studied corruption as an inherent inhibitor to country development, economic growth, and as a factor that significantly undermines assistance programs (Heineman, Ben and Fritz Heimann 2006). In line with this, a debate in the corruption literature has emerged on whether corruption serves to *grease* or *sand* the wheels of economic growth, development, and

¹¹ For an extensive literature review on the determinants and causes of corruption, see: Eugen Dimant, “The Nature of Corruption: An Interdisciplinary Perspective” (2013).

investment.¹² The arguments of the group that advocate the former contend that corruption contributes to trade that otherwise may not take place due to overbearing regulations, especially in developing and underdeveloped countries - in particular by facilitating and overcoming the leviathan of state regulation (Leff 1964; Huntington 1968). This argument was confirmed by Daniel Levy (2007), who looked at the case of Georgia in the 1970s, and affirmed that corruption increased efficiency in the centrally planned Soviet Union (444). While there are few socialist and centrally planned economies around the world today, this argument could be applied to those developing and underdeveloped states in which corruption continues to be a burden on everyday life. On the contrary, opponents of the Leff-Huntington approach debate that corruption serves as *sand* in the economic machine, slowing it down and eroding it over time. Empirical studies in line with this show that corruption reduces investment (Rock and Ronnett 2004, 1010) especially in small countries that are more likely than not to be plagued by corruption. Additionally, Svensson (2005, 39) has declared that corruption erodes human capital accumulation thus contributing to economic deterioration and “severely retards development”. Despite two clear schools of thought on the relationship between development and growth, there is no clear consensus on which is the right view. Campos, Dimova, and Saleh (2010) note that corruption on its own is not enough to grease the wheels of growth, but the true relationship between the two, however, may be less negative than in prevailing literature.¹³

For the purpose of this study, I will deploy several different causes and analyze their effect on corruption, the dependent variable. Simultaneously, I will analyze the effect corruption, as an independent variable, has on various factors, which are relevant in the realm of economic academia.

¹² Although I only present a brief overview of this topic in the corruption literature, for a comprehensive review on this extensive and ongoing debate, see: “Whither Corruption? A Quantitative Survey of the Literature on Corruption and Growth” (2010).

¹³ Campos, Dimova, and Saleh (2010) conducted a rigorous analysis into the relationship between corruption and growth using data from 41 different econometric studies and aimed to unravel the discrepancy on whether corruption acts to *grease* or *sand* the wheels of economic growth.

3.3 SHADOW ECONOMY

3.3.1 DEFINITIONS AND ACTIVITIES IN THE SHADOW ECONOMY

The study of the shadow economy dates back to sociological and anthropological studies of the 1950s and remained a qualitative issue until the 1970s, when development economists made it an integral part of policy studies (Packard, Koettl, and Montenegro 2012, 3). During this time, the International Labour Organization (ILO) (International Labour Organization 1972) released a report on the informal economy in Kenya, which became the pivotal piece of work that spurred academic research into the subject.

Like corruption, defining, measuring, and analyzing the shadow economy has been elusive in quantitative academia. Wrangling a definition has been difficult, since there is very little agreement as to what the *shadow economy* actually is. The literature is littered with similar terminology (often times the issue comes down to semantics and scholarly preference), including terms such as the subterranean, gray, informal, unobserved, unreported, unrecorded, parallel, and black economies (Feige 1990). This opacity has turned some scholars off, leading Lisa Peattie (1987) to declare the *shadow economy* (and its synonyms) an exceedingly fuzzy concept.

Nonetheless, what definition you get depends on whom you ask and in which context. Smith (1997, 15) notes that the shadow economy is “market-based production of goods and services, whether legal or illegal, that escapes detection in the official estimates of the GDP.” To elaborate on this, Dell’Anno (2003) amongst others notes that the shadow economy includes all economic activities whereby the income bypasses official regulation, taxation, and observation¹⁴. While criminologists and other social scientists look at illegal and underground economic activities, such as drug trafficking, illegal weapons sales, and prostitution, the focus of this thesis will focus on *legal* goods and services, which are aimed at bypassing officials. According to Schneider (2006, 5), Buehn and Schneider (2012, 141), and Schneider and Williams (2013, 25)

¹⁴ Others that use this typology of the shadow economy include Feige (1989); Schneider (2005, 2007); Frey and Ommerehne (1984) and is widely regarded as the widest definition of the shadow economy.

this goal to bypass government regulation is aimed at avoiding payment of income or other taxes, to avoid the payment of social security contributions, or to avoid legal regulations amongst other things. This clear-cut definition, without the inclusion of *illegal* activities allows for the measurement and the assessment of its actual size. **Table 4** gives a general overview of the types of activities that can be seen in the shadow economy - both legal and illegal.

Table 4: Types of Shadow Economy Activities

	Monetary Transactions		Nonmonetary Transactions	
Illegal Activities	Trade in stolen goods; drug dealing and manufacturing; prostitution; gambling; smuggling and fraud.		Barter: drugs, stolen goods, smuggling, etc. Produce or growing drugs for own use. Theft for own use.	
	Tax Evasion	Tax Avoidance	Tax Evasion	Tax Avoidance
Legal Activities	Unreported income from self-employment; Wages, salaries and assets from unreported work related to legal services and goods	Employee discounts, fringe benefits	Barter of legal services and goods	All do-it-yourself work and neighbor help

Source: Typology taken from Mirus and Smith (1997, 5) with additional comments from Schneider and Williams (2013)

According to Schneider (2006, 5), these legal activities contribute by adding value to national economies but yet are not captured in the national accounts of any particular country. How commonplace these activities are, they are nonetheless susceptible to changes in the level of taxes for instance, which gives yet another reason why such a study is critical to conduct. **Table 5** offers examples explicitly on what is included in Schneider's (2006, 5) definition and what is left out of the model. In essence, this model includes all economic activities that would be reported and taxable by government authorities, yet leaves out 'classical criminal' activities (Schneider 2006, 5). Additionally, and importantly, the model also leaves out criminal acts such as tax fraud and tax evasion. The reasoning for this being, in line with Buehn and Schneider

(2012), that there is a plethora of research on tax avoidance, evasion, and fraud and its effects on official economies¹⁵.

Table 5: Examples of Activities in the Shadow Economy

<i>Activity</i>	<i>Inside or outside our measure of the shadow economy</i>	<i>Reason if outside</i>
Child-minding with income not declared	Inside	n/a
Selling drugs	Outside	Activity not legal
Paying builder cash, income not declared	Inside	n/a
Building work done by homeowner	Outside	Do-it-yourself activity not subject to tax or regulation
Purchase of cigarettes smuggled from EU country	Inside	n/a
Counterfeit production of an otherwise legal product such as cigarettes	Inside	n/a

Source: Schneider and Williams (2013, 27)

In relation to the shadow economy in the European Union in particular, it is important to underscore two critical aspects of activities that fit our definition: (1) undeclared work, such as off-the-books jobs conducted by individuals and/or work done ‘under the table’; and (2) under declared work, or work that underreports the actual value (an employer may make a deal with an employee of compensation larger than that reported to officials, to avoid a higher tax burden) (Williams and Windebank 2011, 177).

¹⁵ For a thorough study on tax evasion and the shadow economy, along with a model on tax evasion, see Sandmo (2012), “An Evasive Topic: Theorizing About the Hidden Economy” *International Tax and Public Finance*.

3.3.2 MEASURING AND STUDYING THE SHADOW ECONOMY

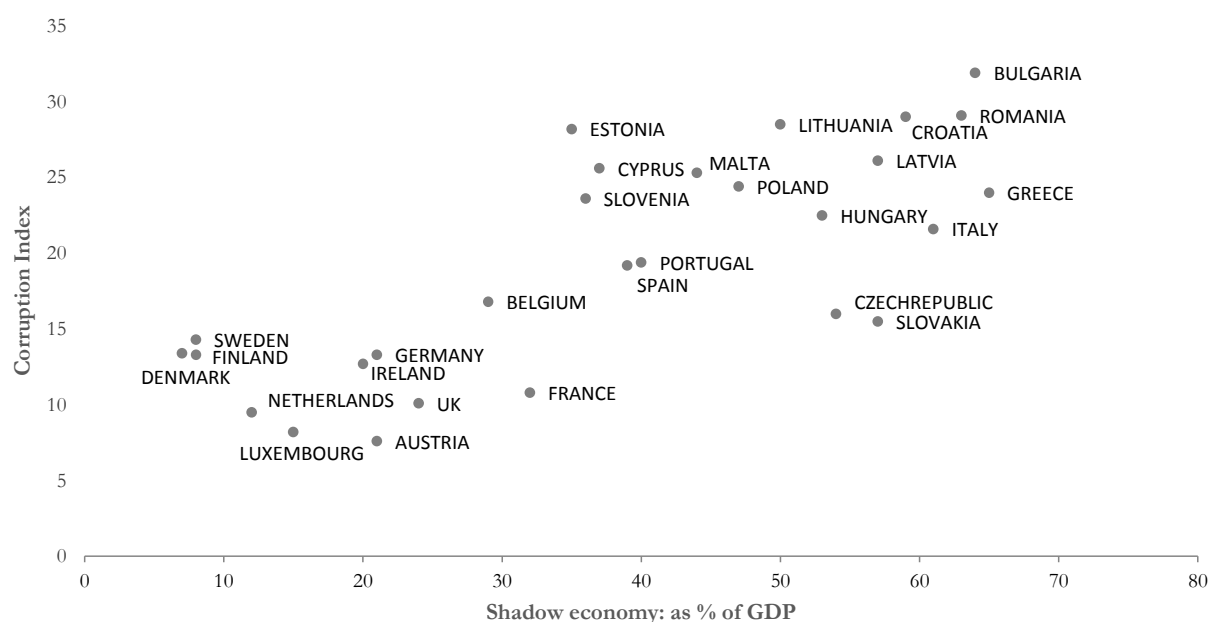
Clearly defining and conceptualizing the shadow economy allows for quantification and empirical studies to be conducted on the effects of the shadow economy. There is consensus that the ever-increasing shadow economy around the world has contributed to the erosion of tax and social security bases, thus directly hindering the provision of governmental services, leading to the driving of individuals further into the shadow economy. This vicious circle, accordingly, perpetuates the effects of the shadow economy making it ever more important to study, measure, and analyze the causes and effects of the shadow economy.

Since the shadow economy is inherently clandestine and cannot be directly observed, the earliest studies have focused on measuring its size (Schneider 1994). Succeeding studies have gone further, and aimed to extricate the causes and determinants of the shadow economy (Friedman 2000; Schneider 2000) amongst others. The most common approach to measuring the shadow economy have been the MIMIC and dynamic multiple-indicators multiple causes (DYMIMIC) methods (see Schneider 2004; 2006; 2012). Although the MIMIC and DYMIMIC approaches have been helpful in securing a measurement of shadow economies, I will be taking a slightly different approach (see **Chapter 1**, methodology). The reason for this, as explained in **Chapter 1**, is because through Schneider's (2004, 2006, 2012) typology and measurements, there *exists* an observable measurement of the shadow economy. Thus, I will apply a SEM approach, like Buehn and Schneider (2012), but will use corruption and the shadow economy as *observable* variables. The DYMIMIC and MIMIC approaches have been applied to various regions and groupings of countries of the world, but to date, however, no exclusive studies have been conducted on the European Union.

3.4 CORRUPTION AND THE SHADOW ECONOMY: AN INTERRELATIONSHIP

As emphasized in **Chapter 1** and in preceding sections, both corruption and the shadow economy plague all states regardless of developmental status. Accordingly, they often go hand-in-hand, and due to their natural complexities, it has been difficult to ascertain whether the shadow economy causes corruption or whether corruption causes the shadow economy. Accordingly, there is an ambiguous determination of whether corruption and the shadow economy are substitutes or complements. **Figure 5** below graphically represents the relationship in the European Union:

Figure 5: Relationship between the Shadow Economy and Corruption in 2012



Source: Data from Miller (2013) and the World Bank, graph author's rendition

The following section will look at the most widely referenced literature, both theoretical and empirical.

3.4.1 THEORETICAL APPROACHES

One of the first studies aimed at uncovering the relationship between corruption and the shadow economy looked at 15 transition countries and found that the shadow economy increases as corruption does as a consequence of a weak legal system and excessive regulations (Johnson et al. 1997). Consequently, corruption acts as a tax by creating a burden of having to adjust in the official economy, thus creating a strong incentive to work in the shadow economy instead. Similarly, Hindricks, Muthoo, and Keen (1999) also find a positive relationship through an analysis into tax activities. In their model, a tax inspector may seek bribes from tax payers in return of favorable declarations - If the taxpayer goes through with the bribe, they are thus acting in the shadow economy leading to a positive relationship between the two actives (421).

Choi and Thum (2005) on the contrary find a negative relationship between corruption and the shadow economy. Their findings are logical, as it notes that when businesspeople make the decision to work in the shadow economy, they take away the opportunity of corrupt bureaucrats to ask for bribes and thus distort the official economy (832). This in return decreases corruption. In addition to this, Dreher, Kotsogiannia, and McCorriston (2009) expand Choi and Thum's model, and analyze institutional quality. In essence, they confirm the aforementioned study by showing that corruption and the shadow economy are substitutes. On the other hand, they declare that while institutional quality decreases the shadow economy, there remains an ambiguous effect on corruption - Just because you have good quality institutions, does not mean that corruption is absent (792).

3.4.2 EMPIRICAL APPROACHES

As a consequence of the ambiguous relationship in the theoretical literature of the interrelationship between corruption and the shadow economy, numerous scholars have aimed at unscrambling this problem through empirical analyses. Johnson, Kaufmann, and Zoido-

Lobatón (1998a) and Johnson, Kaufmann, Zoido-Lobatón (1998b) analyzed OECD, Eastern European and former Soviet Union countries to find that corruption affects the shadow economy in a positive manner and taxation plays a lesser role than previously thought. Positive relationships were additionally found in Johnson et al. (2000) and Friedman et al. (2000). The latter study focused on discretion of the application of laws and rules as the main driving force pushing entrepreneurs into the shadow economy. In short, they emphasized that corruption and countries with poor institutions being associated with higher shadow economies. In a challenge to this finding, Friedman, Dreher and Schneider (2006) studied a cross-section of 120 countries and found that the relationship between corruption and the shadow economy is not unitary - They are substitutes in high-income countries and complements in low-income countries. In a synthesis of their argument, they note that people are more likely to bribe in order to operate in the official economy in high income countries (by facilitating contracts, business deals, etc.) while in low income countries firms have an incentive to operate in the shadow economy to hide from regulation and taxation (15). While the focus of my case study will be the EU (which are mostly high income countries), a mix between the *new* and *old* EU countries will make for an interesting test of this literature.

Due to this ever-replicating ambiguity of the precarious interrelationship between corruption and the shadow economy, I am aiming at contributing to efforts to disentangle the issue with an analysis into the EU. The foundation of this thesis, as mentioned, is Buehn and Schneider (2012) who found a robust mutual relationship between corruption and the shadow economy. While the relationship is robust, they noted that the positive effect of the shadow economy on corruption is stronger than the effect of corruption on the shadow economy. Once again, I will be putting this to the test in the case of the EU.

3.5 CONCLUSION

Chapter 3 served to underpin my research with the theoretical and empirical literature on what is the core of my thesis. Corruption and the shadow economy, as solitary variables, were discussed, including their definitions, measurements, and approaches to studying them. In addition, a thorough literature review was presented of corruption and the shadow economy as interrelated variables, which will be heart of my empirical test. The following chapter will provide a brief contextualization for my case study, the case of the European Union. I will discuss the political and economic background of the EU and delve into the implications the accession framework has on corruption and the shadow economy. I will briefly discuss the current status quo of corruption and the shadow economy in the EU, and will finalize the foundation of my thesis before delving into my empirical test in **Chapter 5**.

CHAPTER 4: CASE CONTEXTUALIZATION: THE EUROPEAN UNION

4.1 INTRODUCTION

As emphasized throughout this paper, the European Union presents an interesting case study to analyze the nexus between corruption, the shadow economy, and its causes and consequences. The 28 member states, with more striving for membership, present a diverse dataset covering a wide range of developmental progress, institutional qualities, and economic competitiveness. This chapter will provide a brief overview of the European Union, and the context in which the dependent variables of my thesis become central themes. The following sections will briefly discuss the historical context of the EU and, more importantly, the accession procedure and its political, legal, and economic implications for a unitary system reliant on battling corruption and the shadow economy. Finally, I will briefly discuss several issues related to corruption and the shadow economy specific to the EU, which will set the foundation for my case results.

4.2 POLITICAL & LEGAL RELEVANCE

The European Union finds its roots in the wake of World War II, and can primarily be traced to the German and French aim of ending recurring wars on European soil. In particular, the EU, as we know it today, slowly morphed from the European Coal and Steel Community (ECSC) of 1952, into the European Community and eventually into the EU proper (Borchardt 2010, 11). Today, the treaty of Lisbon (2007) remains the constitutional and legal foundation of the EU, and lays out the framework for which new members seek to achieve. The idea of the EU as an evolving international organization remains a vast subject, with entire courses and an endless literature for readers to peruse. My goal here, however, will focus on the central themes of my research: corruption and the shadow economy.

In particular, out of the political and legal framework of the EU, it is worth noting the importance of the Copenhagen Criteria in regards to new member states aiming to join. In short, the Copenhagen Criteria (Copenhagen European Council 1993) lay out the rules and regulations that states must meet in order to accede to the EU. Amongst other key requirements, countries have to maintain solid institutions to preserve and respect the democratic system and human rights, and have a functioning market economy (1993). These requirements are of direct concern with regards to corruption and the shadow economy, and are crucial to reducing them. Before any country is able to enter the EU, it must go through a rigorous re-alignment of its institutions and make sure they are in line with that of EU standards, which in support follows through and provides guidance throughout the pre-accession procedure. A critical part of this pre-accession procedure is the evaluation of the levels of corruption (Veebel 2011), which emphasizes the judicial framework for anti-corruption and the existence of the necessary institutional structure to fight it. While this provides for a framework to improve the situation of corruption in prospective member states, it is unclear what long-term effect it has. In the short term, however, Veebel (2011, 13) finds that countries do make significant progress on their corruption rankings in the lead-up to their accession, as analyzed through the progress reports the EU provides. Once countries are full-fledged members of the EU, it becomes unclear as to what effects these policies have, as many countries may revert to previous opaque governing. A prime example of this is Bulgaria, which made significant strides in its lead up to EU membership, but reverted to old ways with a disparity in the distribution of power through providing a select few individuals and companies with unabated access to state resources (Stoyanov, Stefanov and Velcheva 2014).

In short, the Copenhagen Criteria remain to be the single most important factors of EU accession requirements in terms of fighting corruption and the shadow economy. The following sections will provide a brief overview of the current situation of each variable in the EU, starting with the shadow economy. This will provide context for my case study, which will empirically look at the causes and consequences and their relationship in the EU.

4.3 SHADOW ECONOMY IN THE EUROPEAN UNION

One recurring theme throughout this thesis is the emphasis that the EU is not a unitary body, but rather a collection of 28 diverse countries. The size and development of the shadow economy in the EU is a testament to that, and covers a wide range on the shadow economy spectrum. Moreover, over the years the levels of the shadow economy throughout the EU have fluctuated, reaching a peak of 22.3% of GDP in 2003, and decreasing to 18.4% in 2012 (Schneider 2012, 1). Moreover, according to Schneider (2012), *new* EU countries, including those of Eastern Europe such as Bulgaria, Czech Republic, Lithuania, Latvia and Poland have higher rates than that of *old* EU countries, including Austria and Germany. The consultancy firm AT Kearney as recent as 2013 found similar trends, noting that the size of the shadow economy in the EU is vastly different, whereby Poland's shadow economy is 24% and Austria's 7% of GDP respectively (The Shadow Economy in Europe 2013).

Similarly, the increase in size of the shadow economy around the EU can be related to specific sectors, which are most susceptible to shadow economy activities. Going back to the definitions of the shadow economy, we can refer to: (1) undeclared work; and (2) under declared work, or work that underreports the actual value (Williams and Windebank 2011, 177). When conducting surveys to comb out which sectors are most plagued by these trends, it turned out that the construction industry is mostly afflicted, along with men being the core demographic (Packard, Koettl, and Montenegro 2012, 23). Although the EU does take many steps to fight this systemic failure, good governance and solid institutions remain critical. Packard, Koettl, and Montenegro (2012, 118) noted this as being the main deterrents for preventing people going into the shadow economy. In particular, they show how changes in the institutional quality and governance in the EU correspond to changes in the sizes of the shadow economy. Their findings emphasize that, as institutions become better and better, governance takes hold throughout the EU, and shadow economies shrink. This sheds a crucial light to policy makers in the EU and in individual member states. Namely, that responding positively and progressively in terms of

strengthening institutions and improving governance, the shadow economy could be decreased leading to overall increases in the official economy.

4.4 CORRUPTION IN THE EUROPEAN UNION

While many may see corruption plaguing only developing and underdeveloped countries, it is an everyday reality in many EU countries as well. In particular, the European Commission underscores the problem by declaring corruption a phenomenon that costs the European economy around €120 billion per year (Anti-Corruption Report 2014). Moreover, $\frac{3}{4}$ of European citizens see corruption as a widespread problem. To combat this, every two years the EU publishes an EU Anti-Corruption Report aimed at fighting corruption, and getting member states to improve the coherence of anti-corruption policies. These reports are very informational and maintain individual country data-sheets, which maintain everything from populations' perceptions of corruption to the sizes of countries' shadow economies.

In short, as with the shadow economy, there is a wide diversity in the prevalence of corruption across the EU. While many of the *old* EU countries have fairly clean governments, others lag in the scores concerning both perceptions and actual experience of corruption. According to the 2014 report, the worst of these are Croatia, the Czech Republic, Lithuania, Bulgaria, Romania and Greece (European Commission 2014). In theory, all EU countries should maintain stable institutions able to withstand the threat of corruption - this is one of the pillars of the Copenhagen Criteria, as mentioned in the preceding section. In reality, however, many of these countries experience a slide back into their old ways once they are in the EU, in particular the new EU countries such as the most recent entrant, Croatia (Harris 2014).

4.5 CONCLUSION

The purpose of this chapter was to provide a general, albeit short overview of the shadow economy and corruption in the EU. While the focus of my thesis is a quantitative analysis, it would be irresponsible to omit certain aspects of the political and legal framework in which the EU battles against these phenomena. In particular, the Copenhagen Criteria of 1993 remain the foundation of aspiring member states. Although new member states must conform to EU standards, they often do exhibit a slide back to their old ways. This, in addition to the prospects of future EU member states, including Serbia, Turkey, Montenegro, and the Former Yugoslav Republic of Macedonia, amongst others, presents a pressing mandate for the EU to fight back. In particular, as will be re-stated in the concluding chapter of this thesis, the EU and member states must continuously strive to improve institutional quality, aim for better governance, and work to better transparency throughout the entire continent to work to defeat the phenomena of corruption and the shadow economy.

The following chapter will be the core of my analysis. I will present my empirical data, along with the results and its implications for the EU. In addition, I will summarize my research and lay out recommendations for further research in the field of corruption and the shadow economy.

CHAPTER 5: THE EMPIRICAL STUDY: CORRUPTION AND SHADOW ECONOMY IN THE EU

5.1 INTRODUCTION

The following chapter will outline the research conclusions by presenting the empirical findings and comparing them with the theoretically expected signs presented earlier in this thesis. The standardized solutions using the simultaneous equations approach are presented for the 28 European Member States in **Table 6**. I worked with 4,462 data points (18 missing data points) and 280 observations (28 clusters) for the years 2003-2012. Since the coefficients of the explanatory variables in my equations have different units of measurement, the calculation of standardized coefficients is required. The advantage of the standardized solution is that it makes the assessment of relative direct influences much more simple (Bollen 1989, 124). To elaborate, standardized coefficients indicate the average change in standard deviation units of the dependent variable for one standard deviation difference in the independent variable, net of all other variables (Bollen 1989, 126; Buehn and Schneider 2012, 185). When the coefficients are scaled to unity it allows for the interpretation of their effects on one another (Buehn and Schneider 2012, 178-188). Summarizing from previous sections, the following variables are used as independent (exogenous) variables: Labor regulations, credit regulations, business regulations, unemployment rate, tax revenue, social security contributions, government effectiveness, fiscal freedom, bureaucracy costs, the rule of law, the shadow economy, and corruption. As stated before, the shadow economy and corruption also serve as dependent (endogenous) variables in this model alongside GDP growth, the labor force participation rate, M0/M1, GDP per capita, level of bribery, and the level of judicial dependence.

In the following sections I will present my study results, discuss their implications and delve into recommendations for further research. Additionally, I will offer viable policy recommendations in the context of the EU as aimed at stemming and combating corruption and the shadow economy.

5.2 RESULTS & FINDINGS

The empirical research of this thesis has shown that most of the estimated coefficients of the shadow economy and corruption are statistically significant at the conventional 10%, 5%, and 1% significance levels whereby more than half of them have the theoretically expected signs. Moreover, the coefficients in this model reveal that the level of corruption is the biggest driving force on the growth of the shadow economy. Meanwhile, the opposite holds for the size of the shadow economy, in that it is the main contributor of lower levels of corruption in the EU. The latter contradicts the theoretically expected sign presented in this thesis. Both coefficients are highly statistically significant at the 99% confidence level. The estimation results of the standardized solutions are presented in **Table 6**.

Table 6: Estimation Results (Standardized Coefficients)

Exogenous Variables	Endogenous variables								
	Estimation Results (standardized coefficients)	Shadow Economy	Corruption	GDP Growth	Labor Force Participation	M0/M1	GDP per Capita	Bribery	Judicial Dependence
	Corruption	1.067 (15.62***)					-0.768 (-21.91***)	0.852 (40.06***)	0.88 (35.77***)
	Shadow Economy		-0.378 (-3.59***)	0.18 (4.70***)	-0.507 (-4.69***)	0.293 (1.85***)			
	Labor Regulations	-0.325 (-4.72***)							
	Credit Regulations	0.16 (2.53*)							
	Business Regulations	0.174 (1.60)							
	Unemployment Rate	0.026 (0.34)							
	Tax Revenue	0.204 (3.46**)							
	Social Security Contributions	-0.266 (-3.46**)							
Government Effectiveness		-0.486 (-1.92)							
Fiscal Freedom		0.132 (1.83)							
Bureaucracy Costs		0.133 (2.51*)							
The Rule of Law		-0.641 (2.22*)							

Note: absolute z-statistics in parenthesis. * denotes significant at 10% level, ** significant at 5% level, *** significant at 1% level. Constant included but not reported

With respect to the possible *causes* of the shadow economy, while the coefficient for business regulations is not statistically significant, we find that labor regulations are an important determinant for a lower shadow economy in the EU. This is presented and highlighted by the highly significant negative coefficient of labor regulations. This could be due to the effectively higher average minimum wage present in the EU member states. Accordingly, if you have higher wages, there is little incentive for citizens to seek for work in the shadow economy when wages in the official economy are higher. This interesting relationship could only hold in the case at hand - I do not believe this would be the status quo in non-developed countries, as lower wages could serve as a prime incentive into the shadow economy.

On the other hand, credit regulations increase the size of the shadow economy but the effect is less significant. In regards to the high tax burden measured by tax revenue and social security contributions as a cause of the shadow economy, I assumed a positive relationship, but the empirical findings confirm this only in the case of tax revenues. In this model, high tax revenues, and low social security contributions increase the size of the shadow economy in the EU. Both forms of direct taxation are extremely close to being statistically significant at the 1% significance level ($p=0.001$), and the coefficients are almost equally robust which confirms a stable but contradicting relationship. This seemingly contradictory relationship would be interesting to expand on in future research, as most literature provides empirical evidence for an overall strong positive relationship between the tax burden and the shadow economy.

For the consequences that the shadow economy may have on GDP growth, it is apparent from the highly significant coefficient, that there exists a positive relationship between the two and thus confirms my hypothesis. A conceivable explanation for this, as Schneider and Enste (2000) also mentioned, is that in high-income countries at least 2/3 of the income earned in the shadow economy is spent in the official sector thus contributing to the growth of official GDP. It is worth noting that the relationship is not robust as presented by the small size of the estimated coefficient, but it is nevertheless a highly significant one. Even though there was no

hypothesis formed because of the ambiguity in the literature in regards to how the shadow economy affects the labor force participation rate, it is apparent from the estimated coefficient for the labor force participation rate that it is highly significant at the 1% significance level and a fairly robust negative relationship is evident. This confirms that, as activities in the shadow economy increase, the amount of people active in the labor force decrease. The coefficient capturing the amount of cash circulating in the economy is however not statistically significant.

In regards to the level of corruption, unlike what has been found in Buehn and Schneider's (2012) paper "*Corruption and the shadow economy: like oil and vinegar, like water and fire?*", fiscal freedom is not statistically significant but is very close to the established statistical significance level of $p=0.05$ ($p=0.068$). Additionally, there appears to be a positive relationship between fiscal freedom and the level of corruption in the EU, which also contradicts Buehn and Schneider's (2012) findings for the 51 countries they studied. This underscores the fact that not all variables and their respective theoretical relationship can be generalized. In this model, it is also hypothesized that "the lower the quality of the political system and policy formulation and the lower the respect for the rule of law, the higher the level of corruption, *ceteris paribus*" (Buehn and Schneider 2012, 181). The estimated coefficient for the rule of law is statistically significant and fairly robust while the coefficient for government effectiveness is on the cusp of significance ($p=0.055$) and also fairly robust. Both coefficients confirm the theoretically expected signs and hence this highlights that this hypothesis cannot be disproved. I find that the coefficient for bureaucracy costs is statistically significant at the 10% significance level, however, it is worth noting that it is at the boundary of significance at the 5% level ($p=0.012$) and holds the theoretically expected sign. The higher bureaucracy costs are, i.e. "the higher the level of government interference, the higher is the level of corruption, *ceteris paribus*" (Buehn and Schneider 2012, 182).

With respect to the consequences that corruption may have on GDP per capita, level of bribery, and judiciary dependence, all estimated coefficients are highly statistically significant at

the 1% significance level and are inherently robust in size. The coefficients reveal that the level of judiciary dependence and level of bribery are the most crucial determinants of the level of corruption. The coefficient for GDP per capita follows closely with a strong negative relationship. These estimated coefficients confirm the previously stated theoretical findings as well as the empirical findings presented in the literature.

Table 7: Goodness-of-fit Statistics

	Endogenous variables							
	Shadow Economy	Corruption	GDP Growth	Labor Force Participation	M0/M1	GDP per Capita	Bribery	Judicial Dependence
Observations	280	280	280	280	280	280	280	280
R-Squared	0.740	0.831	0.033	0.257	0.086	0.589	0.726	0.774
Overall R-squared: 0.893								
Bentler-Raykov (mc2)	0.746	0.834	0.033	0.257	0.086	0.589	0.726	0.774

In **Table 7** I have presented the results of the overall equation level goodness-of-fit and the Bentler-Raykov squared multiple correlation coefficient. Based on these results, there is a very good fit ($r\text{-squared} = 0.893$) for the variables in this model. I have included the Bentler-Raykov squared multiple correlation coefficient as well to account for the fact that I have endogenous predictor variables in my model (shadow economy and corruption). It is, however, interpreted the same way as the R-squared. Furthermore, I did not present the traditional chi-squared test, RMSEA, and AGFI fit statistics, since I am using clustered standard errors in my model and these statistics would not work properly in this case. On the contrary, the RMSEA and AGFI do not have any substantive meaning here, since I do not have latent variables in this model. In summary, under the assumptions made in this model, and if the model fits the data well, the sample covariance matrix equals the covariance matrix (Buehn and Schneider 2012, 188). **Table 8** gives an overview of my empirical findings, as discussed above:

Table 8: Summary of Empirical Findings

Dependent Variables	Hypothesis	Empirical Finding
Shadow Economy	Increases in the level of corruption are corresponded with increases in the size of the shadow economy , <i>ceteris paribus</i> .	Confirmed
	“The higher the intensity of regulation, the larger is the shadow economy , <i>ceteris paribus</i> ” (Buehn and Schneider 2012, 179).	Partly Confirmed
	“... the higher the burden caused by taxes and social security contributions, the larger the shadow economy , <i>ceteris paribus</i> ” (Buehn and Schneider 2012, 178).	Partly Confirmed
GDP Growth	As the shadow economy grows (increases in size), the official growth rate of real GDP will accordingly increase, <i>ceteris paribus</i> .	Confirmed
Ratio M0/M1	“The larger the shadow economy, the more cash circulates , <i>ceteris paribus</i> ” (Buehn and Schneider 2012, 180).	Not Confirmed
Corruption	Increases in the size of the shadow economy are corresponded with increases in the levels of corruption , <i>ceteris paribus</i> .	Not Confirmed
	“The lower the quality of the political system and policy formulation and the lower the respect for the rule of law, the higher is the level of corruption , <i>ceteris paribus</i> ” (Buehn and Schneider 2012, 181).	Confirmed
	The higher bureaucracy costs – i.e. “the higher the level of government interference – the higher is the level of corruption , <i>ceteris paribus</i> ” (Buehn and Schneider 2012, 182).	Confirmed
Real GDP per Capita	“The higher the level of corruption, the lower the level of economic development – as measured by per capita GDP , <i>ceteris paribus</i> ” (Buehn and Schneider 2012, 182).	Confirmed
Index of Bribes, Extra Payments, & Favoritism	Increases in the level of corruption are corresponded with higher levels of bribery , <i>ceteris paribus</i> .	Confirmed
Judicial Dependence	Increases in the level of corruption are corresponded with dependence of the judiciary on “political influences of government officials, citizens, or firms” (Gwartney et al. 2014, 233), <i>ceteris paribus</i> .	Confirmed

5.3 POLICY RECOMMENDATIONS

As emphasized earlier, this study differs from previous ones as it solely is based on the case of the European Union. While Buehn and Schneider (2012) conducted a rigorous study of various countries around the world, my results have highlighted the fact that the EU is a particular case. With such a rigorous study into the causes, consequences and the analysis of the

interrelationship between corruption and the shadow economy, it would be erroneous to neglect offering some policy recommendations. In regards to corruption specifically, most of the EU member states have solid frameworks designed to prevent individuals penetrating officials, and from officials going into the shadows of corruption. This is highlighted by the fact that some of the EU's countries consistently rank at the top of anti-corruption rankings every year. In short, however, I would recommend policies that capitalize on this solid framework, and ensure that they are replicated *throughout* the EU. The fact that Denmark consistently is the cleanest country in the world, while Romania lags behind as 'mostly corrupt' is unacceptable for the EU. Policies which promote transparency, punish perpetrators, and discourage social notions that corruption is OK should be further promoted in the countries that consistently rank low on the corruption scale.

In regards to the shadow economy, it is clear that the official economy has a real effect on the incentives of people to go into the shadows. The EU does an excellent job by maintaining some of the highest wages in the world that allows people to earn decent salaries without going into the shadows. To tighten this, the EU should promote more efficient regulations, avoid burdensome taxation, and make the formal economy appealing to all. Moreover, specifically, since the shadow economy is primarily conducted under the table, the EU should promote access to basic accounts to all, and facilitate the move towards a virtual payment system, not reliant on cash payments. This will eliminate the shadow economy's most potent enabler, cash, and accordingly push people into the formal economy where they could be encouraged to participate in the open economy.

5.4 RECOMMENDATIONS FOR FURTHER RESEARCH

The main focus of this thesis was to study the shadow economy and corruption in the European Union that is currently comprised of 28 member-states. This thesis studied these factors as aggregates and accordingly did not analyze each member-state individually. Due to the

'big-picture' nature of this thesis, I would recommend further research aimed at comparative studies on individual EU member-states from 2003-2012. A most streamlined and precise study aimed at individual countries would allow scholars to extrapolate certain issues and study them more in depth. This would help us ascertain as to which particular issues affect particular countries more poignantly, thus allowing us to make the most efficient and tailored policy recommendations that are appropriate and specifically applicable to the countries on an individual basis and per individual circumstances. Furthermore, Buehn and Schneider (2012) did studies on the shadow economies of over 162 countries in the world from 1999-2007. This study, however, did not deal with the levels of corruption in each. Thus, it would be interesting to replicate my analysis with regards to various other countries in the world, and more specifically to the developed countries as it would provide for a keen comparative analysis between the EU and the rest of the developed world. From this, one could discover certain policies that may work in one country, which may not be as effective in others, thus contributing to the overall effective policy making debate on a global level. Lastly, expanding the definition of the shadow economy to this model by including illegal activities would open the opportunity to study the shadow economy as a whole, as opposed to the analysis of only legal aspects as I have done. Although entire subjects are dedicated to this endeavor (in criminology and political science in particular), combining the illicit with the formal economy would make for an ideal study into the shadow economy as it truly is. This, of course, would not be without limitations - The very clandestine nature of the illicit economy makes for difficult analysis. Nonetheless, it would serve as a crucial starting point as did Buehn and Schneider's (2012) analysis into the nexus between the shadow economy and corruption.

5.5 CONCLUSION

Since all specifications show a particularly strong goodness-of-fit statistic, especially in the case of the shadow economy and corruption, I will conclude this thesis by interpreting their

mutual relationship in further detail. As one can see from the r-squared (see **Table 7**), 74% of the variation in the shadow economy is explained by labor, credit, and business regulations, tax revenue, the unemployment rate, social security contributions, and the level of corruption, while 83% of variation in the level of corruption is explained by GDP per capita, the bribery index, the level of judicial dependence, and the size of the shadow economy. This is to show that a fairly large amount of variation in my outcome variables (shadow economy and corruption) is explained using the independent variables in this model.

Moreover, my empirical results also find that the shadow economy reduces the level of corruption in the EU, while corruption increases the size of the shadow economy. In 2006, Friedrich Schneider, in his paper *“Shadow Economies and Corruption all over the World: What do we really know?”*, conducted an empirical study to test the relationship between the shadow economy and corruption in 96 developing countries, 25 transition countries, 21 OECD countries, and 3 communist countries and concluded that the shadow economy reduces the level of corruption in **high-income** countries but the shadow economy increases corruption in **low-income** countries. It suffices to say that the EU is comprised mostly of high-income countries and because of the strengthened institutional quality paired with more effective policy measures than in low-income countries, it is likely that the shadow economy decreases corruption. This could also be due to people who take part in shadow economy activities likely staying in the shadow economy rather than bribing government officials, since anti-corruption measures may be more effective. This also applies to government officials, as illegal actions have harsh consequences in the EU member states compared to other European countries.

Although there is a negative influence of the shadow economy on corruption in this model, it is interesting that there is actually a positive influence of corruption on the shadow economy. A higher level of corruption could also be seen as a sign of worsening cultural and social norms within a country and therefore be the result of an increasing shadow economy. The coefficients differ greatly in magnitude in that the positive effect of corruption on the shadow

economy is much stronger than the negative effect of the shadow economy on corruption. This thesis shows that the shadow economy and corruption are neither complements nor substitutes in the case of the EU, as interestingly I observe both phenomena in my case. For instance, as the size of the shadow economy increases, the level of corruption decreases and, simultaneously, as the level of corruption increases, the size of the shadow economy increases. To underscore this concept, the relationship of the shadow economy and corruption varies depending on which variable is the independent (predictor) variable.

BIBLIOGRAPHY

- Abed, George T., and Sanjeev Gupta. "The Economics of Corruption: An Overview." In *Governance, Corruption, & Economic Performance*, 3. Washington, D.C.: International Monetary Fund, 2002.
- Allison, Paul D. "Missing Data - Quantitative Applications in the Social Sciences." *British Journal of Mathematical and Statistical Psychology* 55 (2002): 193-96.
- Allison, Paul D. "Estimation of Linear Models with Incomplete Data." *Sociological Methodology* 17 (1987): 71-103.
- Bajada, Christopher, and Friedrich Schneider. "Unemployment And The Shadow Economy In The OECD." *Revue économique* 60, no. 5 (2009): 1033-1067.
- Bollen, Kenneth A. *Structural Equations with Latent Variables*. New York: Wiley, 1989.
- Borchardt, Klaus. *The ABC of European Union Law*. Luxembourg: Publications Office of the European Union, 2010.
- Buehn, Andreas, Friedrich Schneider. "Corruption and the Shadow Economy: Like Oil and Vinegar, Like Water and Fire?" *International Tax and Public Finance* 19, no. 1 (2012): 172-94.
- Cameron, Colin and Douglas L. Miller. "A Practitioner's Guide to Cluster-Robust Inference", *Journal of Human Resources*, forthcoming, Spring 2015.
- Campos, Nauro F., Ralitza Dimova, and Ahmad Saleh. "Whither Corruption? A Quantitative Survey of the Literature on Corruption and Growth." *Institute for the Study of Labor (IZA)*, Discussion Paper No. 5334 (2010).
- Choi, Jay Pil, and Marcel Thum. "Corruption And The Shadow Economy." *International Economic Review* 46, no. 3 (2005): 817-36.
- Dell'Anno, Roberto. "Estimating the Shadow Economy in Italy: A Structural Equation Approach." *Economics Working Papers, University of Aarhus* 2003-7 (2003).
- Dimant, Eugen. "The Nature of Corruption: An Interdisciplinary Perspective." *Economics Discussion Paper No.* 2013-59 (2013).
- Dreher, Axel and Friedrich Schneider. "Corruption and the Shadow Economy: An Empirical Analysis." *Institute for the Study of Labor (IZA)*, Discussion Paper No. 1936 (2006).
- Dreher, Axel, Christos Kotsogiannis, and Steve Mccorriston. "How Do Institutions Affect Corruption and the Shadow Economy?" *International Tax and Public Finance* 16, no. 6 (2009): 773-96.
- Enders, Craig. "A Primer on the Use of Modern Missing-Data Methods in Psychosomatic Medicine Research." *Psychosomatic Medicine* 68, no. 3 (2006): 427-36.

- Enders, Craig, and Deborah Bandalos. "The Relative Performance of Full Information Maximum Likelihood Estimation for Missing Data in Structural Equation Models." *Structural Equation Modeling: A Multidisciplinary Journal* 8, no. 3 (2001): 430-57.
- "EU Anti-Corruption Report." European Commission, last updated: 24 October 2014. Accessed: 5 January 2015: http://ec.europa.eu/dgs/home-affairs/what-we-do/policies/organized-crime-and-human-trafficking/corruption/anti-corruption-report/index_en.htm.
- European Commission. *Communication from the Commission to the Council, the European Parliament and the European Economic and Social Committee - On a Comprehensive EU Policy against Corruption*. COM(2003) 317. Accessed: 12 December 2014. . <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52003DC0317>.
- Feige, Edgar L. "Defining and Estimating Underground and Informal Economies: The New Institutional Economics Approach." *World Development* 18, no. 7 (1990): 989-1002.
- Ferreira, Carlos, Michael Engelschalk, and William Mayville. "The Challenge of Combating Corruption in Customs Administrations." In *The Many Faces of Corruption: Tracking Vulnerabilities at the Sector Level*, 367-386. Washington, D.C.: World Bank, 2007.
- Fox, John, and Sanford Weisberg. "Structural Equation Modeling in R with the SEM Package: An Appendix to An R Companion to Applied Regression." In *An R Companion to Applied Regression*. 2nd ed. SAGE Publications, 2011.
- Friedman, Eric, Simon Johnson, Daniel Kaufmann, and Pablo Zoido-Lobaton. "Dodging the Grabbing Hand: The Determinants of Unofficial Activity in 69 Countries." *Journal of Public Economics* 76, no. 3 (2000): 459-93.
- Gates, Kathleen M., Peter C.m. Molenaar, Frank G. Hillary, Nilam Ram, and Michael J. Rovine. "Automatic Search for FMRI Connectivity Mapping: An Alternative to Granger Causality Testing Using Formal Equivalences among SEM Path Modeling, VAR, and Unified SEM." *NeuroImage* 50, no. 3 (2010): 1118-125.
- Giles, David E. A., Lindsay M. Tedds, and Gugsu Werkneh. "The Canadian Underground and Measured Economies: Granger Causality Results." *Applied Economics* 34, no. 18 (2002): 2347-352.
- Granovetter, Mark. "Economic Action And Social Structure: The Problem Of Embeddedness." *American Journal of Sociology* 91 no. 3 (1985): 481.
- Gunzler, Douglas, Tian Chen, and Hui Zhang. "Introduction to Mediation Analysis with Structural Equation Modeling." *Shanghai Archives of Psychiatry* 25, no. 6 (2013): 390-4.
- Gwartney, James, Robert Lawson, Joshua Hall. *Economic Freedom of the World: 2014 Annual Report*. The Fraser Institute, 2014. Accessed: 27 December 2014. www.freetheworld.com.
- Harris, Chris. "Where in Europe is Corruption Most Strongly Perceived?" Euro News, 12 September 2014. Accessed: 10 December 2014: <http://www.euronews.com/2014/12/09/where-in-europe-is-corruption-most-strongly-perceived/>.

- Hausman, Jerry A. "Specification and Estimation of Simultaneous Equation Models." In *Handbook of Econometrics*, edited by Zvi Griliches and Michael D. Intriligator, 391-448. Amsterdam: North-Holland Pub., 1983.
- Heineman, Ben, and Fritz Heimann. "The Long War Against Corruption." *Foreign Affairs*, May/June, 2006. Accessed: 12 December 2014. <http://www.foreignaffairs.com/articles/61705/ben-w-heineman-jr-and-fritz-heimann/the-long-war-against-corruption>.
- Hindriks, Jean, Michael Keen, and Abhinay Muthoo. "Corruption, Extortion and Evasion." *Journal of Public Economics* 74, no. 3 (1999): 395-430.
- Hox, Joop J., and Timo M. Bechger. "An Introduction to Structural Equation Modeling." *Family Science Review* 11 (2007): 354-73.
- Huntington, Samuel P. *Political Order in Changing Societies*. New Haven: Yale University Press, 1968.
- International Labour Office. *Employment, Incomes and Equality: A Strategy for Increasing Productive Employment in Kenya*. 72B09_608_engl. Geneva: 1972. 593.
- Johnson, Simon, Daniel Kaufmann, Andrei Shleifer, Marshall I. Goldman, and Martin L. Weitzman. "The Unofficial Economy in Transition." *Brookings Papers on Economic Activity*, 1997.
- Johnson, Simon, Daniel Kaufmann, and Pablo Zoido-Lobaton. "Regulatory Discretion and the Unofficial Economy." *The American Economic Review* 88, no. 2 (1998a): 387-392.
- Johnson, Simon, Daniel Kaufmann, and Pablo Zoido-Lobaton. "Corruption, Public Finances and the Unofficial Economy." *The World Bank Discussion Paper* 194 (1998b). Accessed 26 December 2014: <http://siteresources.worldbank.org/INTWBIGOVANTCOR/Resources/wps2169.pdf>.
- Johnson, Simon, Daniel Kaufmann, John Mcmillan, and Christopher Woodruff. "Why Do Firms Hide? Bribes and Unofficial Activity After Communism." *Journal of Public Economics* 76, no. 3 (2000): 495-520.
- Kaplan, David. "Structural Equation Modeling." *International Encyclopedia of the Social and Behavioral Sciences*. Elsevier Science, 2001.
- Kaufmann, Daniel, Aart Kraay, Massimo Mastruzzi, "Governance Matters VIII Aggregate and Individual Governance Indicators 1996–2008," Working Paper 4978 (The World Bank – Development Research Group, 2009). Accessed 27 December 2014. <https://openknowledge.worldbank.org/bitstream/handle/10986/4170/WPS4978.pdf?sequence=1>.
- Klitgaard, Robert E. *Controlling Corruption*. California: University of California Press, 1988.
- Le, Tuan Minh. "Combating Corruption in Revenue Administration: An Overview." In *The Many Faces of Corruption: Tracking Vulnerabilities at the Sector Level*, 335-338. Washington, D.C.: World Bank, 2007.

- Leff, N. H. "Economic Development Through Bureaucratic Corruption." *American Behavioral Scientist* 82 (1964): 337-41.
- Levy, Daniel. "Price Adjustment Under the Table: Evidence on Efficiency-Enhancing Corruption." *European Journal of Political Economy* 23, no. 2 (2007): 423-47.
- Lippert, Owen, and Michael Walker. *The Underground Economy: Global Evidences of Its Size and Impact*. Vancouver: Frazier Institute, 1997.
- Miller, Terry, Kim R. Holmes, Edwin J. Fuelner, Anthony B. Kim, Bryan Riley, and James M. Roberts. *2013 Index of Economic Freedom*. Washington, D.C.: Heritage Foundation, 2013.
- Mirus, Rolf, and Roger S. Smith. "Canada's Underground Economy: Measurement and Implications." In *The Underground Economy Global Evidence of Its Size and Impact*, edited by Owen Lippert and Michael A. Walker, 3-10. Vancouver: Fraser Institute, 1997.
- Moulton, Brent R. "An Illustration of a Pitfall in Estimating the Effects of Aggregate Variables on Micro Units." *The Review of Economics and Statistics* 72, no. 2 (1990): 334-38.
- Moulton, Brent R. "Random Group Effects and the Precision of Regression Estimates." *Journal of Econometrics* 32, no. 3 (1986): 385-97.
- Packard, Truman, Johannes Koettl, and Claudio E. Montenegro. *In from the Shadow: Integrating Europe's Informal Labor*. Washington, D.C.: The World Bank, 2012.
- Paldam, Martin. "The Cross-Country Pattern of Corruption: Economics, Culture and the Seesaw Dynamics." *European Journal of Political Economy* 18 no. 2 (2003): 215-40.
- Pearl, Judea. "Causal Inference In Statistics: An Overview." *Statistics Surveys* 3 (2009): 96-146.
- Peattie, Lisa. "An Idea in Good Currency and How It Grew: The Informal Sector." *World Development* 15, no. 7 (1987): 851-60.
- "Presidency Conclusions." Copenhagen European Council, 21-22 June 1993. Accessed: 5 January 2015: http://www.europarl.europa.eu/enlargement_new/europeancouncil/pdf/cop_en.pdf.
- "Quasi-Liquid Liabilities (% of GDP)." *The World Bank*, World Development Indicators. Accessed: 20 December 2014. <http://data.worldbank.org/indicator/FS.LBL.QLIQ.GD.ZS>.
- Quinn, Simon. "Maximum Likelihood and Structural Models in Microeconometrics." Reading, from Lecture and class notes for the M.Sc in Development Economics (Quantitative Methods Course), 2013.
- "Report from the Commission to the Council and the European Parliament: EU Anti-Corruption Report." European Commission, COM (2014) 38 final, 2014. Accessed: 24 December 2014: http://ec.europa.eu/dgs/home-affairs/e-library/documents/policies/organized-crime-and-human-trafficking/corruption/docs/acr_2014_en.pdf.

- Rock, Michael T., and Heidi Bonnett. "The Comparative Politics of Corruption: Accounting for the East Asian Paradox in Empirical Studies of Corruption, Growth and Investment." *World Development* 32, no. 6 (2004): 999-1017.
- Rose-Ackerman, Susan. "The Economics of Corruption." *Journal of Public Economics* 4, no. 2 (1975): 187-203.
- Rubin, Donald B. "Inference and Missing Data." *Biometrika* 63, no. 3 (1976): 581-92.
- Sampford, Charles, Arthur Shacklock, Carmel Connors, and Fredrick Galtung. *Measuring Corruption*. Aldershot, England: Ashgate, 2006.
- Sandmo, Agnar. "An Evasive Topic: Theorizing About the Hidden Economy." *International Tax and Public Finance* 19, no. 1 (2012): 5-24.
- Schneider, Friedrich. "Public Choice - Economic Theory of Politics: A Survey in Selected Areas." In: *Essays on Economic Psychology*, edited by Hermann Brandstätter and Werner Güth, 177-192. Heidelberg: Springer Berlin Heidelberg, 1994.
- _____. "Shadow Economies and Corruption All Over the World: What Do We Really Know?" *Institute for the Study of Labor (IZA) Discussion Paper No. 2315*, 2006.
- _____. "Size and Development of the Shadow Economy in Germany, Austria and other OECD Countries: Some Preliminary Findings." *Revue Economique* 60, no. 5 (2009): 1079-1116.
- _____. "The Influence of Public Institutions on the Shadow Economy: An Empirical Investigation for OECD Countries." *Review of Law & Economics* 6, no. 3 (2010): 441-68.
- _____. "Size and Development of the Shadow Economy of 31 European and 5 other OECD Countries from 2003 to 2012: Some New Facts" *Department of Economics, Johannes Kepler University*, 2012.
- Schneider, Friedrich, and Dominik H Enste. "Shadow Economies: Size, Causes, and Consequences." *Journal of Economic Literature* 38, no. 1 (2000): 77-114.
- Schneider, Friedrich and Colin C. Williams. *The Shadow Economy*. London: Institute of Economic Affairs, 2013.
- Serra, Danila, and Leonard Wantchekon. "Experimental Research on Corruption: Introduction and Overview." In *New Advances in Experimental Research on Corruption*. Vol. 15. Bingley: Emerald, 1-11, 2012.
- Shleifer, Andrei; Robert W. Vishny, "Corruption." *The Quarterly Journal of Economics* 108, no. 3 (1993): 599-617.
- Singh, Anoop, Sonali Jain-Chandra, and Adil Mohommad, "Inclusive Growth, Institutions, and the Underground Economy," Working Paper 12/47 (International Monetary Fund, 2012). Accessed: 27 December 2014. <https://www.imf.org/external/pubs/ft/wp/2012/wp1247.pdf>.

- Smith, Philip. "Assessing the Size of the Underground Economy: The Statistics Canada Perspective." In *The Underground Economy Global Evidence of Its Size and Impact*, edited by Owen Lippert and Michael A. Walker, 11-34. Vancouver: Fraser Institute, 1997.
- "Statistical Computing Seminars: Applied Survey Data Analysis with Stata 13." UCLA: Statistical Consulting Group. Accessed February 11, 2015.
http://www.ats.ucla.edu/stat/stata/seminars/applied_svy_stata13/.
- Stoyanov, Alexander, Ruslan Stefanov and Boryana Velcheva. "Bulgarian Anti-Corruption Reforms: A Lost Decade?" Working Paper No. 42, European Research Centre for Anti-Corruption and State-Building, Center for the Study of Democracy, April 2014. Accessed: 5 2015: <http://www.againstcorruption.eu/wp-content/uploads/2014/04/WP-42-Bulgarian-Country-Background-Report.pdf>.
- Streiner, David I. "Finding Our Way: An Introduction to Path Analysis." *Canadian Journal of Psychiatry* 50, no. 2 (2005).
- Svensson, Jakob. "Eight Questions About Corruption." *Journal of Economic Perspectives* 19, no. 3 (2005): 19-42.
- "The Shadow Economy in Europe, 2013." AT Kearney Working Paper, 2013. Accessed: 12 November 2014: http://www.atkearney.com/financial-institutions/featured-article/-/asset_publisher/j8IucAqMqEhB/content/the-shadow-economy-in-europe-2013/10192.
- Transparency International. *Corruptions Perceptions Index*. Berlin, 2014. Accessed: 5 December 2014. <http://www.transparency.org/cpi2014/results>.
- Treisman, Daniel. "The Causes of Corruption: A Cross-National Study." *Journal of Public Economics* 76, no. 3 (2000): 399-457.
- United Nations Office for Drug Control and Crime Prevention. *Global Programme against Corruption - United Nations Manual on Anti-corruption Policy*. Vienna, 2001. Accessed: 12 December 2014. <http://www.unodc.org/pdf/crime/gpacpublications/manual.pdf>.
- Wen, Yi, and Mingyu Chen. "Okun's Law: A Meaningful Guide for Monetary Policy?" Economic Research: Federal Reserve Bank of St. Louis. 2012. Accessed: 27 December 2014. <http://research.stlouisfed.org/publications/es/article/9295>.
- Williams, Colin C., and Jan Windebank. "Regional Variations in the Nature of the Shadow Economy: Evidence from a Survey of 27 European Union Member States." In *Handbook on the Shadow Economy*, edited by Friedrich Schneider, 177-200. Northampton: Edward Elgar Publishing, 2011.
- World Bank. *Quasi Money (current LCU)*. Accessed: 9 May 2015.
<http://data.worldbank.org/indicator/FM.LBL.QMNY.CN>.

APPENDIX

Appendix 1: Estimation Results

Structural equation model
 Estimation method = mlmv
 Log pseudolikelihood= -13743.97

Number of obs = 280

(Std. Err. adjusted for 28 clusters in country1)

Standardized	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
Structural						
shadow <-						
morecorrupt	1.067122	.0683137	15.62	0.000	.9332293	1.201014
laborreg	-.3247917	.0688387	-4.72	0.000	-.4597131	-.1898704
creditreg	.1600593	.0633431	2.53	0.012	.0359092	.2842095
businessreg	.1736282	.1083666	1.60	0.109	-.0387664	.3860229
unemplrate	.0260631	.0777148	0.34	0.737	-.1262551	.1783813
taxrev	.203861	.058986	3.46	0.001	.0882505	.3194715
socialcont	-.2655495	.0766877	-3.46	0.001	-.4158546	-.1152444
_cons	-.1162254	1.509022	-0.08	0.939	-3.073853	2.841403
morecorrupt <-						
shadow	-.3777417	.1051321	-3.59	0.000	-.5837968	-.1716865
goveffect	-.4857444	.2533259	-1.92	0.055	-.9822541	.0107653
fiscalfree	.1321584	.0724141	1.83	0.068	-.0097707	.2740875
bureacosts	.1333755	.0530325	2.51	0.012	.0294338	.2373173
ruleoflaw	-.6413968	.2891434	-2.22	0.027	-1.208108	-.0746861
_cons	4.191353	.5495084	7.63	0.000	3.114337	5.26837
gdpgrowth <-						
shadow	.1808034	.0384552	4.70	0.000	.1054326	.2561742
_cons	-.0169946	.127381	-0.13	0.894	-.2666568	.2326676
laborforce <-						
shadow	-.5071068	.1082223	-4.69	0.000	-.7192186	-.294995
_cons	12.02674	1.192218	10.09	0.000	9.690037	14.36344
m0m1 <-						
shadow	.2926869	.1577924	1.85	0.064	-.0165806	.6019544
_cons	.5187785	.4342829	1.19	0.232	-.3324004	1.369957
gdppercapita <-						
morecorrupt	-.7675364	.0350334	-21.91	0.000	-.8362006	-.6988723
_cons	2.94899	.3141541	9.39	0.000	2.333259	3.564721
morebribe <-						
morecorrupt	.8518327	.021265	40.06	0.000	.8101542	.8935113
_cons	.2961389	.0593381	4.99	0.000	.1798384	.4124394
lessjudicindep <-						
morecorrupt	.8797272	.0245961	35.77	0.000	.8315199	.9279346
_cons	.1466261	.1150562	1.27	0.203	-.0788799	.3721322
Variance						
e.shadow	.2604985	.043488			.1878038	.3613317
e.morecorrupt	.1687414	.04774			.0969173	.2937935
e.gdpgrowth	.9673101	.0133521			.9414914	.9938369
e.laborforce	.7428427	.0992934			.5716359	.9653264
e.m0m1	.9143344	.0940264			.7474307	1.118508
e.gdppercapita	.4108878	.0825592			.2771357	.6091919
e.morebribe	.274381	.0412335			.2043793	.3683587
e.lessjudicindep	.22608	.0366314			.1645672	.3105853

Appendix 2: Equation Level Goodness-of-fit Results

Equation-level goodness of fit

depvars	fitted	Variance predicted	residual	R-squared	mc	mc2
observed						
shadow	54.18692	48.18187	14.11561	.7395015	.8635974	.7458004
morecorrupt	376.4474	349.4238	63.52227	.8312586	.9131212	.8337904
gdpgrowth	16.68403	.5453986	16.13863	.0326899	.1808034	.0326899
laborforce	30.29084	7.789512	22.50133	.2571573	.5071068	.2571573
m0m1	3657.123	313.2897	3343.833	.0856656	.2926869	.0856656
gdppercapita	3.89e+08	2.29e+08	1.60e+08	.5891122	.7675364	.5891122
morebribe	2.480764	1.80009	.6806745	.725619	.8518327	.725619
lessjudici~p	4.157644	3.217684	.9399603	.77392	.8797272	.77392
overall				.8934593		

mc = correlation between depvar and its prediction

mc2 = mc^2 is the Bentler-Raykov squared multiple correlation coefficient

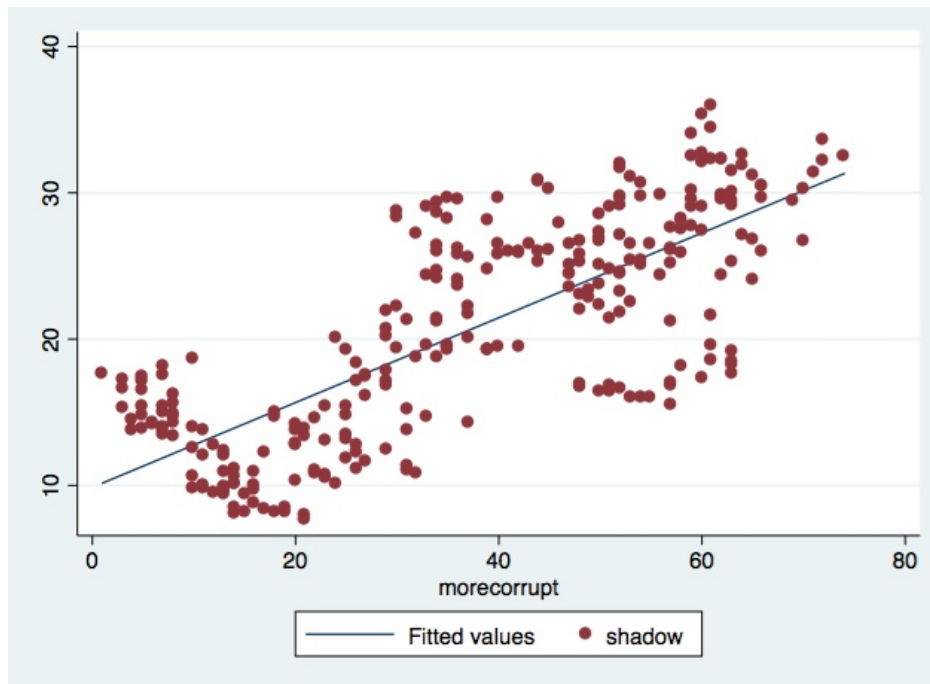
Appendix 3: Table of Terms and Sources

Table of Terms	Source
Freedom from Corruption Index	Miller et al. (2013)
Shadow Economy	Schneider (2012)
Labor Regulations	Gwartney et al. (2014)
Credit Regulations	Gwartney et al. (2014)
Business Regulations	Gwartney et al. (2014)
Unemployment Rate	World Bank (2014)
Tax Revenue	World Bank (2014)
Social Security Contributions	World Bank (2014)
Government Effectiveness	Kaufmann et al. (2009)
Fiscal Freedom	Miller et al. (2013)
Bureaucracy Costs	Gwartney et al. (2014)
The Rule of Law	Kaufmann et al. (2009)
GDP Growth	World Bank (2014)
Labor Force Participation	World Bank (2014)
M0/M1	World Bank (2014)
GDP per Capita	World Bank (2014)
Bribery Index	Gwartney et al. (2014)
Judicial Independence	Gwartney et al. (2014)

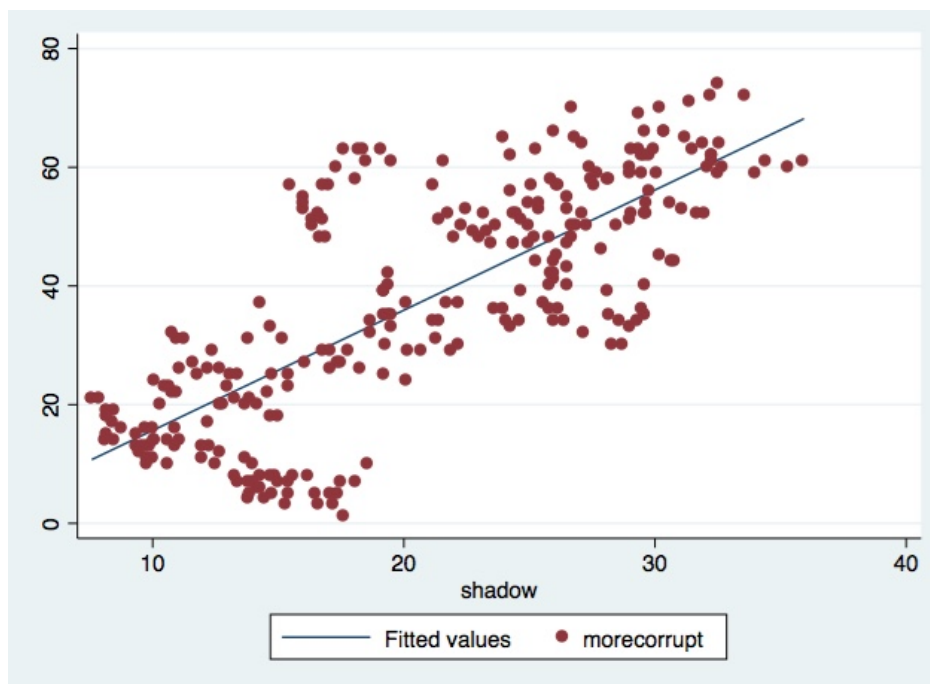
Appendix 4: Matrix Representation of Baseline Model

$$\begin{pmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \\ y_5 \\ y_6 \\ y_7 \\ y_8 \end{pmatrix} = \begin{pmatrix} 0 & \beta_{12} & 0 & 0 & 0 & 0 & 0 & 0 \\ \beta_{21} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \beta_{31} & 0 & 0 & \dots & \dots & \dots & \dots & 0 \\ \beta_{41} & 0 & \vdots & \ddots & & & & \vdots \\ \beta_{51} & 0 & \vdots & & \ddots & & & \vdots \\ 0 & \beta_{62} & \vdots & & & \ddots & & \vdots \\ 0 & \beta_{72} & \vdots & & & & \ddots & \vdots \\ 0 & \beta_{82} & 0 & \dots & \dots & \dots & \dots & 0 \end{pmatrix} \times \begin{pmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \\ y_5 \\ y_6 \\ y_7 \\ y_8 \end{pmatrix} + \\
 \begin{pmatrix} \gamma_{11} & \gamma_{12} & \gamma_{13} & \gamma_{14} & \gamma_{15} & \gamma_{16} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \gamma_{27} & \gamma_{28} & \gamma_{29} & \gamma_{210} \\ 0 & 0 & 0 & 0 & 0 & \dots & \dots & \dots & \dots & 0 \\ 0 & 0 & 0 & 0 & \vdots & \ddots & & & & \vdots \\ 0 & 0 & 0 & 0 & \vdots & & \ddots & & & \vdots \\ 0 & 0 & 0 & 0 & \vdots & & & \ddots & & \vdots \\ 0 & 0 & 0 & 0 & \vdots & & & & \ddots & \vdots \\ 0 & 0 & 0 & 0 & 0 & \dots & \dots & \dots & \dots & 0 \end{pmatrix} \times \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \\ x_7 \\ x_8 \\ x_9 \\ x_{10} \end{pmatrix} + \\
 \begin{pmatrix} \zeta_1 \\ \zeta_2 \\ \zeta_3 \\ \zeta_4 \\ \zeta_5 \\ \zeta_6 \\ \zeta_7 \\ \zeta_8 \end{pmatrix}$$

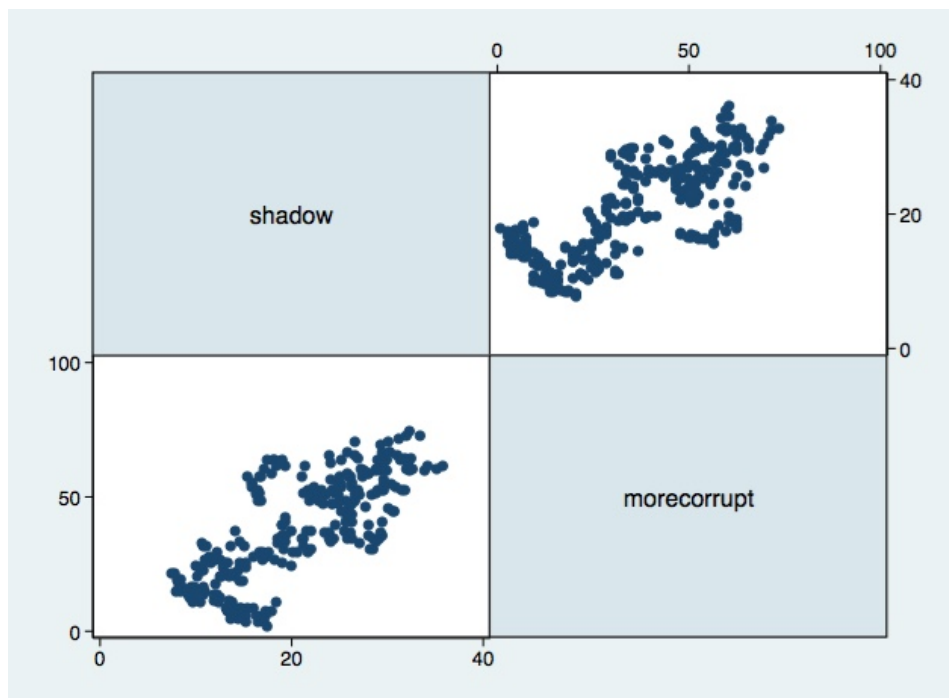
Appendix 5: Two-way Scatterplot as Shadow Economy (dependent variable) and Corruption (independent variable)



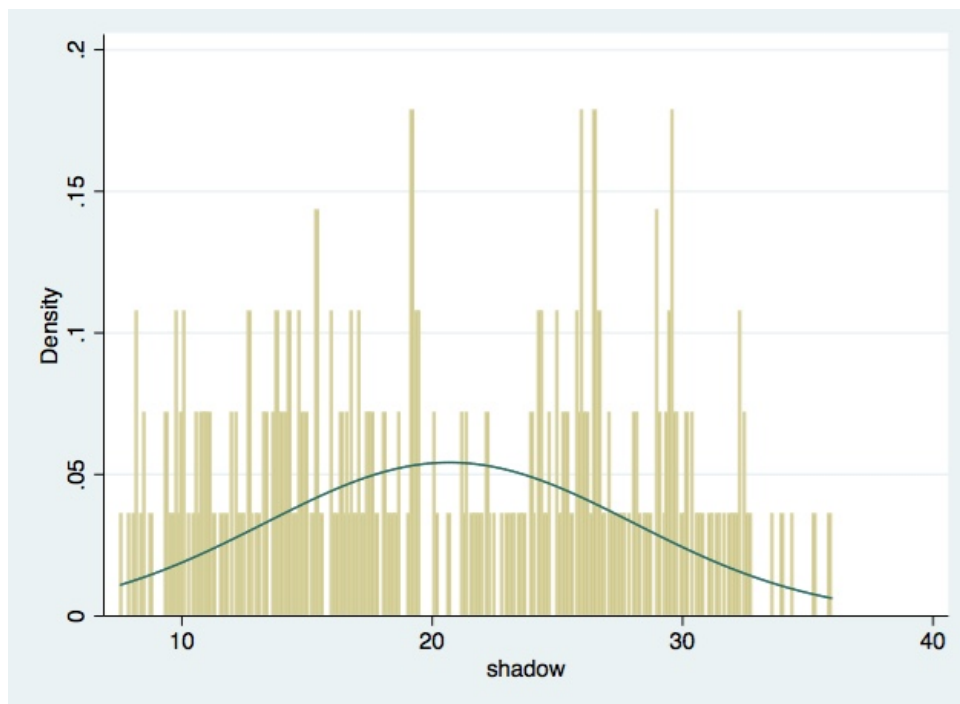
Appendix 6: Two-way Scatterplot as Corruption (dependent variable) and Shadow economy (independent variable)



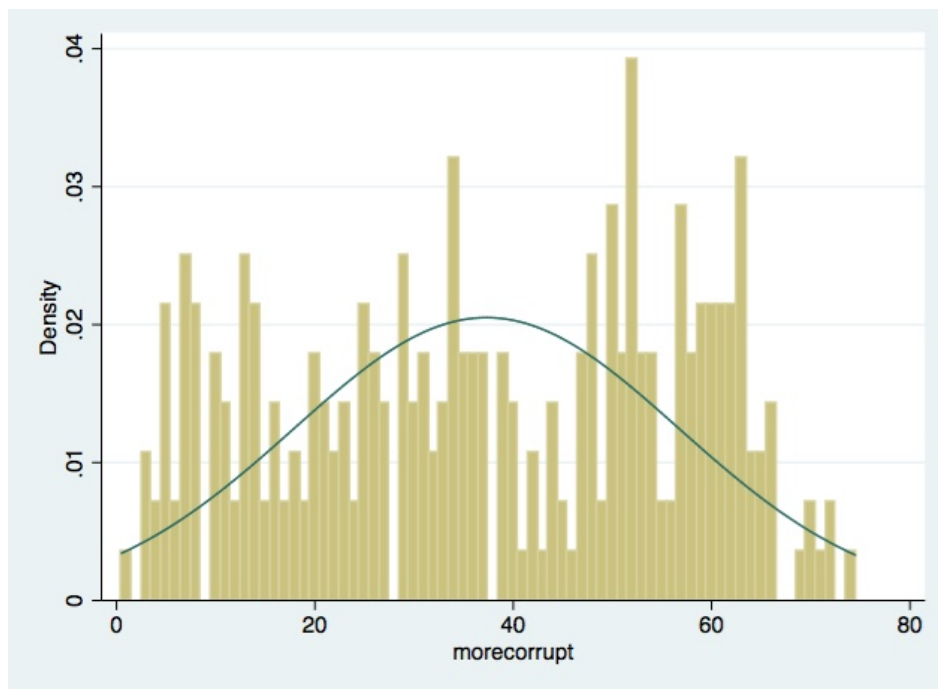
Appendix 7: Matrix Scatterplot for Shadow Economy and Corruption



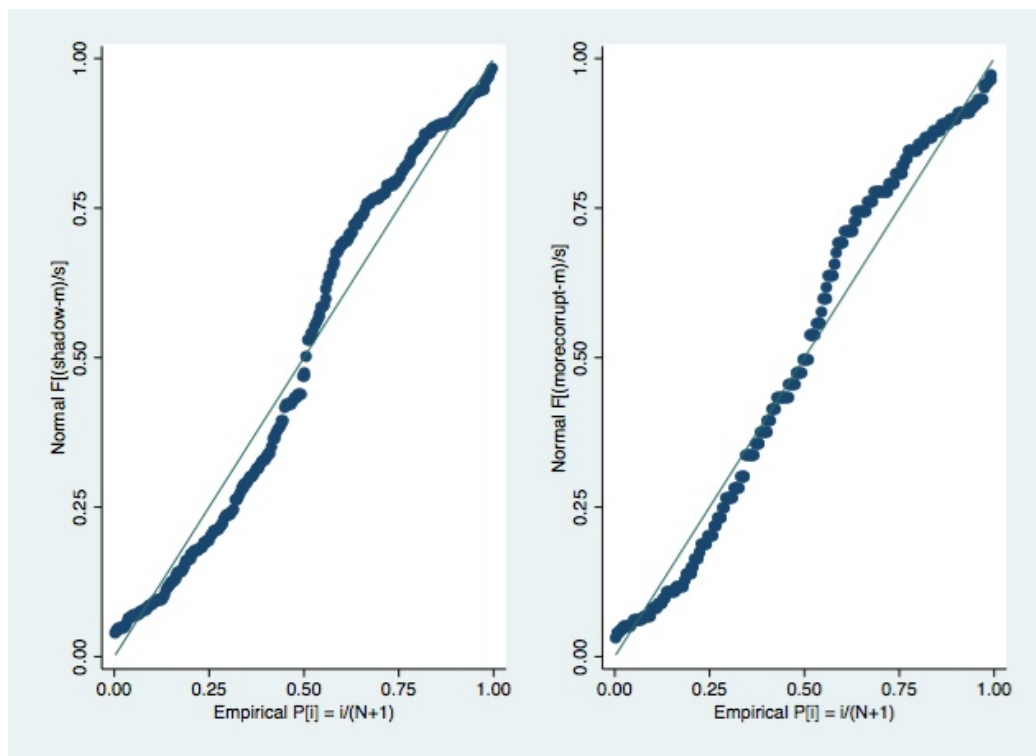
Appendix 8: Histogram of Density for Shadow Economy



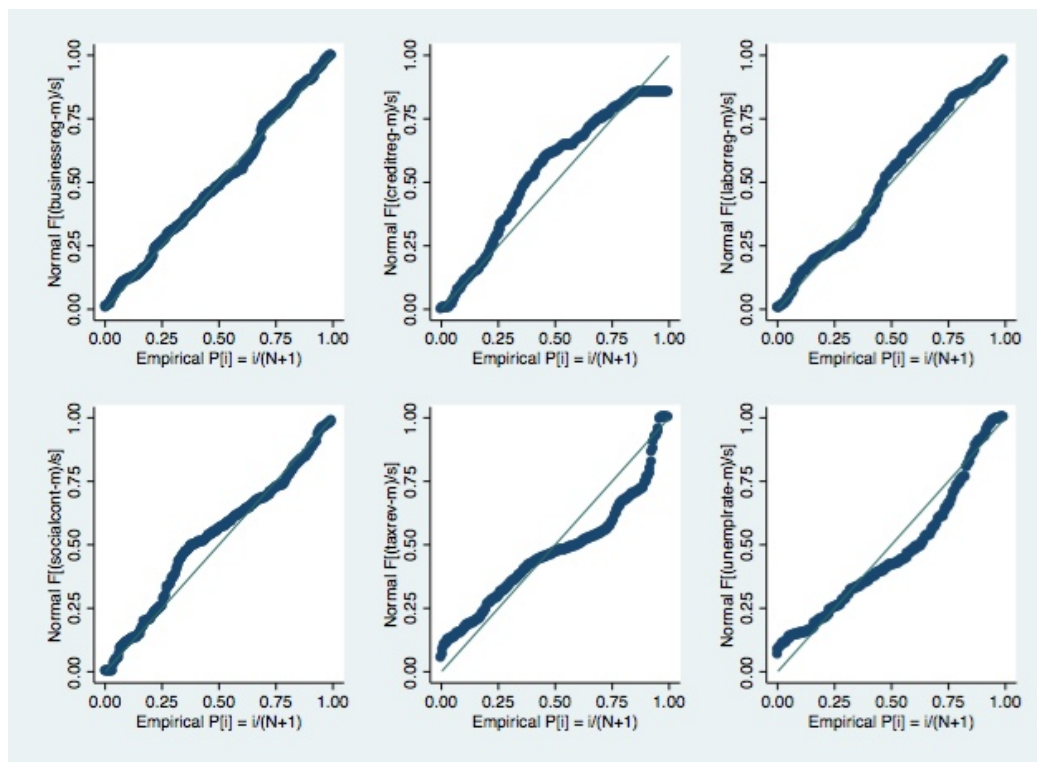
Appendix 9: Histogram of Density for Corruption



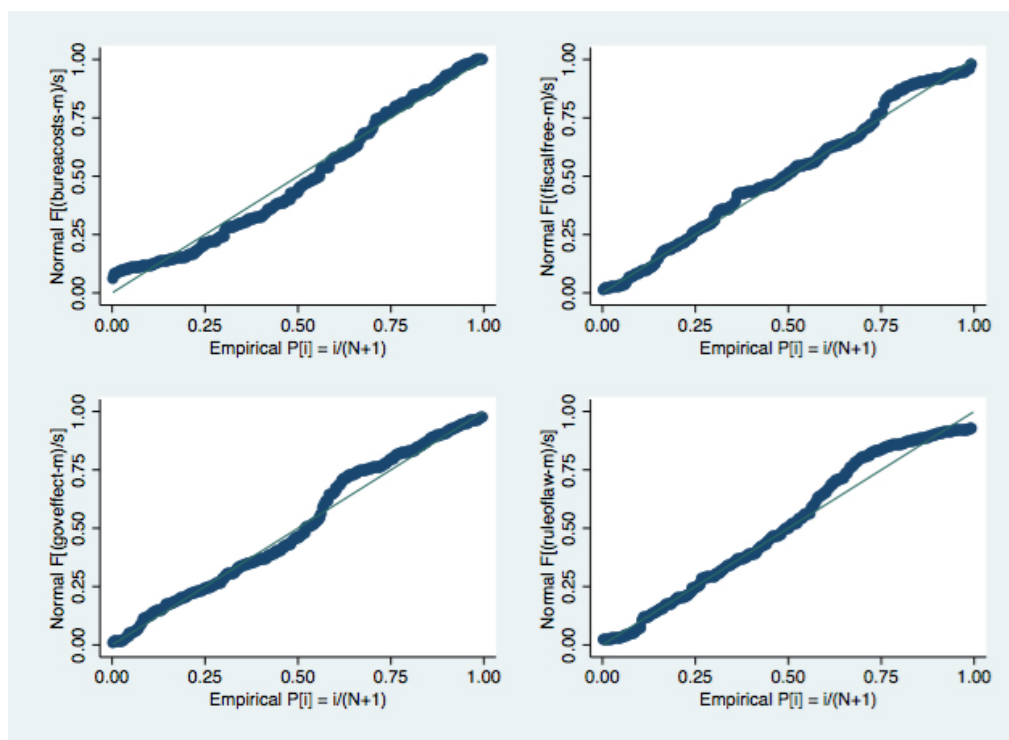
Appendix 10: Normal Probability Plot for Shadow Economy and Corruption



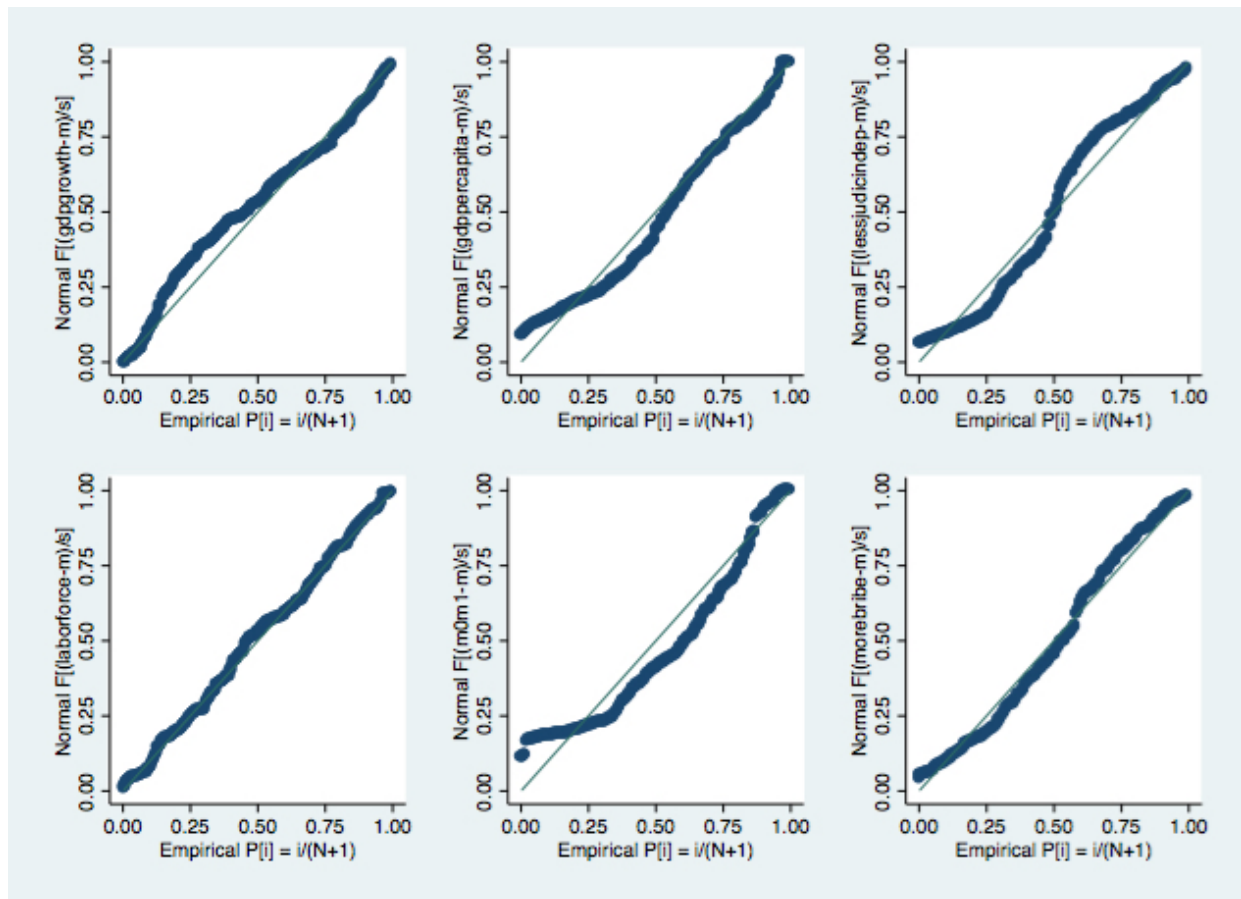
Appendix 11: Normal Probability Plot for Business Regulation, Credit Regulation, Labor Regulation, Social Security Contributions, Tax Revenue, and Unemployment Rate



Appendix 12: Normal Probability Plot for Bureaucracy Costs, Fiscal Freedom, Government Effectiveness, and the Rule of Law



Appendix 13: Normal Probability Plot for GDP Growth, GDP per Capita, Judicial Dependence, Labor Force Participation Rate, M0M1, and Bribery



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CURRICULUM VITAE

Daria Emkic, BSc

BACKGROUND:

I am a performance driven professional with a strong academic background in mathematics and an excellent analytical skillset. In combination with my multi-cultural qualities and my fluency in three languages I am able to flourish with a diverse group of individuals.

EXPERIENCE:

Sberbank Europe | Vienna, Austria

March 2014 – Present

Retail Coordinator (Product Management)

- Facilitate with the Build the Bank project, to include building a Retail bank in Austria.
- Create market and competitor analysis for the Austrian retail market, covering current account packages, savings accounts, term deposits, client identification and account opening process, and preparation of business requirements.
- Prepare monthly Retail Product MIS reports. Maintain Retail Product MIS template and conduct quality controls.
- Prepare monthly product specific MIS report. Maintain product specific MIS report template and conduct quality controls.
- Gather monthly Retail MIS follow-ups and Micro project tasks lists in preparation for monthly calls. Conduct quality controls.

Sberbank Europe | Vienna, Austria

August 2013- February 2014

Product Management Intern

- Support the implementation of new cost allocation keys in conjunction with Controlling and other Segment owners.
- Set up implementation plan and monitor. Ensure new allocation key is in force.
- Preparation of product materials for product development and management across all product areas, including: Packages and current accounts, liabilities (savings and term deposits), lending (personal loans and mortgages), cards (debit and credit).

Raiffeisen Bank International AG | Vienna, Austria

March-May 2013

Risk Excellence and Projects Freelancer

- Independent work with project-related tasks and compilation of statistics on significant risk issues within Raiffeisen Bank International and affiliated Network Banks in Central and Eastern Europe.
- Reporting to top management on findings and risk maturity level.
- Implementation of effective processes ensuring all risk factors are escalated, investigated, and resolved.

- Maintenance, enhancement and further development of risk models.
- Active participation in the delivery of strategic projects.

Calderton Residential | Vienna, Austria

September 2012– February 2013

Portfolio Administrator

- Helped facilitate the portfolio review process and maintain the portfolio file for 26 properties
- Produce monthly cash flow reports
- Maintain bookkeeping and profit and loss statements on a monthly basis
- Draft compliance procedures on the letting process
- Conducted ad hoc analyses and prepared audits of letting agents

Wells Fargo Bank | Phoenix, AZ (USA)

2011– July 2012

Personal Banker

- Deputy Branch Manager, facilitating Teller approvals, and general branch monitoring.
- Prepared branch logistics and participated during quarterly branch audits.
- Collected and analyzed quarterly customer service data and implemented plans for branch improvement.
- Advised and provided customers with deposit account services including; checking, savings, money markets, CDs, IRAs, insurance and other investment products.

Wells Fargo Bank | Phoenix, AZ (USA)

2008 – 2011

Lead Teller

- Customer Service Advocate for Wells Fargo.
- Branch improvement management with focus on customer service, leading to Customer Service Regional awards from 2009 – 2011.
- Cooperation with marketing teams to improve marketing effectiveness based on trend analysis.
- Responsible for providing accurate information on banking products and services while advising customers on financial management.

EDUCATION:
University of Vienna | Vienna, Austria

2012 – Present

Master of Science in Quantitative Economics, Management, and Finance
Arizona State University | Tempe, AZ (USA)

2007 - 2011

Bachelor of Science in Mathematics with emphasis in Statistics
Bachelor of Arts in German

Sufficient knowledge and background in; Experimental Statistics (analysis and reporting using SAS), Probability theory, Stochastic processes with basic knowledge in process validation, Multivariable methods, and Calculus.

INVOLVEMENT & AWARDS:

- ASU Actuary Club Member | Arizona State University
- Customer Service Advocate | Wells Fargo
- Metro East Elite Certificate of Excellence 2010 and 2011| Wells Fargo
- Best Buddies International | Volunteer

LANGUAGES & SKILLS:

- **Languages:** Fluent: English (native); German; Serbo-Croatian.
- **Professional:** Strategic planning; Designing creative ways to reduce the likelihood of undesirable risks of happening; Diagnostics and Reporting; Risk management and Evaluation.
- **Computer:** Proficient in all Microsoft programs including: Excel, PowerPoint, Outlook, Word, OneNote, WordPerfect, and Adobe Reader. Substantial experience working with SAS (Statistical Analysis Software), LaTeX, Visual Basic, C++ Programming, and Java Programming.
- **Personal:** Ability to keep calm under pressure; Keen attention to detail; Excellent numerical and problem solving skills; Strategic thinker.