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Estimating The Size Of The Shadow Economy In The Kingdom Of Saudi Arabia

Ali Alsubaie
Wayne State University

ESTIMATING THE SIZE OF THE SHADOW ECONOMY IN THE KINGDOM OF SAUDI ARABIA

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ALI ALSUBAIE

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DEDICATION

I dedicate this dissertation to my mother and father, who encouraged and supported me all of my life to be a successful person; to my wife and children, who struggled and continued to support me to achieve our goals; to my sisters and brothers, who encouraged and helped me during the PhD journey; and to all my family members and friends.

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CHAPTER 1: INTRODUCTION

1.1 Introduction

The shadow economy (SE)—most generally referred to as that part of the economy unreported to the authorities—is a challenge for every country, for national economic policymakers, and for the economics profession. More than half of the world's workforce is estimated to participate in the shadow economy (Navickas et al., 2019). Policymakers depend on accurate economic statistics to develop national budgets, to understand the state of the economy, and to monitor the wellbeing of citizens for potential interventions. Yet how do you analyze something that is, by definition, hidden? If the shadow economy is significant—and, on average, it is estimated to be 33.77% of the global economy (Hassan and Schneider, 2016)—then it is essential to try to get some idea about its size, despite its opaque nature. The SE can distort the indicators used to measure the economy for fiscal and monetary policy purposes, can reduce the revenue available to the government to serve the needs of its population, and can conceal economic activity that might be either beneficial or harmful to the economy.

There is considerable debate about whether, how, and when the SE helps or harms economies. It has been argued that in many countries, the SE provides much-needed alternative employment opportunities that are not available in the official economy during times of high unemployment. It is claimed that the SE contributes a significant part of its revenue to that formal economy (Putniņš and Sauka, 2011). At the same time, it has been argued that the SE is harmful because it removes vital tax income from the

government that needs it to provide services that can strengthen the economy as a whole (Nchor and Adamec, 2015).

Over the years, a variety of techniques have been developed by economists to try to get a handle on the SE. These techniques have had varying degrees of success. Figure 1.1 shows estimates of the SE for several key countries.

In this dissertation, we are interested in sizing the shadow economy of Saudi Arabia. We focus on Saudi Arabia because it is the largest economy in the MENA (Middle East and North Africa) region and also the largest oil exporter in the world. As such, it is a vital lynchpin in the world economy. Hydrocarbons still drive this world economy. Saudi Arabia is also a valuable model and exemplar for the rest of the countries in its region, especially the GCC (Gulf Cooperation Council) countries and other developing countries that depend on the energy market as their main source of income. In short, the shadow economy of Saudi Arabia has been insufficiently studied, given the country's unique features. In this study, I endeavor to respond to these challenges, especially given my familiarity and experience with Saudi Arabia.

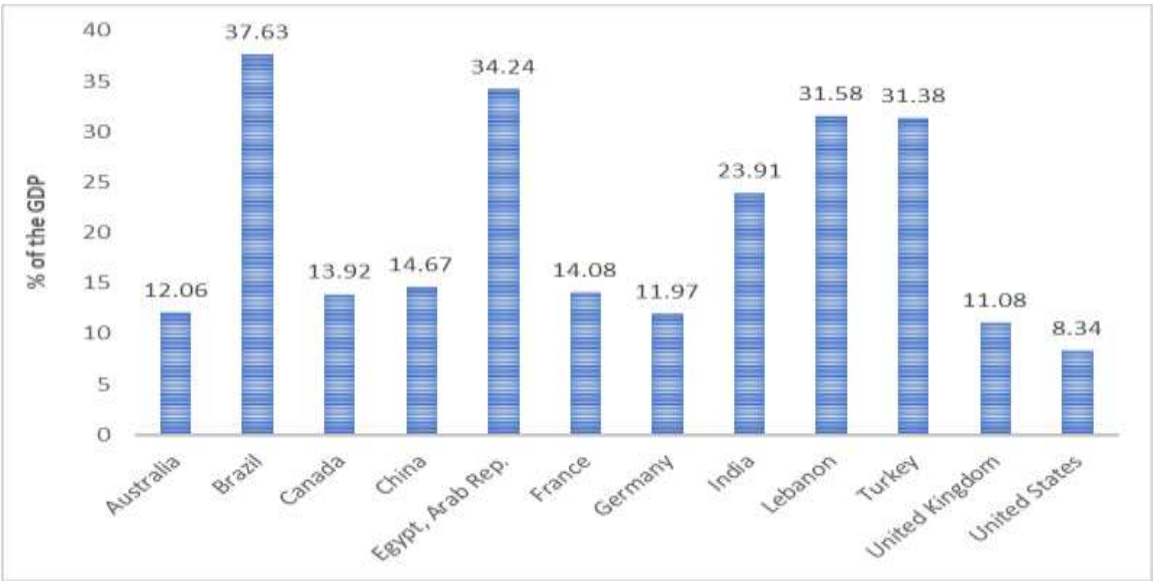

Figure 1.1. Average size of the shadow economy for the period 1991–2015 for several key countries.
Source: International Monetary Fund IMF

1.2 Definition of the Shadow Economy

As a starting point, I define the shadow economy for descriptive and analytical purposes. At present, no generally accepted definition of the SE has emerged. In part, this is because the SE can be thought of in many dimensions, including legal but unreported economic activity and illegal activity. Hart (2008) identifies the SE as economic activities that operate outside officially recognized public and private organizations. Ihrig and Moe (2004) see it as an arena where legal goods are produced outside of government regulations. Equivalent views are expressed by Dell'Anno (2004), Fleming et al. (2000), Frey and Pommerehne (1984), Johnson et al. (1997), Johnson et al. (1998), Loayza (1996), Schneider and Enste (2002), Schneider and Enste (2000), and Thomas (1999). There is no consensus among these sources. Friedrich Schneider, the leader in research on SE, separates legal but unreported economic activities such as unpaid work done in

households and volunteer work from illegal activities such as drug trafficking as the appropriate focus for investigations, since the last are extremely difficult to size using any reputable approach. Schneider and his colleagues recognize that there are challenges in trying to disaggregate legal from illegal activities in any of the conventional methods (Schneider and Buehn, 2017). There are many views about what motivates the existence of the SE, including high versus low income for a country (Dreher and Schneider, 2010), taxes (Elgin, 2010; Friedman et al., 2000; Schneider and Enste, 2000), and corruption (Dreher and Schneider, 2010). There is a divergence of opinion, too, about the consequences of the SE, including fiscal policy (Çiçek and Elgin, 2011), social security and labor-force behavior (Schneider and Enste, 2000), income distribution (Hatipoglu and Ozbek, 2011), the magnitude of business cycles (Elgin and Oztunali, 2012), the monetary base (Tanzi, 1983), and total factor productivity (Moscoso-Boedo and D'Erasmo, 2012).

Taking all of these into account, I define the shadow economy as follows for purposes of this dissertation:

The SE includes all unregistered productive market transactions that would, if recorded, typically increase the official gross domestic product (GDP). This definition does not include barter; criminal transactions such as smuggling, human trafficking, and drug-dealing; unpaid activities contributing to the wellbeing of households; or volunteer and charitable work. Despite these limitations, it is inevitable that some of these latter activities will wind up being counted if cash is involved, an important issue because we are using a currency demand approach for sizing the SE.

1.3 Purpose of the Study

This dissertation addresses the challenge of correctly sizing the shadow economy in Saudi Arabia in response to the fact that, to date, very limited research on this topic has been done. This is despite the fact that Saudi Arabia is an essential economic player in the world, especially in the Middle East Region. The studies by Elgin and Oztunali (2012) and Schneider and Buehn (2017) that have included Saudi Arabia thus far have used generalized factors to look at its SE, such as tax and Social Security contributions, unemployment, self-employment, and the GDP. The latest IMF work on the SE estimates that in Saudi Arabia, it has averaged 16.65% of the GDP for the period 1991–2015 (Medina and Schneider, 2018). The purpose of this study is to provide a more accurate estimate of the SE in Saudi Arabia by developing an improved model that focuses on the specific condition relevant to the economy of Saudi Arabia. This includes the government's recent focus on dealing with income diversification, the introduction of VAT, regulation, the number of foreign workers, and reducing the dominance of cash transactions. All these issues specific to Saudi Arabia are especially crucial, as the kingdom effectively implements its recent greatest strategy plan Vision 2030. It is hoped that this further study of the SE in Saudi Arabia will benefit researchers and policymakers.

1.4 Questions of the Study

The most important question that this dissertation addresses is what the size of the shadow economy in Saudi Arabia has been during the time frame 1975–2018, given its specific economic characteristics. This time frame was chosen because reasonably

reliable data on the economy in Saudi Arabia start to become available with the start of the second national economic plan in 1975. To our knowledge, no study to date has been done on the SE in Saudi Arabia for this whole timeframe. In addition, significant new policies have been put in place over the last couple of decades to reform the Saudi economy. Examining what has happened to the SE in Saudi Arabia before and after the introduction of these policies is an important research subject. Useful time-series data, needed to evaluate the SE in Saudi Arabia, have become increasingly available. There is good reason to believe that not only has government employment and spending had a great impact on the SE in Saudi Arabia, but foreign-worker remittances, government regulations, inflation, and the activities of the Saudi Arabian Riyal Express (SARIE) banking infrastructure have also had a powerful effect. This dissertation examines the relationship among all these factors, including, most important:

- The fact that increased government spending and employment may draw activity away from the shadow economy.
- Higher value added taxes increase or decrease SE activity to the extent that they make Saudi products and services more or less competitive.
- Improved government services and enhanced regulation may increase or decrease the SE in Saudi Arabia, depending on whether they provide incentives for people to leave or to join the official economy.
- The incorporation of more people into the banking system by SARIE may reduce the SE in Saudi Arabia by reducing cash transactions.

- Significant foreign remittances of income, due to large registered and unregistered expatriate workforces in Saudi Arabia, may or may not stimulate more activity in the SE in Saudi Arabia, depending on whether those remittances drive a need to make more unofficial income.

1.5 Study Contributions

This dissertation aims to achieve several advances. These include improving the quality of research done on the shadow economy in Saudi Arabia and its evaluation, as well as the importance of government spending, changes in regulation, and the reform of the financial infrastructure through SARIE. These are factors not previously explored in relation to the SE in Saudi Arabia. Another goal of this dissertation is to gain more accurate insights into the size and dynamics of the SE in Saudi Arabia for Saudi policymakers and others interested in understanding what might be the right mix of incentives and penalties to promote healthy development in Saudi Arabia, especially in the government's ongoing effort to strengthen the implementation of Saudi Arabia Vision 2030. This study could be the first of its kind to size the SE in Saudi Arabia annually for the years 1975–2018, a period covering many developments in the Saudi Arabian economy and society. My findings should help appropriate parties to better understand what works and what does not work in developing a relationship between the official and informal parts of the Saudi economy. A more informed and fact-based relationship between the two should enable the country to increase the benefits derived from the entrepreneurial dynamism that is associated with the SE and its known contribution to the official economy through substantial spending.

1.6 Organization of the Study

This dissertation is structured as follows: Chapter Two presents an overview of the Saudi economy during the period of the study. Chapter Three reviews the economic literature on the shadow economy. Chapter Four analyzes the methodology and explains the data that are used in estimating the SE in Saudi Arabia. Chapter Five presents the estimation results of the annual size of the SE in Saudi Arabia using the currency approach during the period 1975–2018. Finally, Chapter Six presents the summary and the conclusion of this study.

CHAPTER 2: SAUDI ECONOMY

2.1 Introduction and Overview

The Saudi Arabian economy is the largest in the MENA (Middle East North Africa) region and the 18th largest in the world, with a GDP of $782 billion and a population of 33.7 million (World Bank, 2018). It is also the largest exporter of oil in the world, with that product accounting for more than 80% of its exports. Oil income accounts for approximately 87% of government budget revenues and 42% of GDP. This GDP includes government consumption (25%), exports (34%), investment in fixed capital (23%), and household consumption (42%). The private sector has been developing and growing over the period under consideration in this study (1975–2018) and currently produces 40% of the country's GDP.

During this period, Saudi Arabia has evolved from a developing country, almost totally dominated by government and the oil/gas sector, to a more complex and diverse society, whose economy is moving towards achieving the beginnings of developed status under the guidance of its Saudi Arabia Vision 2030 plan, published in 2016. This vision focuses on economic liberalization and diversification. Saudi Arabia's private sector is growing in size and importance as a result of the success of a series of five-year plans the government has been implementing for the past few decades. These have made significant improvements in education and in developing effective conditions for foreign investment. The implementation of the plans has stimulated private sector performance, although their results have not coincided with their goals. The Kingdom is currently highly focused on the development of educational programs aimed at facilitating

economic transformation through the involvement of more highly trained local specialists. It is also focused on creating employment opportunities for nationals, stimulating productivity increases, and continuing to promote overall infrastructure expansion. The power generation and telecommunication sectors are among the country's priorities in the government's Vision 2030 infrastructure plans. The government is also very concerned with societal welfare and quality of life improvement through the provision of expanding social services and education opportunities.

2.2 Economic Growth

The Kingdom of Saudi Arabia has come through the long process of economic transformation during the period 1975–2018. During this time, successive governments have achieved positive results in promoting economic growth and social wellbeing, although there have been significant fluctuations in the outcome of this effort. The ride has been bumpy and more highly correlated with global oil prices than with domestic economic achievements (see Figures 2.1, 2.2, and 2.3).

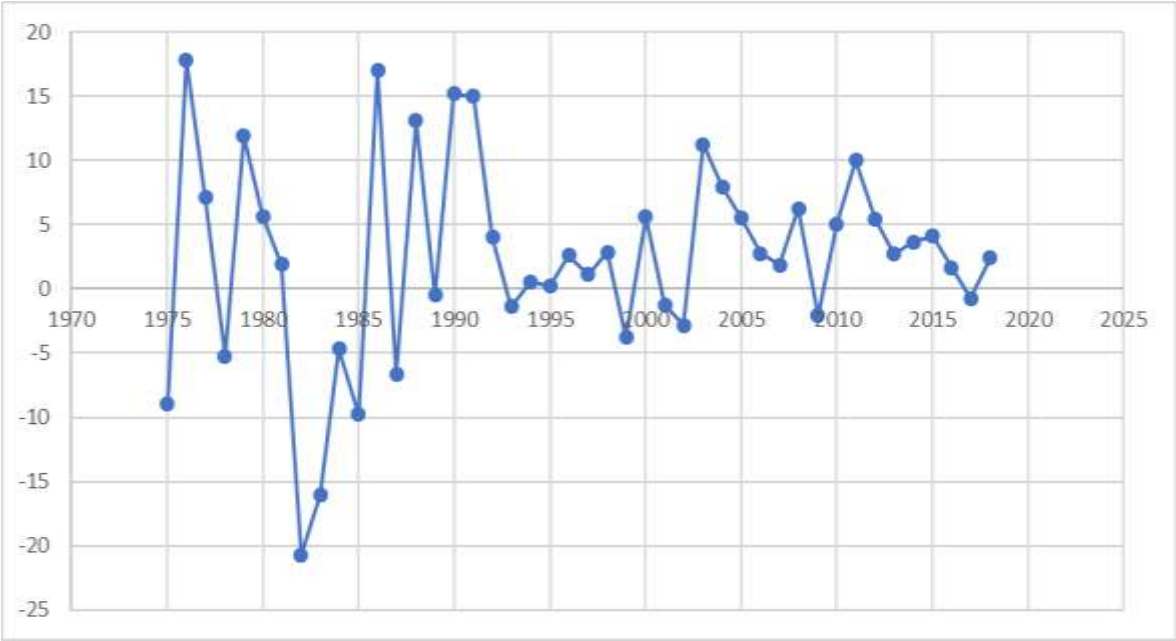

Figure 2.1. Economic growth in Saudi Arabia from 1975–2018.

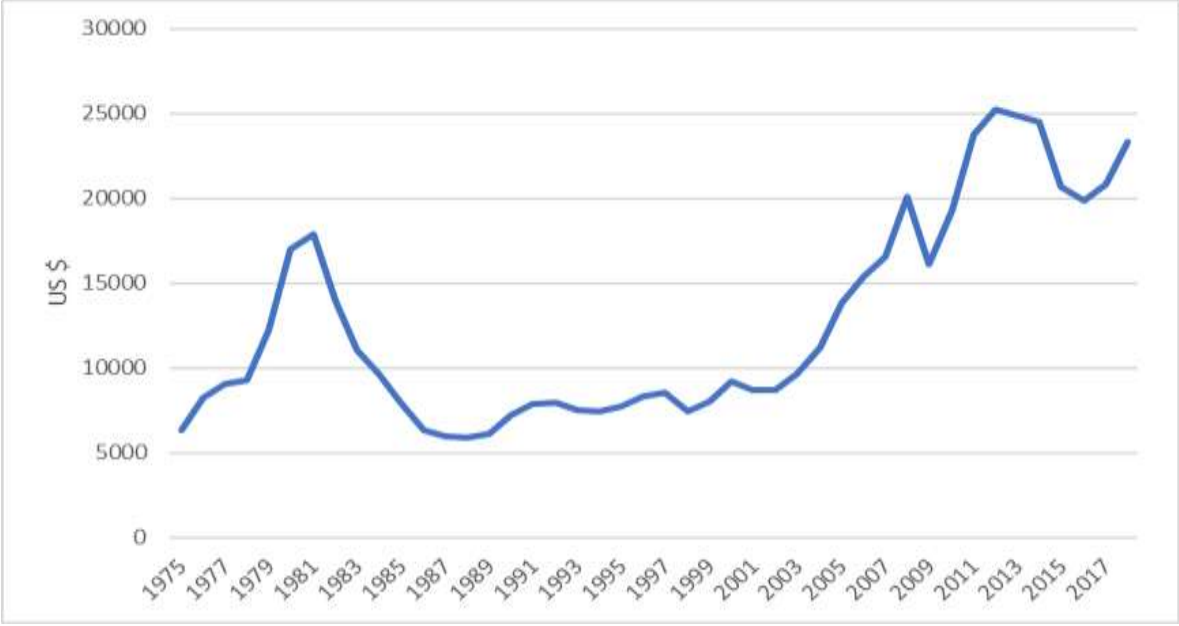

Figure 2.2. GDP per capita in current US $ from 1975–2018.

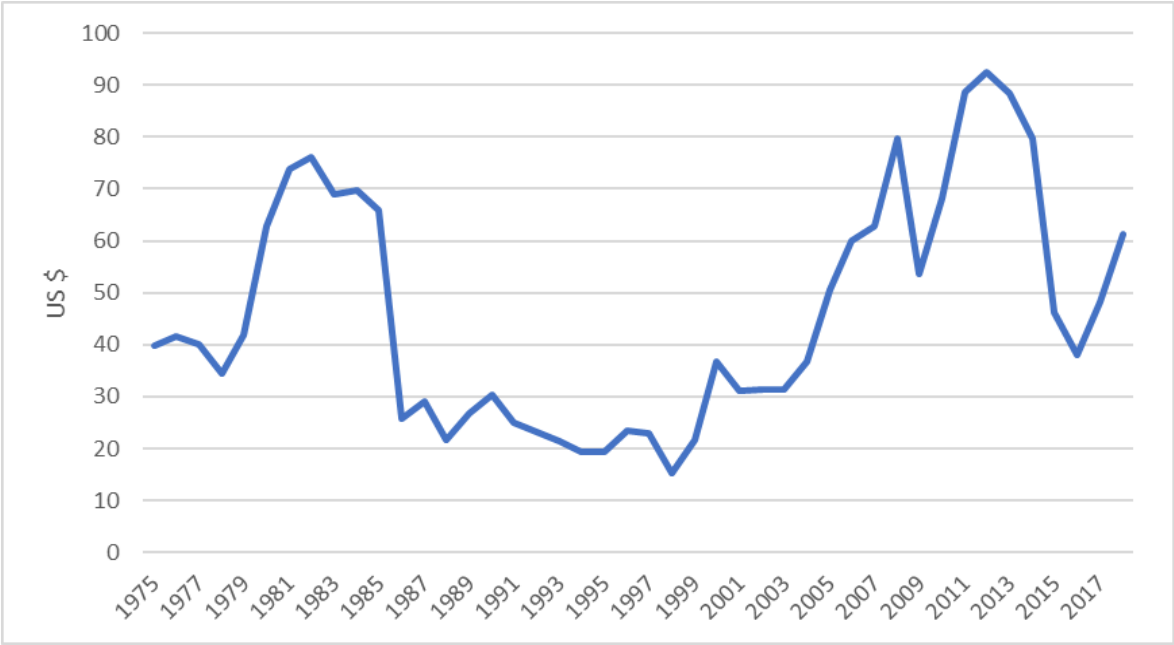

Figure 2.3. The oil price in current US $ from 1975–2018.

Five-year plans to promote growth and diversity in the economy have been a featured strategy of successive Saudi governments since the 1970s. Their focus has consistently been to decrease dependency on hydrocarbon revenues, enhance the nation's infrastructure, and diversify the goods and services produced domestically, as well as to expand the contribution, quality, and wellbeing of the domestic labor force. Early plans were aimed at developing the country's transportation and communication facilities, which, until the 1970s, were rudimentary. Subsequent plans addressed growing the private sector and diversifying economic activities, sometimes with mixed results. These plans have variously promoted production of domestic food, improvement of education, facilitation of professional training, enhancement of the availability of quality health care, and establishment of partnerships and trade relations, both between the country's regions

and internationally. The success of these plans has fluctuated with oil prices and the government spending more than was hoped for, but progress has been made, frequently occurring as a result of intensified capital and labor/expertise inflows from abroad to different sectors of the economy. The global crisis of 2008 had a significant impact on the country. It caused a decrease in oil prices and overall demand. Business performance in all sectors decreased, creating unemployment and pressures on government budgets. This led government to reorganize its finances, implement more discipline into its budgeting, and reorient its priorities towards improving the quality and access of its domestic workforce. These efforts paid off as economic activity recovered worldwide from 2010 onwards, and oil prices grew. As shown in Figure 2.2, the real GDP per capita increased significantly in 2010 and even approached pre-crisis levels. With the introduction of its new (2016) Vision 2030 program, Saudi Arabia aimed to embed more sustainability and a broader base into its ability to grow. This is true in the oil sector, where it is making a significant push into renewable energies such as solar. Saudi Arabia is also making big investments in new kinds of sustainable cities and trade hubs. The challenges facing Saudi economic growth going forward include how to insulate it more from oil price changes and how to drastically reduce the burning of fossil fuels worldwide to address climate change. They also include how to balance the use of foreign labor and expertise with the need to engage more Saudi nationals productively in the economy. There is also the issue of how to deliver on the promise of Saudi Arabia Vision 2030 in an era of possible limitations on government spending, as the oil price stagnates and often declines. The role of the shadow economy in hindering or helping with this issue is potentially

critical and a topic worthy of important policy consideration and ongoing research. Table 2.1 shows some key statistics of the Saudi economy.

Table 2.1. *Saudi Arabia Economy Key Statistics (2013–2018)*

Year	2013	2014	2015	2016	2017	2018
Gross domestic product, billions of 2010 U.S. dollars	629	652	678.7	690.1	685	701.6
Capital investment as percent of GDP	26.47	28.75	35.13	30.93	28.86	24.23
Household consumption, billion USD	223.66	242.63	263.68	276.12	283.64	298.2
Unemployment rate	5.57	5.72	5.59	5.65	5.89	5.92
Trade openness: exports plus imports as percent of GDP	82.71	80.64	72.07	61.86	64.2	66.57
Foreign direct investment, percent of GDP	1.19	1.06	1.24	1.16	0.21	0.54
Percent of world GDP	0.98	0.96	0.89	0.86	0.86	0.92
Percent of world oil reserves	16.15	16.11	16.03	16.15	16.19	17.20

2.3 Population

The population of the Kingdom of Saudi Arabia has grown significantly over the period considered by this study, reaching nearly 34 million by 2018 (see Figure 2.4). This growth is mainly due to improvements in the country's social and economic situation, as well as an inflow of foreigners during the last few decades to take advantage of opportunities and to provide needed expertise. As of 2018, foreigners composed 37% of

the country's population, with the most substantial proportion from South Asia. They made up 76% of the employed population and almost 80% of employees in the private sector. In Saudi Arabia, 30% of these foreign workers are estimated to be illegal or undocumented. Many work full- or part-time in informal companies. More than 70% of this labor force is employed in the service sector or engineering support/construction (Françoise, 2018). This situation has created a number of dynamic tensions. On the one hand, more population means a larger GDP and more demand. However, the increasing ratio of foreigners to the domestic population has created worries for the Saudi leadership, especially when it comes to the employment of Saudi nationals, per capita GDP, political loyalty, shadow activity, and the use of national resources. This is especially true since efforts to strengthen the skills, develop business motivation, and improve the education of Saudi nationals are still at a relatively early stage and have experienced some setbacks from time to time. This is true nationally and at the regional level, where efforts to even out opportunities and growth across the country have been mixed. From time to time, the Saudi government has tried to restrict or control the number of foreigners working in the country, but the long-term increase has been relentlessly upward as the wealth of the Kingdom and its ambitious development goals have created an overwhelming demand for more foreign workers and expertise.

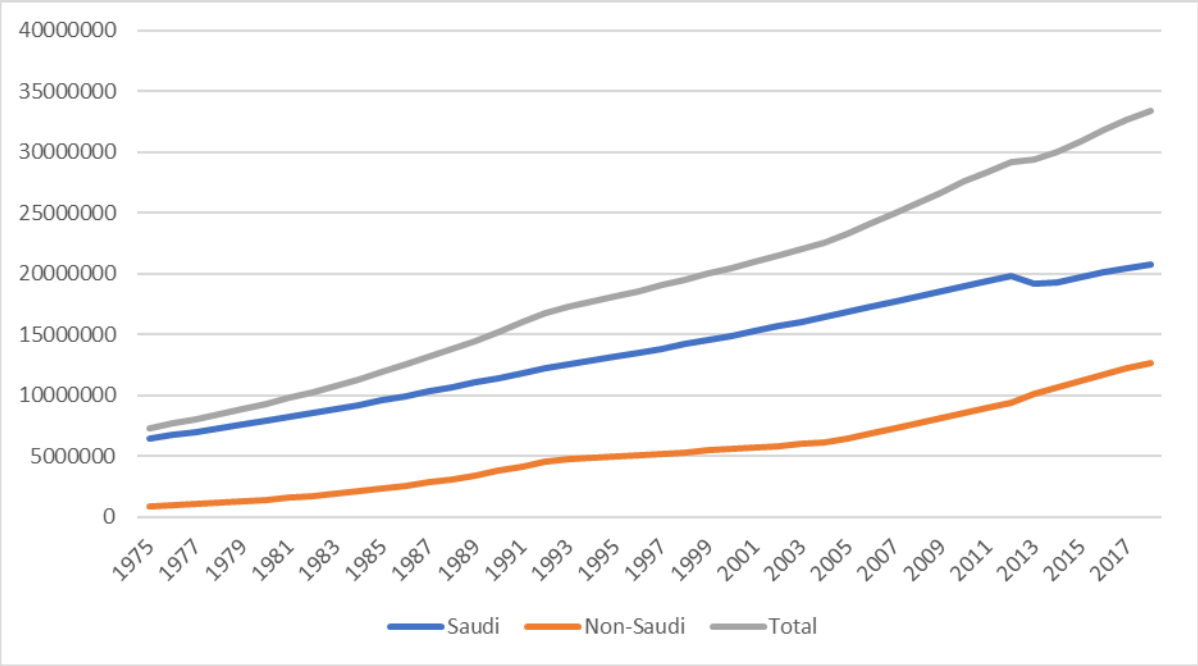

Figure 2.4. Population in Saudi Arabia from 1975–2018.

Since 2011, the government has implemented a policy called Nitaquat, designed to increase the relative proportion of Saudi nationals in the workforce. A host of regulations, such as new taxes and fees on foreigners and deportations of unregistered or improperly registered expatriates, have been applied. These have had mixed results. On the one hand, 800,000 foreigners left Saudi Arabia between 2017 and 2018, according to official statistics, but since then there have been an unknown number of new entrants—both official and unofficial—to meet new demands for foreign expertise associated with Vision 2030 and the difficulty, in the short term, of replacing foreigners with Saudi nationals.

2.4 Urbanization

As in many developing countries, the urban population in Saudi Arabia is growing due to the increase of employment possibilities available in cities where the proximity of complementary businesses, government operations, advanced healthcare facilities, and tertiary education establishments cross-fertilize innovation and, hence, growth and development. This is not true in many rural areas, where several of these important growth and development factors are frequently lacking. Urban environments are also the location of shadow economy activities that take place for good or for ill.

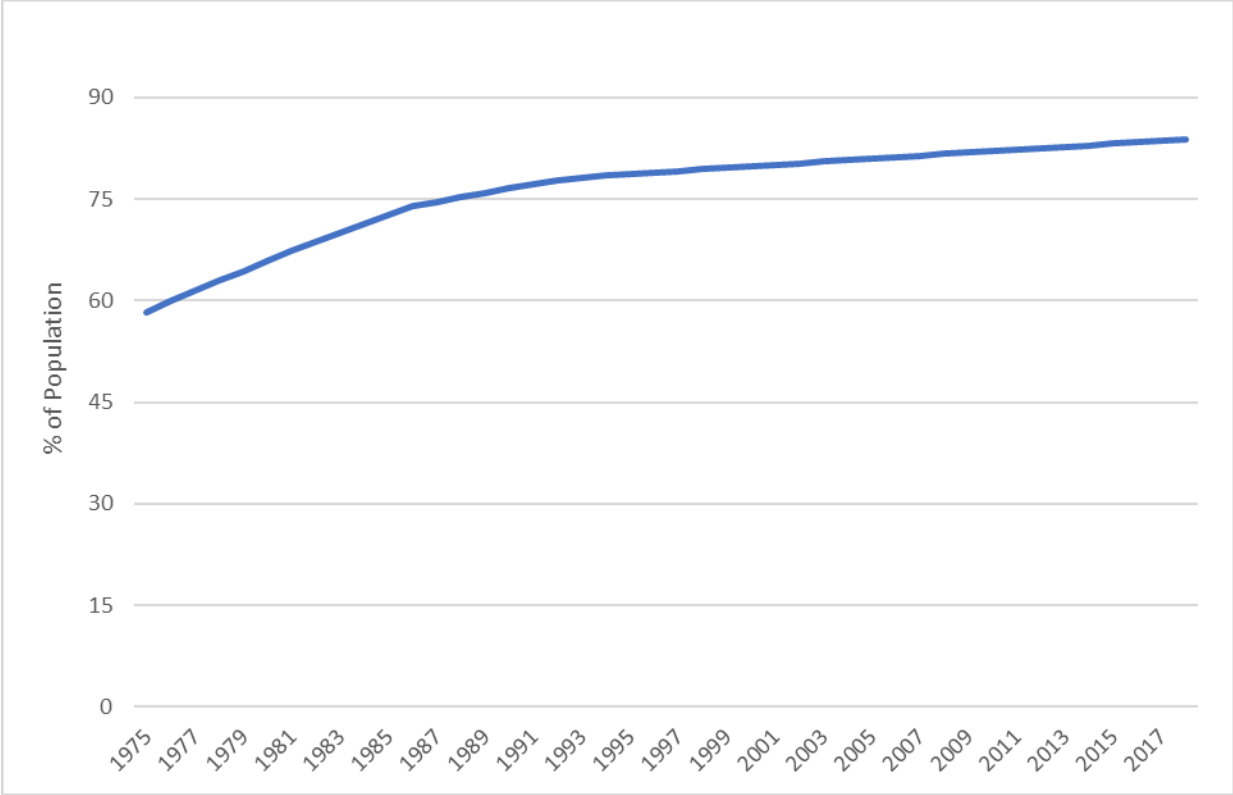

Figure 2.5. Urban as a percentage of population from 1975–2018.

2.5 Taxes

The tax system in Saudi Arabia is quite byzantine, with a variety of different foreign and domestic taxes and fees. A host of various regulations are applied differentially to Saudi nationals and foreigners. The Saudi tax system is managed by the General Authority of Zakat & Tax (GAZT), which is responsible for the development of tax regulations as well as the collection of taxes within the country, relating to individuals and organizations. The tax treatment of investments in the country is quite favorable. This is because the Saudi government's national development policy is highly focused on leveraging private investment and increased privatization of the economy. Corporate taxes are based on the net income of a company without reference to its type of activity or form. Corporate taxes apply only to foreign companies or foreign partners. They range from 25% to 45%. The percentage levied depends on net business income. The government provides tax abatements of up to 10 years on investments in specific provinces of the country, with the aim of attracting businesses into these regions to increase employment opportunities for residents. There is no tax on personal income in Saudi Arabia. There are voluntary social security charges, fees levied per foreign worker employed, and, more recently, value added tax (VAT) levies. VAT applies to almost all suppliers of goods and services, and it is charged at a standard rate of 5% (Muhammad, 2019).

2.6 The Banking System

The central bank of Saudi Arabia is the Saudi Arabian Monetary Agency (SAMA). It was established in 1952 to issue a national currency called the riyal,

supervise the country's commercial banks, manage the nation's reserves of foreign currency exchange rates, promote price stability, and ensure sustainable development of the country's financial system. As an Islamic institution, SAMA cannot charge interest under the religious law, but it is able to charge for lending. It also pays commissions on deposits. SAMA is focused on encouraging private sector development through efficient and effective monetary policy. It has evolved a set of regulations and policies to address the limitations of Islamic law and to facilitate the liquidity and solvency of the nation's businesses and banks.

SAMA has also worked diligently to promote online banking and the use of credit cards instead of cash. As part of this process, since 1997, it has put in place and manages a national payment system called the Saudi Arabian Riyal Interbank Express (SARIE). Reducing the use of cash for transactions has long been an important priority for the government of Saudi Arabia. This is part of its ongoing efforts to curb corruption and establish better control and understanding of the unofficial or shadow economy. It is also part of a strategy for bringing more people in the country into the official financial system to enhance their business opportunities. The exponential increase in the number of credit cards issued and ATMs put in place during the past 30 years reflects these official drivers, as does the growth of e-commerce in Saudi Arabia, which reached 1.5% of GDP in 2018.

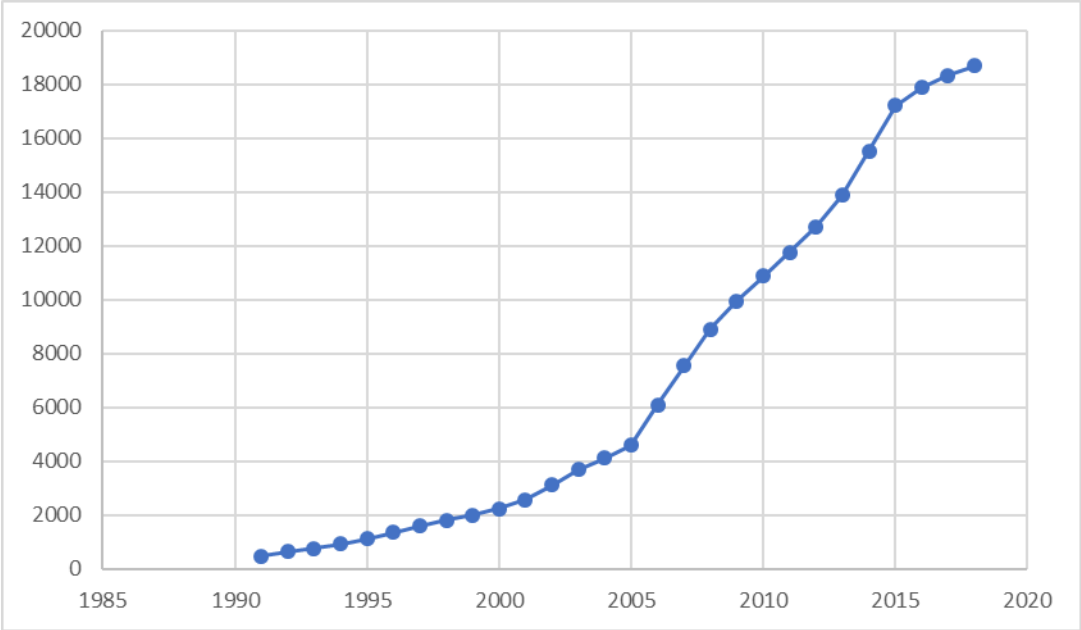

Figure 2.6. Number of credit cards issued in Saudi Arabia.

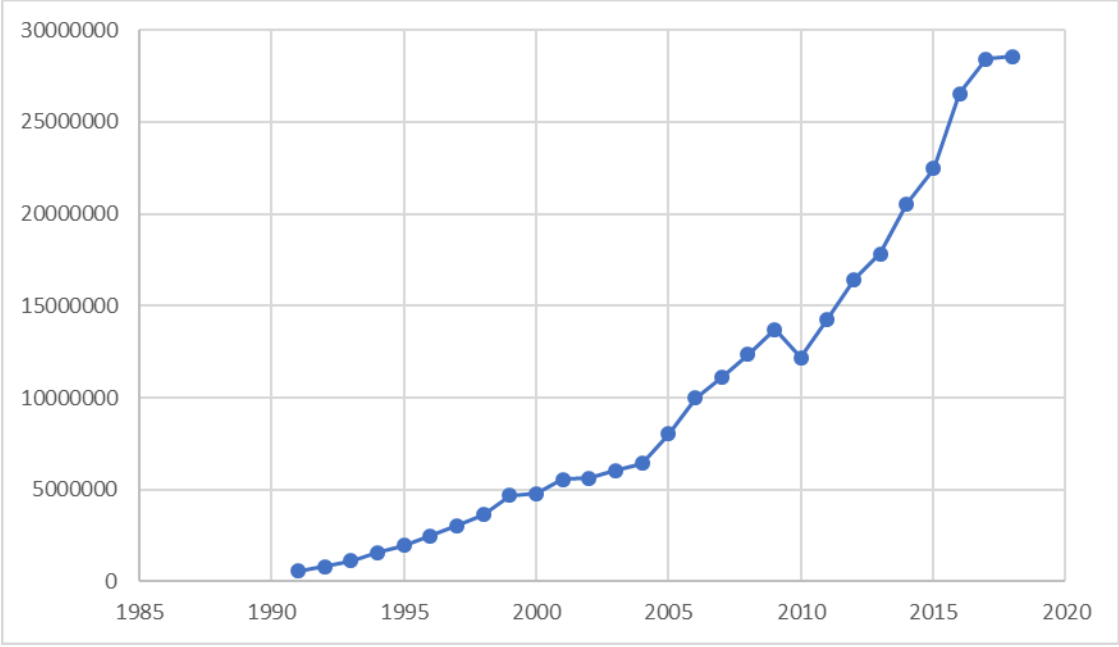

Figure 2.7. Numbers of ATMs in Saudi Arabia.

2.7 The Saudi Arabian Riyal Interbank Express (SARIE)

The Saudi Arabian Riyal Interbank Express (SARIE) banking system is the digital backbone established by SAMA to enable electronic account settlement, monetary exchanges of all kinds, and the digital payment of bills. This service has simplified key business transactions in the country and improved business performance as well as accountability. The creation of a more cashless society has helped Saudi Arabia to save money spent on printing, facilitated national and international commerce, enabled better monitoring of economic performance and behavior, and reduced fraud in the country including the shadow economy. Any funds transferred via the SARIE system are secured and processed the same day. SARIE operations and transactions are available among all bank accounts in the country.

The main benefit of the system is full assurance that monthly payments are received on time without any delays and without the need for follow-up calls. Figure 2.8 shows the increasing rate of transactions completed with the SARIE system since its creation in 1997. The intensification of financial performance as a result of the system guarantees ensures its further development and growth.

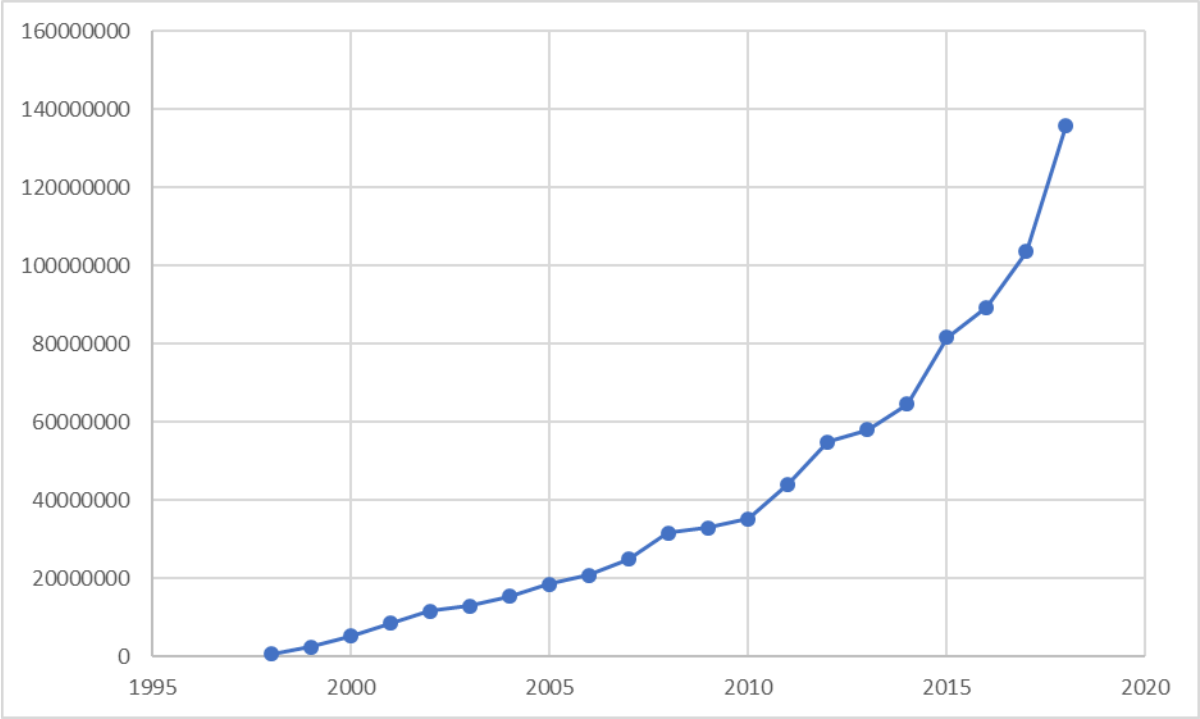

Figure 2.8. SARIE system's number of transactions.

2.8 Five-Year Development Plan (1970–2015)

The development of Saudi Arabia has been closely connected with the rise of the oil and gas industry there. Despite many changes in government policy, including efforts to diversify the Saudi economy away from hydrocarbons exports, Saudi Arabia has always depended to a significant degree on oil and gas revenues to fund its growth and development. This development has been driven by a series of nine (to date) five-year plans starting in the 1970s. The first plans in the 1970s focused on government-led infrastructure development, especially the infrastructure needed to strengthen its petrochemicals industry and expand power generation. The latter has been expanded many times over the years, and seaports' capacity has grown tremendously to facilitate

oil exports. The 1980–1984 plan added health care, social development and infrastructure development, to enable local Saudis to increase their ability to play a more significant role in the economy and improve the quality of their lives. This was deemed essential to increase growth and development. The fourth plan of 1985–1989 added education, training, and privatization as the necessary infrastructure projects were completed, and a further need for more Saudi national engagement through new business development in the economy was perceived. The government initiated entrepreneurship development stimulation through the encouragement of investments within the public and private sectors of the economy. This played a significant role in increasing the private sector share of the economy, especially in trade and commerce, agriculture, construction, and banking. The next five-year plan (1990–1995) focused on improvements to the country's military services due to regional tensions, a transformation of government social services, and a shift towards regional development within the country. The private sector growth has helped the country to expand employment opportunities for Saudi nationals and attract new investments to develop the country. The success of investments in education made by the previous plans enabled these new businesses and government efficiencies to come into being. The 1996–2000 plan continued the work of its predecessors but also aimed aggressively to reduce the country's dependency on oil and gas through private sector diversification, especially within agriculture. Investments in the development of a better educated and more highly trained labor force were significantly expanded during this plan. The subsequent development plans have put a very high priority on further growth of the private sector, which has now reached 40% of GDP, alternative energy, and

the rapid development of non-oil-related sectors. A further focus on jobs for citizens in these domains has become of paramount importance as the government sees the end of oil and gas dominance on the horizon, with increasing global concern about hydrocarbon-driven global climate change. Already, starting in 2005, the Saudi leaders have targeted international cooperation to achieve planned goals through the intensification of trade relations and investments within developed countries, as well as involvement in the World Trade Organization (WTO).

2.9 Vision 2030

Saudi Arabia has achieved significant development and growth during the past few decades, but its economy remains too dependent on oil and gas revenues, as well as foreign labor and expertise. In 2016 Saudi Arabia introduced a plan known as Vision 2030 to address these festering issues with new vigor and creativity. The main features of this plan include the transformation of public services, health care, education, and tourism. The goal is to create sustainable economic and social development that is able to transform the country's performance through the reinforcement of investment and economic activities, intensification of non-oil trade, and expansion of government spending on the social sector (Alshuaibi, 2017).

Three main goals are associated with Vision 2030:

1. Create a vibrant society that is culturally sophisticated, urbanized, and a tourist destination through sports and entertainment.

2. Produce a thriving economy: More women in the job market, greater competitive advantage, more foreign direct investment, enhanced non-oil exports, and far more privatization.
3. Evolve a nation that reaches for much higher excellence using new digital technologies, improves government effectiveness, mobilizes and motivates popular participation in sustainable development, and increases household wellbeing and savings capacity.

By *vibrant society* we mean the connection of Islamic principles with the cultural heritage and national identity through up-valuing national historic sites and the development of museums and cultural funds. Moreover, there is a strong emphasis on physical and social wellbeing improvement, including an increase in household earnings. "Daem" is a country program designed to promote a healthy lifestyle and facilitate the development of sports programs in order to increase quality and livability within the country (Foley, 2017). Sustainability is promoted through a decrease of environmental impact, optimization of resources usage, and development of balanced activities (Al-Ruithe and Benkhelifa, 2017).

Vision 2030 is driving 80 key projects to achieve its goals. These are financed by the Public Investment Fund of Saudi Arabia. As part of this process, the Saudi Council of Ministers approved the National Transformation Program. Vision 2030 aims to ensure that Saudi Arabia remains at the heart of the Arab and Islamic world. It highlights the strategic position of the country as connecting three continents. Vision 2030 also aims to really address the challenge of further privatization and engagement of Saudi nationals in

the private sector, which has been limited to date. This involves putting in place new incentives, increasing transparency in government and private sector activities, and ensuring efficiency-driven growth focused on non-oil sector performance, improvements in governmental indexes, and government spending control (Yamada, 2016). Vision 2030 is a complex plan that will be a challenge to implement. The role of the shadow economy is one that needs to be seriously addressed as part of this implementation process.

CHAPTER 3: THEORY AND LITERATURE REVIEW

3.1 Theory

Measuring the size of the shadow economy is a challenge because there are no generally agreed-upon definitions of it. Definitions run the gamut from the very broad—income that avoids government observation or taxation (Del'Anno, 2003; Feige, 1989; Fleming et al., 2000)—to the quite narrow—unregistered economic activities that could contribute to the officially calculated gross national product (Feige, 1989, 1994; Frey and Pommerehne, 1984; Schneider, 1994, 2005, 2011).

Generally, researchers tend to characterize the SE from two points of view: a definitional (unregistered or unaccounted economic activity) or a behavioral (engaging in illicit or unreported economic activity). Either approach may be preferred, based on whether an investigator is primarily interested in sizing the SE or understanding its theoretical causes and drivers. Both are frequently combined, leading to issues of consistency and rigor (Fleming et al., 2000). Regardless of the emphasis, both approaches are interested in differentiating the criminal (offerings that are produced outside the law), the irregular (actions that avoid regulations and taxes), the household (usually unrecorded or unpaid work by households), and the informal (activities that avoid legally associated costs and benefits) dimensions of the shadow economy (Feige, 1990; Portes et al., 1989). Table 3.1 shows the various classifications of the shadow economic activities, according to monetary and nonmonetary transactions and the legal status of the activity.

Table 3.1. *Types of Shadow Economic Activities*

Type of Activity	Monetary Transactions		Nonmonetary Transactions	
Illegal Activities	Trade-in stolen goods; drug dealing and manufacturing; prostitution; gambling; smuggling; fraud.		Barter of drugs, stolen, or smuggled goods. Producing 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.

Structure of the table taken from Rolf Mirus and Roger S. Smith (1997), with additional remarks from Enste and Schneider (2000).

Theoretical efforts to understand the shadow economy are quite varied. They range from looking for key parameters to determine how best to track and recoup missing tax income (Cowell, 1989) to attempting to determine whether the SE has a negative or positive effect on the official economy with the goal of incenting or discouraging its driving factors (Acemoglu, 1995; Dabla-Norris and Feltenstein, 2003; Friedman et al., 2000; Johnson et al., 1997; Kanniainen et al., 2004).

In looking at the SE as a concept, it is useful to examine the major theories about its content. These have been viewed as encompassing Marxist, dualistic-modernist,

structuralist-globalist, neoliberal-legalistic, post-structuralist illegality-voluntarist-utilitarian, and management theories. All have been identified as being either negative or positive towards the SE views that are considered somewhat simplistic (VanderBerg, 2014). The Marxian theory is held to posit a dependence of the official economy on the shadow economy (Sanyal and Bhattacharyya, 2009; VanderBerg, 2014). The dualistic/ modernist theory is focused on the SE as informal work for cash and illegal activity (Doeringer and Piore, 1971; Losby et al., 2002; Routh, 2011; Saint-Paul, 1997). The structuralist/globalization theory understands the SE to be a natural complement to though imposed constraint on the official economy, allowing players in the latter to become more efficient by outsourcing work to the former to reduce costs (Godfrey, 2011; Maloney, 1999; Routh, 2011). The neoliberal/legalistic theory identifies the efficiency/inefficiency of government regulation of the official economy as freely chosen driver of SE (Alderslade et al., 2006; Godfrey, 2011). The post-structuralist-illegality-voluntarist-utilitarian theory is similar to the neoliberal/legalistic theory in its perspective on the SE in that this economy is perceived as a freely chosen option to the official economy. However, it focuses more on the level of development of the official economy as the main driver, with lower development driving a larger SE (Chen and Jim, 2012; Maloney, 2004).). Management theories of the shadow economy concern themselves with its dualistic characteristics and its interconnectedness to the official economy. (Godfrey, 2011; London and Hart, 2004).

3.2 General Literature Review

Cagan (1958) triggered the emergence of academic shadow economy research. In a pioneering study, he examined the ratio of currency to the total money supply from 1875–1955 for the US economy after new data became available for this period, with the intention of understanding the main drivers of that ratio. He noted that the US economy fluctuated significantly during this period as a result of war, the Great Depression, and the increasing adoption of banking by the general population. Cagan observed that standard demand analysis focused on price (interest paid) and income (expected real income per capita), variables needed to be supplemented by indirect estimates of attempts to conceal income tax payments (income taxes as a percent of personal income) in order to account for the size of the fluctuations, especially during wartime. He did an econometric analysis of these three variables and found that the results were consistent with the data. Cagan speculated that, *ceteris paribus,* increases in the interest rate, declines in taxes, and an increase in per capita income would lower the currency ratio and that such a lowering might well occur in the future. Cagan's work formed an important foundation for the use of currency demand in the sizing of the SE by later researchers since it has always been known that many transactions in the informal economy are conducted in cash, although it does need costly surveys and sampling. Usually, monthly, quarterly, and yearly data from monetary sources are available.

Gutmann (1977) followed the groundbreaking currency ratio efforts of Cagan (1958) and examined currency demand in the US economy for the period 1892–1976, with the specific intention of linking it to the growth of what he called the "subterranean

or extra-legal economy." Gutmann noted that currency in circulation, after some ups and downs during the period, had been growing more rapidly than demand in recent times, deposits peaking at $344 per $1,000 of such deposits by 1976. Using the prewar period of 1937–44 (prior to large wartime tax increases) as a benchmark indicator averaging $217 per $1000 of deposits, he attributed the subsequent increase of $127 to the growth of the shadow economy by 1976 and sized it at $200 billion in 1976 dollars, or 10% of US GDP. Gutmann assumed that this increase was a consequence of the actions of the government, including its taxes and regulations, and warned that the underground economy would grow if these actions were not reined in.

Feige (1979) lamented the stagflation occurring worldwide in the 1970s and the lack of an explanation for it by the economics profession, which was driven mainly by Keynesian theory and official GDP statistics. He focused on the problems with these statistics in lieu of an acceptable substitute for theory. Feige examined the issue of what he called the irregular economy—economic activities unreported, unmeasured, and unmonitored by conventional techniques—as a bellwether of those problems. He started by examining Guttman's work on the US economy. In this examination, Feige noted that Guttman made the problematic assumptions—all of which he challenges, except for two—that (1) only currency is used for transactions in the irregular economy, (2) his benchmark of 1937–41 is justified as mostly clear of such an economy, (3) subsequent growth in currency to demand deposits was exclusively associated with this economy, and (4) per-dollar income generation in this economy was equivalent to that of the official economy. As an alternative, he proposed to size the US irregular economy by

examining the ratio of total transactions in the economy—both regular and irregular—to observed income—income counted in the Official Statistics. Because taxes were low before WWII, Feige took 1939 as his benchmark year, which, following Guttman and for purposes of analysis, he assumed to represent an economy with no "shadow." From this year forward, Feige looked at the development in the total transactions to the official income ratio through 1978 and concluded that the irregular economy reached 26.6% of GDP that year. In arriving at this estimate, he acknowledged the need for considerable refinements in his methodology that might change that percentage. These included changes to his financial-sector calculations, adding barter transactions and unreported government payments in debits, variations in the velocity of money between the official and irregular economy, and relaxing the assumption of no shadow before 1939. The implications that Feige drew from his study are that official government statistics are unreliable and that the irregular or unofficial economy is much larger than expected and is growing. He also determined that a better understanding of its drivers, followed by policies that reduce it, would significantly improve the health of the US economy. The policies that Feige recommended, which flow from his analysis, were to create a better and more comprehensive data collection that includes the irregular economy and broadens the tax base and to legalize more goods and services then defined as illegal.

Tanzi (1980) observed the increasing focus in the media on what he called the *underground economy*. He defined this underground economy (UE) as the activities not reported in the official statistics. Tanzi did so in order to provide a common basis of dialog among competing views of what the UE represents. He identified taxes and

restrictions as its main drivers. Tanzi also reviewed available sample direct review estimates from income tax returns of the UE by the Internal Revenue Services (IRS), which measured it in the 5.9%–7.9% of GDP range. He reviewed Gutmann's (1979) tax returns (initially published in 1972 and updated in 1979), a monetary statistics-based indirect measure of the UE of around 10% of GDP. He also reviewed Feige's estimation based on the quantity equation that is expressed by Irving Fisher (1922),

$$M*V = P*T$$

(M = M_0 and M_1, V = transaction velocity of money, P = average price of all goods exchanged, and T = physical volume of transaction), which found the UE in the US to be 25.5%–33.1% of GDP in 1979. He criticized both Guttman's and Feige's approaches for assuming that no UE existed before US involvement in WWII as a benchmark and their undue focus on government taxes and restrictions following that war. He suggested that this leads to unduly high estimates of the growth and size of the UE. Tanzi then proposed a better approach to sizing the shadow economy. He revisited and extended Cagan's work to derive a new currency demand equation and applied it to statistics for the period 1929–76. After discussing pros and cons of using particular variables to do this, he settled on the following regression equation for currency demand:

$$\ln\left(\frac{C}{M2}\right)_t = \beta_0 + \beta_1 ln(1 + TW)_t + \beta_2 ln\left(\frac{WS}{NI}\right)_t + \beta_3 lnR_t + \beta_4\left(\frac{Y}{N}\right)_t + u_t$$

where:

C/M2 = the ratio of cash holding to current and deposit accounts, TW = a weighted average tax rate (to proxy changes in the size of the shadow economy), WS/NI = the

proportion of wages and salaries in national income (to capture changing payments and money-holding patterns), R = the interest paid on savings deposits (to capture the opportunity cost of holding cash), and Y/N = the per capita real income. Tanzi's empirical results using this equation indicated that the US underground economy in 1976 might have been between 5.1% and 11.7%. He concluded this study by arguing that the existence of the UE distorts both public policy and the economy. He posited that the UE negatively affects the efficient and optimum allocation of public and private resources. For these reasons, he argued for a greater understanding of the UE to enable its size and impact reduction.

Tanzi (1983) used his method deployed in 1980—somewhat modified—to look at the US economy for the period 1929–80. He first noted the movement of underground economy interest away from the press and more into academia. Tanzi pointed out ongoing disagreements about its definition and measurement since his last study and suggested that advances had occurred, including the use of his monetary approach and other approaches to look at several countries besides the US. He distinguished the fixed ratio, currency denomination, and currency-equation variants of the monetary approach to which he subscribed. Tanzi pointed out that the fixed ratio variant problematically assumes a monetary ratio that would have remained constant but for the UE and that such an economy was once not present. He again reviewed and critiqued Guttman's and Feige's methods, identifying the former's monetary ratio as C/D and the latter's as MV/GNP with C = currency in circulation, D = demand deposits, M = money supply (M0+M1), V = transactions velocity of money, and GNP = officially estimated gross

national product. He continued to be concerned about their prewar "no underground economy" benchmark and their assumption of an ongoing constant fixed currency to demand deposits ratio, which he claimed drove their high estimates of the US UE. Using his method on more updated data, Tanzi found that the US UE in 1980 was 4.5%–6.1% of the GNP and that this figure was probably double what it had been in the mid-1960s due to increases in marginal tax rates between 1975 and 1980. He pointed out that, due to the limitations of the data and all methodologies addressing the UE, these results are merely indicative of "trends and magnitudes" in the size of the US UE and certainly are not definitive. However, Tanzi noted that they correlate quite well with direct estimates for 1974 and 1976.

Nikopour (2003) measured the shadow economy in Iran for the period 1961–2001. To do this, they used a modified currency ratio approach with a regression model focused on the specific features of the Iranian economy. The variables that they used in their model were per capita income, inflation, urbanization index-linked to financial institutions, private consumption outlays, government outlays to GDP ratio, import taxes, social security taxes, and a black-market foreign-exchange rate. The model estimation used an auto-regressive distributed lag (ARDL) method. The average size for the Iranian SE during the period was estimated by the model to be 27.6% of GDP, with the government element having the biggest impact. This study concluded that the SE is harmful across many macroeconomic variables, including Social Security funds, labor-force allocations, the ability to plan economic growth successfully, exchange rate management, and corruption. For these reasons, the study recommended that measures

should be introduced to reduce the SE, without specifying any particular one.

Shima (2004) sized the Norwegian shadow economy for the period 1991–2002 using a currency demand approach (CDA). The dependent variable used was the real currency per capita defined as the deflated (1990 = 100) average currency in circulation. The independent variables were the household consumption per capita, the bonds interest rate, the amount of electronic payment (domestic credit cards) per capita, direct tax relative to gross labor costs, indirect tax relative to GDP, and the complexity of the tax system using the Herfendal-Hirschman index. This study found a reduction in the SE of Norway from 10.5% of GDP in 1995 down to 5.6% in 2002, after a period of increase prior to this timeframe. The study explained this decline as a consequence of increased use of electronic payments and tax reform, including simplification, after 1992.

Carolina and Pau (2007) estimated the size of the SE for the Netherlands Antilles for the period 1979–2005 using an adjusted CDA approach, along with other confirmatory methods. The study constructed two equations using the error correction model (ECM) framework. In the first one, the dependent variable was the ratio of cash holdings to M2. The independent variables were total taxes, savings deposit interest rate, real income, and number of self-employed persons. In the second one, the variables were unemployed, indirect tax, interest rate, and self-employed. The study found that the SE in the Netherlands Antilles averaged 8% during the period 1988–2000, rising to 14% of GDP during the period 2001–2004.

Hametner and Schneider (2007) sized the Colombian SE and examined its development for the period 1976–2002 by implementing a CDA that used two variations,

one looking at cash holdings to checkable deposits and another looking at currency demand per capita. They took this two-pronged approach in order to maintain a check on the robustness and reliability of their work. The variables that Schneider and Hametner assumed drove currency demand generated by shadow activities were taxes on income and VAT, the unemployment rate, and the real expenditures for public employees as a % of GDP. Their work found that the shadow economy in Colombia rose from around 20% of GDP at the beginning of the period to 50% during the 1990s. Their results also found that the Colombian SE was positive for economic growth and that its expansion was driven primarily by unemployment and tax increases. However, Schneider and Hametner expressed concerns that Colombia's economic potential was nonetheless held back by inadequate government efforts to integrate the SE better into the official economy.

Macias and Cazzavillan (2009) sized and examined the development of what they call the *informal economy* in Mexico for the period 1970–2006. To do this, they used a CDA that deployed vector-error correction and added Mexican remittances from abroad to the standard variables such as currency in circulation as a dependent variable, with tax, GDP, and interest rate as independent variables. Their results suggested that the informal economy in Mexico grew to 66% of GDP by the late 1980s, declining to 30% by the end of the 1990s. They concluded that changes in the nature and extent of the informal economy can have a positive long-run relationship to economic growth but that a lack of interest by successive governments in addressing the negative effects of the informal economy, such as economic stagnation and lower-than-necessary productivity, needed to be reversed. Macias and Cassavaillan asked that policies be put into place that formalize

the informal economy, especially with respect to the substantial remittances from Mexicans working abroad.

AnaMaria et al. (2009) looked at the development of the Romanian shadow economy between the years 1998 and 2008 using a CDA approach and vector-correction model, with a particular focus on addressing non-stationarity and cointegration issues. AnaMaria et al. (2009) used deflated cash to M2 as the dependent variable, with GDP, taxes, interest rate, and wages as the independent variables. Their results showed the Romanian SE growing to 38.12% of GDP by 1999 and then declining to 27% by the end of the period.

In order to revise the CDA study of the Romanian SE for the period 2000–2010, Dobre and Davidescu (2013) used a bounds-testing approach to co-integration and error correction developed within the ARDL framework. They used deflated currency in circulation outside the banks as the dependent variable. For the independent variables, they deployed GDP (the base year 2000 = 100), total tax revenues normalized by GDP, the one-year real savings deposit interest rate, and the ratio of wages and salaries in the national income. Their results estimated the Romanian shadow economy to be in a range of 37.4%–45% of GDP during the time frame. Dobre and Davidescu concluded that there was a stable relationship between currency demand and its determinants throughout the period.

Alm and Embaye (2013) estimated the size of shadow economics around the world for 111 countries for the period 1984–2006 using a four-step Arrelano and Bond (1991) GMM dynamic panel method driven by a CDA approach. Their results showed a

range of SE size with means from 10%–86% of GDP grouped into development categories—OECD (17%), Non-OECD: high income (24%), upper middle income (33%), lower middle income (37%) and low income (38%)—exhibiting long term secular growth. The study used the currency ratio C/M2 as the dependent variable, with tax rate, enforcement, inflation rate, per capita income, interest rate, and urbanization as the dependent variables. A central study finding was the following: The currency to M2 ratio tends to be higher as the economic return from underreporting increases, the weaker the enforcement capability of the tax authorities is, and the higher the rate of inflation.

Trebicka (2014) assessed the growth and size of the Albanian underground economy for the period 1993–2013 using CDA and found it went from 40% of GDP in 1993 down to 30% in 1999, rising again to 45% in 2008 and declining somewhat to 40% in 2013. The variables this study used were currency in circulation per capita, sales and income taxes, custom duties, net income per capita, interest on savings deposits, amount of cash outside banks, and a currency depreciation dummy variable. He attributed these fluctuations to the vagaries of government tax policy during the time frame.

Asiedu and Stengos (2014) used a CDA developed by Giles (1999) to estimate the size of the Ghanian shadow economy between 1983 and 2003. Their results showed its average for the period at 40% of GDP, fluctuating between 54% in 1985 and 25% in 1999. In their model they used currency in circulation, measured and underground real output and income, short-term interest rates, and the price level. They concluded that these estimates might be somewhat low due to the challenge of incorporating all aspects of the SE in Ghana with existing techniques. Asiedu and Stengos suggested that their

sizing of the SE could be improved by including labor-market factors, a proxy for the burden of government regulation, and some better indicators of taxation.

Raut et al. (2014) sized the underground economy in Nepal using a CDA approach for the period 1985/86–2010/11. They found that the Nepalese UE rose from 20% to 30% of GDP up until 1997, accelerated to 50% by 2009/10, and finally climbed sharply to 70% in the last two years of the period. The variables they used in their model were the ratio of cash holdings to current and deposit accounts, tax revenue per GNP, the proportion of private consumption in national income, the interest rate on savings deposits, rate of inflation, and per capita income. Raut et al. (2014) attributed the rapid UE increases in the second period to the armed conflict in Nepal involving UE used to purchase weapons. They speculated that the UE escalation in the years 2010 to 2012 could be attributed to a big rise in the Indian UE influencing Nepal through its open border with that country, as well as an increase in government corruption and poor trade and financial-sector regulation.

Ashok et al. (2017) used a combination of the Tanzi (1983) CDA and Andreas and Schneider's (2008) multiple indicators multiple causes (MIMIC) approach to model and size the shadow economy in Pakistan for the period 1972–2015. They found that it declined from 50% of the GDP to 28% during the period. Ashok et al. (2017) attributed this decline to reductions in the demand for cash, the unemployment rate, and the tax burden, as well as positive developments in the financial sector. They found the tax burden to be the most important driver of the SE in Pakistan from a list of causes and indicators variables (causes—tax burden, financial sector, disposable income, currency in

circulation/M2, and unemployment rate—and indicators—GDP, labor force participation rate, and growth of electricity consumption).

Hassan and Schneider (2016) sized and evaluated the shadow economy in Egypt using a CDA and a MIMIC approach for the period 1976–2013. Their MIMIC results showed a decrease in the Egyptian SE from 35% of GDP to around 23% during the period. Their CDA results also showed a decrease from 60% of GDP to around 23%. Hassan and Schneider explained that this decline in the Egyptian SE was the result of the reforms implemented by the Mubarak regime (1981–2011). In doing this work, they added variables of specific importance to the Egyptian economy to the standard variables, such as the tax burden, GDP, and unemployment used to measure shadow economies. They added self-employment, the significance of agriculture, and democratic institutional quality. They found the tax burden, agriculture, and institutional quality to be the main factors determining the size and evolution of the SE in Egypt. They concluded that a high level of unemployment is not correlated with a bigger SE in Egypt and that, in fact, it confers multiple benefits on the official economy such as absorbing the unemployed, stimulating the official economy, and creating new small-scale production markets. Hassan and Schneider also concluded that there is no best indirect approach to sizing the SE and that some new direct survey work would be beneficial.

Chen and Schneider (2018) used two estimation models to size the Chinese economy for the period 1978–2016. One used real M_0 per capita as the dependent variable, and the other used the currency ratio of the total currency supply M_0/M_2 as the dependent variable. This was fed into three CDA models to simulate the shadow

economy in China using a Prais-Winsten approach. Their findings showed fluctuations in the size of the SE in China, with it rising from 18.44% in 1978 to 32.16% in 1989 and then falling after that year to 4.27% by 2016, figures that mirrored changes in the official economy during the period. The fall in the Chinese SE after 1989 was attributed to economic reforms launched after that year. Chen and Schneider's models differed in detail but were similar in trend. One of three models, which focused on cash per capita, was identified as the most accurate. Taxes, regulation, employment in the primary sector, and fiscal decentralization all showed up as statistically significant drivers of the SE in China in this study, with these factors growing in significance over time and individual factors playing a more or less important role during different periods.

Mughal and Schneider (2018) looked at the Pakistan SE during the period 1973–2015 using a CDA with two econometric applications, ARDL and Engel Granger two-step. They added unemployment and government-control intensity as indicator variables in addition to the standard tax variable. Their different models estimated the average size of the Pakistan shadow economy for the period at between 25.29% of GDP and 26.41%, with fluctuations up and down between 14% and 42% and all models converging on 30% in 2015. Mughal and Schneider concluded that the SE is catalytically beneficial to the official economy over the long-term, despite some short-term negative effects.

Gamal et al. (2019) sized the Malaysian shadow for the period 1972–2012 at an average 42.53% of GDP but trending significantly down from 55.95% in the first year to 20.79 % in the last year of this time frame. These measures were derived using an ARDL approach based on a modified currency demand function (CDFM) that deployed the Todd

and Yamamoto (1995) causality test. In their model they used currency in circulation plus demand deposits as a dependent variable, with indirect tax revenue, real GDP, the interest rate on savings deposits, and the rate of inflation as independent variables. The primary driver of the SE in Malaysia was determined to be the performance of government fiscal policy.

3.3 Saudi Literature Review

Schneider et al. (2010) sized the shadow economies of 162 countries for the period 1999–2006/7 using a MIMIC model. This model, which is applied to all countries, has seven causal variables: size of government, the share of direct taxation, fiscal freedom, business freedom, unemployment rate, GDP per capita, and government effectiveness. The model also has four indicators variables: growth of GDP per capita, labor force participation rate, growth of labor force, and currency. The study found a general decrease in the un-weighted average size of the SE in these economies from 34.1% of GDP at the beginning of the time frame to 31.0% in 2007, with the main drivers of the shadow economy being—differentially in importance by country and region—taxation, labor-market regulations, government quality, and the condition of the official economy. This work did not take into account the special economic and socio-political conditions of individual countries. For Saudi Arabia, this study found the SE in Saudi Arabia to be 18.6% of GDP in 1999, falling to 17.2% in 2006, with an average for the period of 18.0%. The study concluded by remarking on the size of the SE and its declining trend and observed that it is complex and present in all economies. The study also noted there are disparities in the prevalence of the SE between regions, with Sub-

Saharan Africa having the largest shadow economies and the OECD countries having the smallest.

Elgin and Oztunali (2012) estimated the SE for 161 countries over the period 1950–2009 with some developing countries, including Saudi Arabia, only evaluated for the period 1981–2009. To do this, Elgin and Oztunali used a two-sector (official and shadow economies) dynamic general-equilibrium model adapted from Roca, Moreno, and Sanchez (2001), Ihrig and Moe (2004), and Busato and Chiarini (2004). With this model, the authors sized the SE in Saudi Arabia at 18.44% of GDP in 1986, falling to 16.61% in 2008. This approach did not consider the specific economic and socio-political characteristics of individual countries.

Gamal and Dahalan (2015) sized the SE in Saudi Arabia for the period 1980–2010 at an average of 62.8% of GDP, with 64.25% in 1980 falling to 57.82% in 2010, using CDA with the Gregory Hansen co-integration test. It added the variable of money outflows to the standard CDA approach. Gamal and Dahalan found that there is a significant long-run relationship among tax revenue, interest rate, and money demand in Saudi Arabia. However, they found that the positive relationship in the long run between the GDP and the demand for money, and the negative relationship in the long run between the outflow of money and demand for money, are not significant.

In the IMF working paper, Medina and Schneider (2018) reflected on what has been learned over the past 20 years in the research on the SE and found no paramount or best approach to its investigation. They critiqued the various direct and indirect approaches that have been tried. As part of this process, Medina and Schneider averaged

the results of different methods, all using the causal variables of trade openness, unemployment, size of government, fiscal freedom, rule of law, control of corruption, and government stability in sizing the shadow economies of 158 countries around the world for the period 1991–2015. They found all these variables to be of significance to varying degrees in different countries at different times. Medina and Schneider did this without taking the special economic characteristics of individual countries into account. The SE in Saudi Arabia was found to average 16.65% of GDP, fluctuating around a minimum of 13.34% and a maximum of 19.15%. They concluded that a new currency demand approach and MIMIC method combined in an integrated model correlate quite closely with various direct methods, overcome the usual critiques of the CDA and MIMIC model, and have considerable promise. However, the authors noted that some double-counting related to household activities using indirect or macro approaches, focused on taxes, unemployment, and regulation, probably causes overestimation of the SE in many cases.

The material in the studies discussed in this literature review is very helpful. It provides methodological options for developing a model for the sizing of the shadow economy in Saudi Arabia. It highlights the strengths and weaknesses of our preferred CDA model for this purpose. One major challenge is the focus of existing CDA studies on taxes as a key determinant of shadow activity, even for those studies that include a developing country like Saudi Arabia, as we have seen. In a developing country like Saudi Arabia, where taxes are not a major factor in the economy, such a focus is highly problematic. To address this issue, research must look to other variables of potentially

greater significance to determine how the SE in Saudi Arabia has evolved and is evolving. Until now, it has not done this. These variables include government expenditures, the quality of government services and regulation, foreign remittances, and labor force composition impacts, among others. Looking in detail at such developing country-specific variables for Saudi Arabia is and has been our task and contribution. It must be the task of future studies. Such explorations provide many questions that will be fruitful for research.

CHAPTER 4: METHODOLOGY AND DATA

4.1 Estimation Methodology

There are many approaches to estimating the shadow economy. In general, any method depends on how the SE is defined for its efficacy. An approach also depends on what the research focus is, as well as what qualified data are available. In turn, the latter depends on the country being targeted. Broadly speaking, the approaches to estimating the SE can be classified into two main categories: direct and indirect. There are plusses and minuses associated with each.

4.1.1 Direct Approaches

These include methods related to microeconomics that deploy surveys and tax auditing, plus other types of compliance methodologies. Sample surveys to size the SE are predominant in this category, but like all surveys, their veracity depends on how well a person responds to them and how truthful respondents are willing to be when it comes to their personal economic behavior. People are rarely accurate about undeclared or illicit activities or even about bartering. Also, the outcome of surveys is very much a function of the type of questions asked and how well they are constructed, as well as the cultural differences between countries (Feld and Larsen, 2005, 2008, 2009; Haigner et al., 2013; Isachsen and Strøm, 1985; Pedersen, 2003; Van Eck and Kazemier, 1988; Kazemier, 2006; Renooy et al., 2004.) Nonetheless, surveys can and do provide a lot of detailed information relevant to sizing the SE, including fiscal auditing. Of course, fiscal auditing itself has a variety of challenges, including sample bias, a lack of randomness, and a lack of overall accurate representation of the whole SE. Survey methods, in general, tend to

underestimate the size of the SE for these reasons, but they do provide details that other approaches cannot match and are often—where they are possible—useful as starting points, as checks on different methods, and as valuable indicators of what variables to focus on. Survey methods tend to establish a lower limit for the size of an SE (Schneider and Buehn, 2018).

4.1.2 Indirect Approaches

These include the following methods related to macroeconomic indicators.

4.1.2.1 National Accounts Discrepancy

With this approach, the gap between the official income and official expenditure sides of the national accounts, as determined by an independent estimate, is treated as the shadow economy. However, it has been pointed out that this is a problematic way to size the SE (Schneider and Enste, 2000). National accounts statisticians like to minimize this difference to protect their reputation, and, hence, published national accounts often fail to represent an accurate picture. Variations also can be the result of statistical omissions and errors unrelated to the SE.

4.1.2.2 Electricity Use

This approach has some variants. One, the Kaufmann-Kaliberda (K-K) method (Kaliberda and Kaufmann, 1996), assumes, based on research findings of Lizzeri (1979) and Del Boca and Forte (1982), that electricity power-consumption is a good surrogate for overall economic activity, that is, official and unofficial GDP. The K-K method, along with other electricity-use surrogates for the SE, looks at discrepancies between income and expenditure statistics in the national accounts. In those accounts, both

measures of GNP should be equal. When they are not, an independent estimate of the expenditure side, such as electricity use, can be deployed as an indicator of the extent of the SE. Despite its simplicity, there are some issues with the K-K method. Electricity is not always involved in SE activities, especially if they are services. Use of electricity may differ over time and across countries due to continuing technological improvements and cultural differences. Another variant, the Lackó Method, assumes that electricity consumption by households is an important indicator of the SE by itself because a lot of SE activities are assumed to take place in households (Lackó, 1998, 1999, 2000). There are some issues with this variant too. These include the same problem: that not all SE activities use electricity. In addition, there are SE activities unrelated to household ones, including do-it-yourself, volunteer work, and more. Furthermore, different countries at different levels of development have different levels of electricity use.

4.1.2.3 MIMIC (Multiple Indicators Multiple Causes) SEM Modeling

Another indirect approach is modeling multiple indicators of the emergence and development of the shadow economy, incorporating hidden variables. This is called the multiple indicators multiple causes (MIMIC) model, which uses a latent or unobserved variables approach. The SE is measured as a latent variable over time. MIMIC models validate the relationships between an unobserved or latent variable, such as the size of the SE, and observed variables such as inflation, tax rates, unemployment, and GDP, using their covariance information. The observable variables are grouped into causal and indicator signals of the latent variable (see Figure 4.1). In this path, diagram arrows, which represent causal relationships, go from SE causes (X_1, X_2, …, Xq) to the

unobserved variable η (i.e., the SE), and from there to its indicators (Y_1, Y_2, …, Y_p). With MIMIC, a sample covariance matrix of observable variables is compared with a parametric structure imposed on this matrix by a hypothesized model (Cziráky, 2004). Several steps follow, including creating and linking a measurement model and a structural model and tests for consistency. Critiques of MIMIC have included the following: MIMIC is a confirmatory rather than an exploratory model and thus has limitations and the need for benchmarking, using other approaches such as CDA, which is shown below. Associated with all of these are the challenges of distinguishing an accurate and relevant definition of the SE and sizing specification as well as unstable coefficients, with respect to changes in the sample size and alternative-model specifications (Breusch, 2005, 2016; Del'Anno, 2003; Dell'Anno and Schneider, 2009; Feige, 2016; Hashimzade and Heady, 2016; Helberger and Knepel, 1988; Schneider, 2006, 2016).

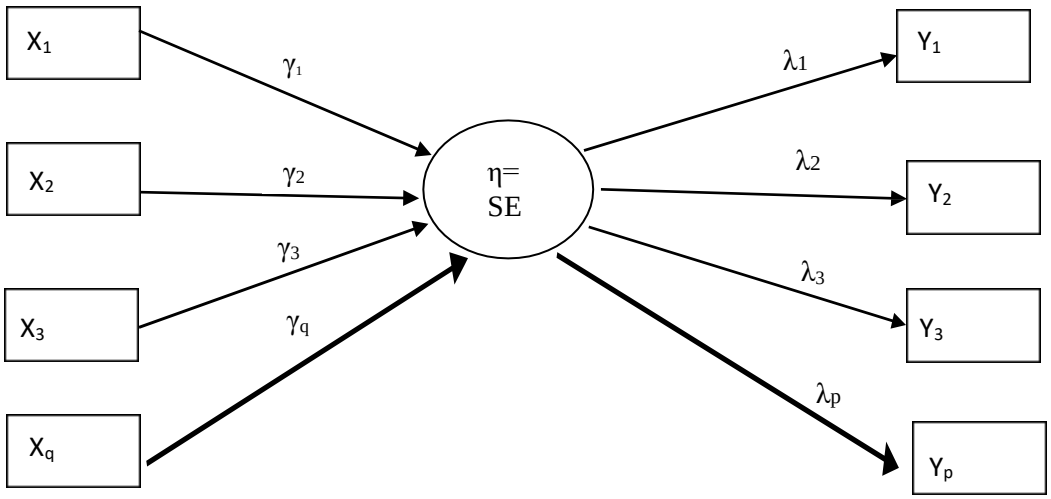

Figure 4.1. Visualizing a MIMIC model based on Tedd and Giles (2002).

4.1.2.4 Currency Demand Approach (CDA)

The monetary approaches to shadow economy estimation originate with Cagan (1958), Gutmann (1977), and Feige (1979). Tanzi developed the basic CDA regression equation to which refinements have subsequently been made (Tanzi, 1980, 1983). This approach assumes that most of the transactions that take place in the SE are in the form of cash. An unexplained increase in the demand for currency is believed to generate an increase in the SE or to be indicative of its growth. In order to separate the rise in the demand for cash attributable to the SE from other factors, an equation for currency demand is estimated over time, controlling for standard relevant variables such as interest rates, income, payment habits, and credit cards. This equation also includes variables that are assumed to motivate participation in the SE, such as tax and perceived tax fairness and regulation. Any increase in currency beyond what can be explained by conventional economic drivers can then be attributed to the SE. These activities are usually linked to growing tax and regulatory burdens. Since its inception, the currency demand approach (CDA) has been the most widely used method of sizing the SE. CDA, of course, has not gone unchallenged. The main issues with it are the following:

- The velocity of money is probably greater in the SE than in the official economy. Assuming that they are the same, as most CDA studies do, is questionable.
- The assumption that all payments in the SE are made in cash is problematic.

- An excessive focus on tax increases is suspect. This is due to the fact that other factors may be of equal or greater importance, such as trust in government and the quality of its services; the strength, fairness, or weakness of regulation; and cultural attitudes towards tax evasion. These factors are often avoided in many studies because they are difficult to measure.
- Increasing currency demand often may be the result of reduced demand deposits, not because of currency demand arising from more SE activity.

4.2 Study Methodology

For our study of the shadow economy in Saudi Arabia, we have adopted the currency-to-deposit ratio method as one of the CDA options. CDA is the most widely used method and thus has the most validation. Our selection of CDA is motivated by the extent and quality of the data available for sizing the SE in Saudi Arabia. Other methods almost always use CDA as a benchmark. Following Cagan, Tanzi, and others, we estimate the size of the SE in Saudi Arabia assuming that shadow (or hidden) transactions are concealed from the authorities in the form of cash payments. An increase in the size of the SE is therefore assumed to be represented by an increase in the currency demand. To isolate the resulting "excess" demand for currency, we follow their general equation for currency demand, estimated econometrically over time, which takes the following form:

$$lnCR_{it} = \beta X_{it} + \mu_{it} \qquad (1)$$

where t indexes years and μ_t is the disturbance term, $lnCR$ is the logarithm of the ratio of currency, X is a vector of explanatory variables, and β is the vector of corresponding coefficients, further discussed below.

In common with current practice, we use the resulting estimates of equation (1) to calculate the yearly SE. Several steps are involved. First, we calculate the predicted value of the currency with all factors included; this value is denoted *CR*. Second, we calculate the predicted value of the currency ($\widehat{CR}$) assuming the indicator variables to be at minimum values (0). Third, we subtract $\widehat{CR}$ from *CR* to get the extra currency demand EC_t. This represents the amount of currency held that is assumed to be used to conduct (shadow) transactions without the indicator variables.

$$EC_t = CR_t - \widehat{CR}_t \qquad (2)$$

Fourth, we estimate the annual size of the SE by using Fisher's quantitative relation (*M*V = P*Y)*, where P*Y is the nominal income. In line with other studies, we assume that the velocity of money (V_t) in the official and shadow economies are the same.

$$V_t = \frac{GDP_t}{M_1} \qquad (3)$$

Finally, we multiply the annual velocity of money, (V_t), by the annual amount of the excess (informal) currency, EC_t. Then we divide this quantity by GDP to express the SE as a percentage of the official economy.

$$SE_t = EC_t * V_t \qquad (4)$$

4.3 Data Used

The model stipulation is key in using the currency ratio method. An important differentiator in our model development is taking into account the special economic and socio-political conditions that designate Saudi Arabia as a still-developing country. It is important to recognize that drivers of the shadow economy are different in developing countries than in OECD (Organization for Economic Cooperation and Development) developed countries. In developed countries, people are most frequently attracted to the SE in order to avoid taxes and Social Security contributions. Many researchers who are attempting to size the SE create their models on this fundamental assumption and then apply it to all countries. However, in developing countries like Saudi Arabia, government intervention, governmental income derived from sources other than taxation, and inward and outward remittances to and from abroad are often key drivers of the economy and take on an important role in any model attempting to size their SE (Nikopour, 2003). We do this in our model. Our currency ratio specifies that gross domestic product (GDP), inflation, and tax revenue are explanatory variables affecting not only the Saudi currency ratio but also government expenditures, government intervention, and money outflow abroad. These variables and their data resources are described in the next section.

4.3.1 Variables Explanation and Sources

In order to estimate the currency deposit ratio in Saudi Arabia, annual time-series data for its economy are used for the period 1975–2018. An effort to identify a co-integrating relationship between this currency deposit ratio and other related variables is undertaken and then used to infer the size of the SE in Saudi Arabia. The time period

selected reflects the requirements of our method and the more recent availability of consistent national-accounts data from Saudi Arabia up to the near past (2018). This period covers an important time of change and evolution in government policy towards the national economy in Saudi Arabia and the SE in Saudi Arabia. The data used were obtained from the Saudi Arabian Monetary Authority (SAMA), the Ministry of Labor and Social Development, the Ministry of Finance, the General Authority for Statistics, the World Bank, and the IMF. A detailed description of the variables and data sources used follows.

4.3.2 Variables Selected to Model the SE in Saudi Arabia

For the dependent variable, different measures of the currency deposit ratio (CDR) were evaluated from various studies. From this evaluation, a CDR method was selected based on the work of Mughal and Schneider (2018). These authors used a currency deposit ratio as the dependent variable to provide a more comprehensive sizing of the shadow economy. Their work builds on that of Ardizzi et al. (2012). They used a "ratio of the value of cash withdrawn from bank accounts to the value of total payments settled by instruments other than the bank" as the dependent variable. In our study, this measure comes from the SAMA yearly statistical series. This selection follows from the widely accepted assumption that, by definition, participants in the SE seek to avoid traceable financial assets because they fear legal sanctions for tax evasion and for not doing required reporting of economic activities. As a consequence, a bank account-based variable on its own does not adequately reflect what is going on in the SE. To estimate our model, we use the following seven independent variables:

- **Tax Rate (TR):** This variable is defined as total tax revenue divided by nominal GDP. It includes taxes on goods and services; profit and capital gains; trade and transactions (custom duties); other taxes, including Islamic tax (Zakat); and other non-oil income, such as the governmental services fees. Previous studies established a positive relationship between this variable and the SE. The necessary data for this variable were obtained from SAMA and the Ministry of Finance.
- **Money Outflow (TRAN):** This variable represents the outflow of money that is transferred abroad, as a percentage of the GDP, by legal and illegal foreign workers in Saudi Arabia. In this, we follow Macias and Cazzavillan (2009), who found that tax burden and remittances have a positive long-run effect on currency demand. There are millions of non-Saudi legal and illegal workers operating in Saudi Arabia. Some of the legal workers also have other unofficial jobs. In those activities, these workers prefer to deal in cash in order to avoid scrutiny by the authorities and to circumvent reporting and tax-paying requirements. Some policymakers believe that this behavior increases unemployment in Saudi Arabia and has a negative effect on the Saudi economy in general. As a result, it is important to know whether there is a relationship between such cash transactions and the size of the SE in Saudi Arabia. The data source for this money outflow variable is SAMA.
- **The Intensity of Regulation (REG):** This variable is represented by the number of Saudi Arabian government employees as a percentage of the total labor force

(population over the age of 15, not retired or on disability, and at work or looking for it [ILO]). The variable is a key indicator of the level of intervention in, and regulation by, the government in the economy. Johnson et al. (1997) found empirical evidence that countries with a higher degree of regulation in their economies tend to have a larger share of SE activity in their GDP. Berdiev et al. (2018) also found that freedom from regulation affects the SE by decreasing its size. The data sources for this variable are the Saudi Arabian Ministry of Labor and Social Development, the General Authority for Statistics, and SAMA.

- **(Real) Gross Domestic Product (GDP):** This variable is generally considered a key income indicator in any estimation of CDA-based shadow economy. In this estimation, GDP is typically related to the effects of factors such as the number of credit cards, ATMs, banks, and their branches in a country; that country's economic development during a time period; and the SE itself. The relationship between GDP and the SE is different from country to country. There is a divergence of views about that relationship in the literature. For example, studies by Bajada and Schneider (2003), Giles (1999), and Tedds (2005) found that there is a positive relationship between the official GDP and the SE. According to their studies, an increase in the official level of GDP increases the demand for goods and services in the official economy as well as in the SE. In contrast, studies by Del'Anno (2003), Frey and Pommerehne (1984), and Schneider and Enste (2000) found that there is a negative relationship between the official GDP and the SE. Our data source for Saudi GDP is the SAMA annual statistical series.

- **Government Expenditure (GE):** This variable is defined as government expenditure as a percentage of the GDP. It is a significant factor in the Saudi economy because government spending is large and is a critical driver of economic activity. Studies on many countries have found that government expenditure can have a positive or negative effect on the SE (Malaczewska, 2013). The data sources for this variable are SAMA and the World Bank.
- **Inflation (INF):** This variable is modeled by the GDP implicit deflator annual growth rate. Many previous CDA studies have ignored inflation, despite its potential impact. Higher inflation generates tax bracket creep. This expands taxpayer liabilities and, consequently, tax evasion incentives. Inflation can also change the currency ratio when individuals use interest-bearing assets as a substitute for their depreciating currency holdings (Alm and Embaye, 2013). The data source for this variable comes from the World Bank.
- **SR:** This is a dummy variable for the Saudi Arabian Riyal Interbank Express (SARIE) Electronic-Payments System, which commenced live operation in May 1997. (SR = 1 for the years 1997–2018 and SR = 0 for the years before 1997). SARIE is a key indicator of the impact of that system on demand for cash during the period. SARIE provided a cutting-edge process for banks in Saudi Arabia to make Saudi riyal payments to each other and to facilitate digital banking. It was extended in 2004 by its SADAD, which equipped it with an efficient and secure electronic infrastructure that simplified bill-paying. It was further extended by

MADA, another electronic-payment system that directly linked bank accounts to debit cards, which allowed instant cash withdrawals from Saudi bank accounts.

After determining the variables in our currency ratio, its linear regression model is described below:

$$\ell nCR_t = \beta_0 + \beta_1 \ell nTR_t + \beta_2 \ell nTRAN_t + \beta_3 \ell nREG_t + \beta_4 \ell nSPEN_t + \beta_5 \ell nGDP_t + \beta_6 INF_t + \beta_7 SR_t + v_t \quad (5)$$

where,

ℓnCR: logarithm of the currency deposit ratio

ℓnTR: logarithm of the total revenue of tax and other income as a percentage of GDP

$\ell nTRAN$: logarithm of the money that is transferred by foreign workers outside of Saudi Arabia as a percentage of GDP

$\ell nREG$: the intensity of regulation (logarithm of employment in the public sector as a percentage of the total employment in Saudi Arabia)

$\ell nGDP$: logarithm of GDP

$\ell nSPEN$: logarithm of government expenditure as a percentage of GDP

INF: Annual growth rate of GDP implicit deflator

SR: dummy variable (the Saudi Arabian Riyal Interbank Express [SARIE] system)

v_t: Error terms

Some transformation strategies have been deployed on the raw data in this study. This has been done to avoid results in the study that might be spurious and to facilitate effective policy suggestions, such as changes from percentages to decimal notation and the use of natural logarithmic form to suit the operation of variance as one

of the Box-Cox transformations. Note that the natural log transformation is often desirable because it produces a smaller value of the coefficients after estimation and, hence, facilitates results interpretation.

4.3.3 Unit Root Test

A valid and reliable estimation of the model requires that the time series be evaluated for stationarity or non-stationarity. This is because applications of traditional and common econometric methods for the estimation of coefficients by using time-series data are based on the assumption that model variables are stationary. A time-series variable is stationary only if its mean value, variance, and correlation coefficients remain constant through time. When time-series variables used in any estimation of the coefficients are non-stationary, then the value of its R^2 coefficient can be too high. This may cause an erroneous association of variables with each other when there really is no association. To avoid this issue, a unit-root test, such as the Augmented Dickey-Fuller (ADF) Test (1979), must be applied.

4.3.3.1 ADF Test for our Model Variables

The stationarity of all the variables is examined using ADF to determine the order of integration. The results of the ADF test for our variables show that the outflow of money, government expenditure, and inflation are stationary at the level. The other variables—tax revenue, GDP, intensity of regulation, currency ratio, and the dummy variable—exhibit evidence of a unit root and are non-stationary. Therefore, this test is applied to the first difference of variables. The results indicate that all these variables became stationary. Therefore, we have variables that are stationary at the level I(1) and

I(0), as shown in Table 4.1.

Table 4.1. *The Results of Dickey-Fuller Unit Root (ADF) Test for the Variables*

variables	At the level	Result	1st difference	Result
ℓnCR	-0.685	I(1)	-7.620	I(0)
ℓnTR	-1.814	I(1)	-5.414	I(0)
$\ell nREG$	-1.280	I(1)	-4.699	I(0)
$\ell nGDP$	-0.180	I(1)	-5.502	I(0)
SR	-0.976	I(1)	-6.481	I(0)
$\ell nTRAN$	-3.126	I(0)	-	-
$\ell nSPEN$	-2.977	I(0)	-	-
INF	-5.002	I(0)	-	-
	Critical Value: 1%: -3.634		5%: -2.952	10%: -2.610

4.4 The Study Model and Hypotheses

Since our variables are stationary at I(0) and at I(1) and not at I(2), as shown in the data section, we employ the autoregressive distributed lag (ARDL) model. This model, suggested by Pesaran and Shin (1998) and Pesaran et al. (2001), is used to address co-integration. It allows the use of both stationary and non-stationary variables in one model and can also identify long-run relationships. Pesaran and Shin (1998) showed that ARDL-based estimators are "super-consistent." This means that valid inferences on the long-run parameters can be drawn by using the standard normal asymptotic theory.

ARDL has three advantages over traditional co-integration methods. First,

ARDL does not require that all of the variables under study be integrated in the same order. ARDL can be applied when the underlying variables are integrated of order one, order zero, or combined integration of I(1) and I(0) but not I(2). Second, the ARDL test is relatively more efficient in the case of small and finite sample-data sizes. Finally, we obtain unbiased estimates of the long-run model by applying the ARDL technique (Harris and Sollis, 2003).

The ARDL estimated in this study can be defined as follows:

$$\Delta \ell nCR_t = \beta_0 + \beta_1 CR_{t-1} + \beta_2 \ell nTR_{t-1} + \beta_3 \ell nTRAN_{t-1} + \beta_4 \ell nREG_{t-1} + \beta_5 \ell nSPEN_{t-1} + \beta_6 \ell nGDP_{t-1} + \beta_7 INFL_{t-1} + \beta_8 SR_{t-1} + \sum_{i=0}^{n} \delta_{1i} \Delta \ell nTR_{t-i} + \sum_{i=0}^{n} \delta_{2i} \Delta \ell nTRAN_{t-i} + \sum_{i=0}^{n} \delta_{3i} \Delta \ell nREG_{t-i} + \sum_{i=0}^{n} \delta_{4i} \Delta \ell nSPEN_{t-i} + \sum_{i=0}^{n} \delta_{5i} \Delta \ell nGDP_{t-i} + \sum_{i=0}^{n} \delta_{6i} \Delta INF_{t-i} + \sum_{i=0}^{n} \delta_{7i} \Delta SR_{t-i} + \varepsilon_t \quad (6)$$

As seen in equation (6), Δ is the first-difference operator, and n is the optimal lag length. Equation (6) provides the long-run and short-run effects simultaneously after the adjustment is completed. The first part of the equation, with β_2, β_3, β_4, β_5, β_6, and β_7, represents the long-run dynamics of the model, whereas the parameters δ_1, δ_2, δ_3, δ_4, δ_5, δ_6, and δ_7 represent the short-run relationship.

That being the case, a joint significance test that implies no cointegration hypothesis (H_0: $\beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = 0$) (there is no long-run relationship) against the alternative hypothesis (H_1: $\beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq 0$) should be performed for equation (6). The F-statistic tests, therefore, should be checked for the joint significance

of the coefficients on the one period lagged levels of the variables. The computed F-statistic is compared with the critical values tabulated by Pesaran (2001). If the computed F-statistic is greater than the upper bound critical value, then we reject the null hypothesis of no cointegration (no long-run relationship) and conclude that there exists a steady-state equilibrium between the variables. If the computed F-statistics is less than the lower bound critical value, then we cannot reject the null of no cointegration. If the computed F-statistics falls within the lower and upper bound critical values, then the result is inconclusive.

Once cointegration is confirmed, we move to the second stage and estimate the long-run coefficients of the currency deposit ratio. In order to inspect the goodness of fit of the ARDL model, diagnostic and stability tests are conducted. The diagnostic test checks the serial correlation, functional form, heteroscedasticity, and normality associated with the model. Parameter stability is necessary since unstable parameters can result in model misspecification (Narayan and Smyth, 2004).

CHAPTER 5: ESTIMATION RESULTS

Here we estimate the size of the shadow economy in Saudi Arabia using our currency deposit ratio for the period 1975–2018. We begin by estimating equation (6). This equation represents the currency deposit ratio in Saudi Arabia for which we use the previously described ARDL model. This model is used to determine the excess demand for currency in Saudi Arabia during the period of study.

5.1 Estimating the Model Equation

Equation (6) is estimated by using an ARDL bounds-testing approach. Our estimation results are shown in Table 5.1. All of the variables were I(1) and I(0) after being tested by ADF. None of the variables is I(2); therefore, it is appropriate to run ARDL. Based on the Schwartz Bayesian criterion, the maximum lag length is (2), which is more fit to minimize the residual sum of squares. As shown in the results, a negative and statistically significant estimation of the ADJ not only represents the speed of adjustment parameter but also provides an alternative means of supporting cointegration between the variables. The bounds test for long-run co-integration is shown in Table 5.2. Since the calculated F statistic of 13.508 is above the upper bound, we can say that we reject the hypothesis H_0 (no co-integration among the variables) and accept the alternative hypothesis H_1 (co-integration exists among the variables). According to theory, this means that there is a long-run relationship between the dependent and independent variables in our model.

Table 5.1. *ARDL Results for the Currency Demand In Saudi Arabia*

Dependent Variable: Currency Deposit Ratio		**No. of Obs: 44**		
Exogenous Variables			**ARDL Model**	
	Description	**Variable Name**	**Coefficient**	**P>t**
ADJ	Lagged Currency Deposit Ratio	*L1.CR*	-0.944*** (0.111)	0.000
LR	*Tax Revenue GDP Ratio*	*TR*	0.332*** (0.082)	0.000
	Outflow GDP Ratio	*TRAN*	0.348*** (0.098)	0.001
	Intensity of Regulation	*REG*	1.693*** (0.450)	0.001
	GDP	*GDP*	-0.648*** (0.192)	0.002
	Government Expenditure GDP Ratio	*SPEN*	-0.738*** (0.213)	0.002
	SARIE System (Dummy VAR)	*SR*	-0.267 (0.068)	0.000
	Inflation	*INFL*	-0.011*** (0.003)	0.002
SR	*Tax Rate*	*TR*	0.313*** 0.075	0.000
	Outflow GDP Ratio	*TRAN*	- 0.184 0.162	0.268
	Intensity of Regulation	*REG*	1.599*** 0.458	0.002
	GDP	*GDP*	1.175*** 0.263	0.000

	Government Expenditure GDP Ratio	*SPEN*	-0.697*** 0.188	0.001
	SARIE System (Dummy VAR)	*SR*	-0.252*** 0.067	0.001
	Inflation	*INFL*	-0.010*** 0.003	0.001
	Intercept	_cons	8.363** (3.811)	0.036
R-squared			0.7886	
Legend: * p<.1; ** p<.05; *** p<.01			(Standard Errors in Parentheses)	

Table 5.2. *Pesaran/Shin/Smith (2001) ARDL Bounds Test*

H_0: no levels of relationship				F = 13.508			
	[I_0]	[I_1]	[I_0]	[I_1]	[I_0]	[I_1]	[I_0]
	L_1	L_1	L_05	L_05	L_025	L_025	L_01
k_7	2.030	3.130	2.320	3.500	2.600	3.840	2.960

accept if F < critical value for I(0) regressors

reject if F > critical value for I(1) regressors

Table 5.1 shows that all of our selected variables have an effect on the currency deposit ratio and hence on the SE in Saudi Arabia, with significantly less than 5% in both the long run and short run except the outflow of money in the short run. Our indicator variables, namely tax revenue and intensity of regulation, show a positive effect in the long run, with significance at 1%. This means a 1% increase in tax rate and intensity of

regulation leads to a 0.332% and 1.693% increase, respectively, in currency demand on average. This positive relationship is in line with many other studies that show a positive relationship among these variables and currency demand. Our results also show that there is a positive relationship between the outflow of money, which is considered an indicator variable in this study, and currency demand. This suggests that increased tax revenue, the outflow of money, and increased intensity of government regulation lead to the expected greater demand for currency. Our GDP indicates a negative effect at a 1% level of significance for income and as a proxy for some factors that relate to the demand for Saudi currency, such as fintech innovations like credit cards and ATMs, as well as the development of the Saudi economy. We find a 1% increase in the GDP leads to, on average, a 0.648% decrease in currency demand. These findings are in line with several studies that suggest that these relationships could be negative (Del'Anno, 2003; Frey and Pommerehne, 1984; Schneider and Enste, 2000).

In addition, our results show that government expenditure also has a negative relationship with currency demand in Saudi Arabia. As a consequence, it has a negative impact on SE in Saudi Arabia. Malaczewska (2013) has shown that government expenditure can have a positive or negative effect on the SE. Since an economy like Saudi Arabia's depends on government revenue for its growth and development, it follows that the private sector there depends on it, too. Increases in Saudi government income and expenditures, therefore, are likely to decrease unemployment and to increase income. Our SARIE dummy variable has an expected negative effect because it results in more control over cash in the country and makes it easier to monitor financial activities

that occur as a result of increasing electronic transactions. Finally, in line with many other studies, we see inflation playing a role in the currency demand and, hence, the size of SE in Saudi Arabia.

We find no big difference in the long-run relationship among our selected variables in the short run, except when it comes to the outflow of money and the GDP. The relationship between money outflows and currency demand in the short run is negative, but it is not significant. The relationship between GDP and currency demand is positive and significant. We find a 1% increase in GDP leads to, on average, 1.175% increase in currency demand in the short run. That being said, our main focus is on the long-run relationship between our variables. This is because of the controversies associated with short-run dynamics via error correction models as they relate to money demand equations (Asiedu and Stengos, 2014).

We address serial correlation in our model by implementing the widely used Breusch-Godfrey LM Test and the White heteroscedasticity test. We also do a normality test as well using the Jarque-Bera normality test. These are shown in Table 5.3. They indicate that there is no serial-correlation problem, heteroscedasticity, or normality in our model. Figure 5.1 shows the stability of the model over the period 1975–2018.

Table 5.3. *Diagnostic Tests*

Breusch-Godfrey LM test for autocorrelation *H_0: no serial correlation, H_1: serial correlation*	chi2 = 1.388	P = 0.239
White test for H_0: homoskedasticity against H_1: unrestricted heteroskedasticity	chi2 = 42	P = 0.4274
Cameron & Trivedi's decomposition of IM-test		
Heteroskedasticity	chi2 =42.00	P = 0.427
Skewness	chi2 =14.610	P = 0.201
Kurtosis	chi2 =0.840	P = 0.360
Total	chi2 =57.450	P = 0.314
jb resid Jarque-Bera normality test: Jarque-Bera test for Ho: normality	Chi2 = 1.158	P = 0.5605

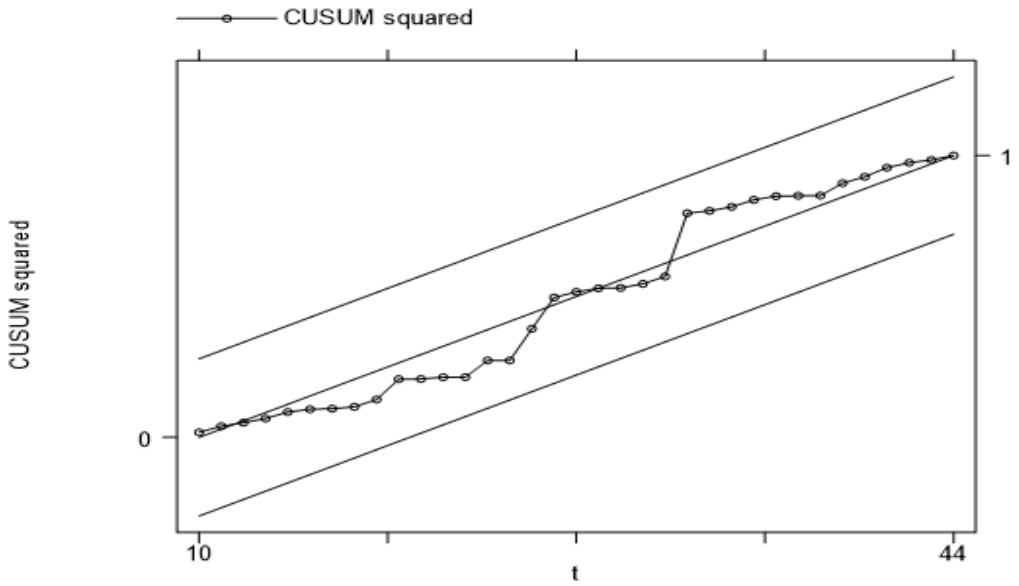

Figure 5.1. Show the stability of the model.

From the long-run co-integration results, we get the following equation, which represents the estimated total (formal and informal) demand for currency in this study:

$$\ell nCR_t = 8.363 + 0.332\ell nTR_t + 0.348\ell nTRAN_t + 1.693\ell nREG_t - 0.738\ell nSPEN_t - 0.648\ell nGDP_t - 0.011INF_t - 0.267SR_t \quad (7)$$

5.2 Size of the Shadow Economy in Saudi Arabia

Here we describe the results of our econometric estimations and simulations/ calculations for the size of the SE in Saudi Arabia. Following Schneider and Buehn (2018), we note that our SE in Saudi Arabia estimate is, at best, an indicator of trends in shadow-sector activities. Our results, based on an indirect approach, cannot be considered exact. This is a consequence of the limitation of all macroeconomic estimates and their data sources because of the hidden nature of agents operating in the SE. It is also a consequence of the reality that large shadow-sizing changes can occur with very small shifts, inaccuracies, or errors (phenomena unexplained by any of the variables deployed) in any CDA or other macroeconomic (MIMIC, etc.) model variable parameters. This follows from the hidden nature of agents operating in the SE. As we have said, even direct estimates, such as surveys, tend to be as inaccurate as indirect methods. A downward or upward bias in the findings of such direct methods frequently occurs because people are naturally unwilling to admit to illegal activities or failure to report income and employment for tax and regulation purposes.

Equation (7) reflects the total demand for cash in Saudi Arabia, which includes money demand for both formal economic activities (the official economy) and informal economic activities (the shadow economy). In order to separate the formal currency

demand from the total, the same equation is used with the assumption—following Tanzi (1983)—that tax revenue, money outflow, and the intensity of regulation are at their minimum value (0) to get the formal demand for currency without any indicator variables that caused the informal demand for currency. Other variables and their coefficients are kept unchanged. Consequently, the real formal demand for currency $\ell n\widehat{CR_t}$ is determined according to the following equation:

$$\ell n\widehat{CR_t} = 8.363 - 0.738\ell nSPEN_t - 0.648\ell nGDP_t - 0.011INF_t - 0.267SR_t \quad (8)$$

By subtracting equation (8), which represents the estimated formal demand for cash, from equation (7), which represents the estimated total demand for cash, we get the extra currency that represents the informal demand for currency (EC).

$$EC_t = CR_t - \widehat{CR_t} \qquad (9)$$

According to the CDA, the informal demand for cash is assumed to be used in the SE. From equation (9), the annual excess (informal/shadow) currency demand is caused by our indicators. The annual velocity of currency, V_t, which is assumed to be equal for both the official and shadow economies, is calculated for Saudi Arabia as follows:

$$V_t = \frac{GDP_t}{M_1} \qquad (10)$$

The annual SE is then derived by multiplying this annual velocity of money, V_t, by the annual excess (shadow/informal economy) currency (EC).

$$SE_t = EC_t * V_t \qquad (11)$$

Table 5.4 and Figures 5.2 and 5.3 show the estimated size of the SE in Saudi Arabia during the period 1975–2018.

Table 5.4. *The Shadow Economy in Saudi Arabia (1975–2018)*

Year	GDP (million SAR)	Shadow Economy (million SAR)	SE as a % of the GDP	Year	GDP (million SAR)	Shadow Economy (million SAR)	SE as a % of the GDP
1975	164530	65434.25919	39.7704122	**1997**	621533.5	98070.1892	15.77874493
1976	225940	70762.34261	31.31908587	**1998**	550408.1	106173.1808	19.28990095
1977	261521	64419.52839	24.63264074	**1999**	606438.6	138476.719	22.83441703
1978	272871	81432.09836	29.84270896	**2000**	710681	156454.5398	22.01473595
1979	375938	89366.34854	23.77156567	**2001**	690515.7	91710.88143	13.28150522
1980	547381	105596.8074	19.2912811	**2002**	711021.8	117352.6401	16.50478857
1981	623367	139013.5929	22.30044145	**2003**	809278.7	105217.2237	13.00135822
1982	525334	166038.0865	31.60619463	**2004**	970283	84836.98021	8.743529487
1983	446288	174151.4521	39.02221259	**2005**	1230771	122381.4703	9.943478859
1984	421558	149833.563	35.54281095	**2006**	1411491	215696.3747	15.28145776
1985	376318	125046.0123	33.22881508	**2007**	1558827	163558.6712	10.4924197
1986	322020	102881.0808	31.94866183	**2008**	1949238	220142.3489	11.29376686
1987	320931	76269.8602	23.76518946	**2009**	1609117	188148.9201	11.69268157
1988	330519	91016.46214	27.53743723	**2010**	1980776	160186.6004	8.087061359
1989	357064.6	73269.49282	20.51995424	**2011**	2517146	193140.8267	7.673009573
1990	440525.4	118131.7721	26.8161111	**2012**	2759906	209589.2586	7.594073286
1991	495176.1	92678.70616	18.71631094	**2013**	2799927	247257.1449	8.830843411
1992	513394.1	84721.82251	16.50229771	**2014**	2836314	222419.145	7.841838404
1993	497964.8	118115.3551	23.71961979	**2015**	2453512	247703.9804	10.09589383
1994	506229.9	115504.7324	22.81665326	**2016**	2418508	226490.4745	9.364883155
1995	536819.7	120810.1397	22.50479001	**2017**	2582198	226827.1394	8.784266012
1996	594190.7	92434.54138	15.55637676	**2018**	2949457	200299.2741	6.791056219

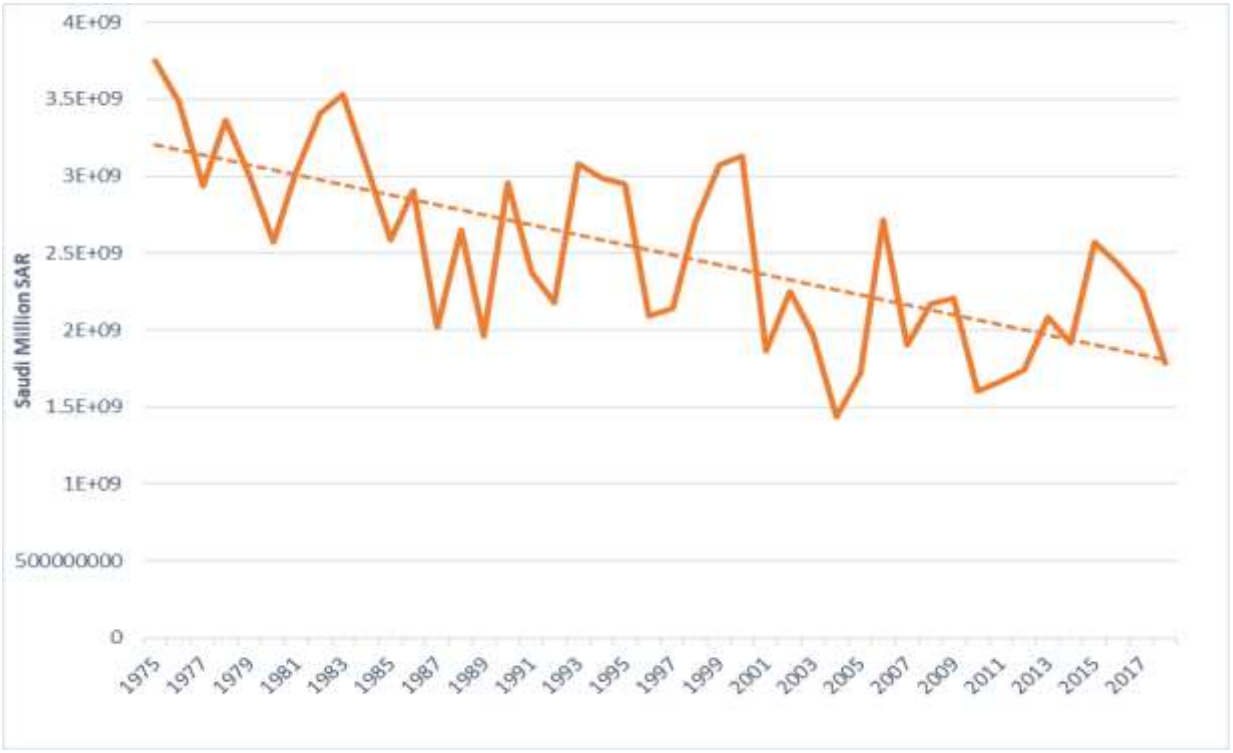

Figure 5.2. Trend of the shadow economy in real term from 1975–2018.

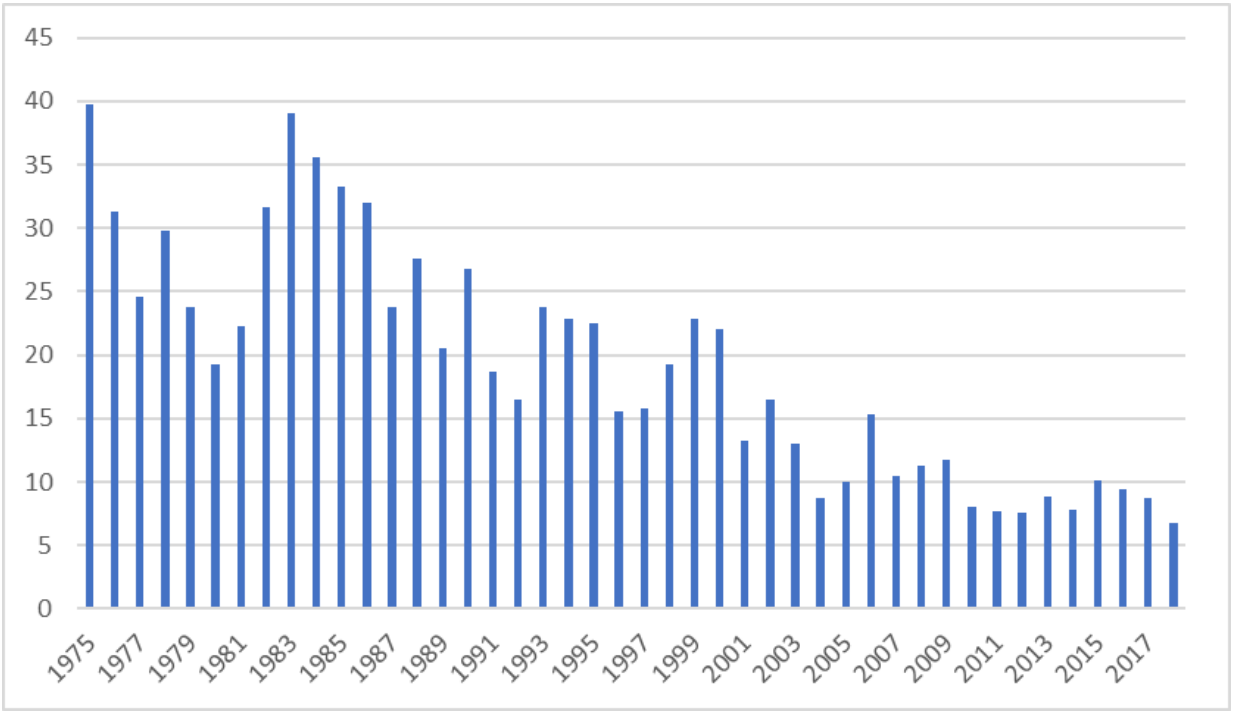

Figure 5.3. Trend of the shadow economy in Saudi Arabia (% of GDP).

This study's SE in Saudi Arabia sizing in riyals and SE-to-GDP ratio estimates for the period under study (1975–2018) are shown in Table 5.4, Figures 5.2 and 5.3. The average size of the SE in Saudi Arabia is 19.23% of GDP during the period. The highest ratio of the SE in Saudi Arabia to GDP occurs in 1975 at 39.77%. The lowest ratio takes place in 2018 at about 7%. The variables with the biggest effect are the intensity of the regulations, the GDP, and government expenditure. The SE in Saudi Arabia experienced strong fluctuations around the trend from 1975 to 2018. It seems reasonable to assume that these fluctuations were a consequence of unstable oil prices and other key events that have had a disproportionate effect on GDP and government expenditure in Saudi Arabia.

Looking at the graphs in the two figures, we see a long-term downward secular trend in the size of the SE in Saudi Arabia punctuated by cyclical peaks and troughs. The following are some observations on this trend and these ups and downs. In 1975, new leadership increased government employment and expenditures. Our results show a decline in the SE from around 39% of GDP to 19% in 1980. In the early to mid-1980s, there was a drop in the price of oil and reduced government spending and income as a result.

In 1982, there was a change in leadership, which impacted the intensity and extent of government regulation. At the same time, we show the SE climbing back up above 39% of GDP by 1983. It seems reasonable to assume that there is a strong association between these phenomena. The region war between Iraq and Iran (1980–1988) and ongoing international economic pressures, followed by increases in the price of oil, expanded Saudi GDP and government income. This increase in income was

followed by employment. At the same time, we show a fluctuating but significant long-term decline in the SE in Saudi Arabia. From 1987 to 1999, it fluctuated around 15.5–27.5% of the GDP. Again, it seems reasonable to conclude that there is a significant relationship between these events.

The SARIE system was introduced in 1997. This reduces the extent of cash used in the Kingdom over the next couple of decades. It also seems reasonable to conclude that this helped contribute significantly to the long-term decline in the SE in Saudi Arabia that we show from about 23% of GDP before that year to less than 10% by 2010. This decline is probably reinforced by Saudi Arabia joining the World Trading Organization (WTO) after 2005 and the advent of another leadership change in 2006. This change was followed by a big decline in the stock market, which required significant intervention by the government. The new leadership increased deregulation and privatization in the Saudi economy. There was also an increase in oil prices for several years after 2006, with an increasingly positive effect on Saudi GDP and on government spending. All of this likely helped to maintain and to reinforce a continued reduction in the SE in Saudi Arabia.

In 2015, another leadership change happened, bringing new rules aimed at controlling the number of foreign workers in Saudi Arabia and establishing more efficient taxes and fees. It seems reasonable to conclude that these actions also helped to continue the ongoing reduction in the SE. Since 2015, there has been an important rise in non-oil GDP, despite a significant decrease in oil prices. This has driven reform of the finances of the Kingdom.

In 2016, Saudi Arabia Vision 2030 was introduced as part of these reforms. This policy-document focuses on diversifying the Saudi economy away from overdependence on oil and gas revenues and on improving the efficiency of government operations in the ongoing effort to strengthen the Saudi economy.

CHAPTER 6: SUMMARY AND CONCLUSION

6.1 Summary

This study observes that the shadow economy, often called the unreported or unofficial economy, is important to all economies because it distorts official statistics vital to policy formulation and is about one-third of the world economy. It notes that several different approaches to studying SE have been tried, but all have difficulties because of its hidden nature and a lack of any commonly accepted definition of SE. The purpose of this dissertation is to size the SE in Saudi Arabia more accurately than previous efforts, for the period 1975–2018, in order to assist policymakers and advance research. The major contribution of this study is the inclusion of special characteristics of the Saudi economy, in looking at the SE, that were not previously taken into account for the period under consideration.

The economy of Saudi Arabia discussed in this dissertation is observed to be the 18th largest in the world, with a GDP of $782 billion (population of 33.7 million) driven mainly by oil and gas exports at 87% of government revenues and 42% of GDP. It points out that the private sector is estimated to be 40% of GDP and that its labor force is estimated to be 80% foreign. This dissertation also observes that the SE in Saudi Arabia merits investigation for domestic reasons because it is a challenge for effective government policy and a spur to income growth and dynamic innovation. It notes that during the period under examination (1975–2018), the Saudi Arabian economy grew and diversified under successive governments and five-year plans. It explains that these plans have had mixed success in reaching their goals. They have always been challenged with

difficult trade-offs between encouraging local and foreign involvement in the economy. These plans have also successfully taken Saudi Arabia from a government-dominated rural developing country with limited resources, physical infrastructure, and opportunities to an increasingly prosperous and diverse urban economy. That economy now has significant social infrastructure, health care, and education provisioning as well as a growing and diversifying private sector. These developments have happened in part because of rising oil and gas revenues and also because of a tremendous focus on building capacity in the local population, targeted investments in the private sector, reform and automation of the banking and monetary system, tax reform, investments in regional development, and strenuous efforts to reduce dependence on oil and gas exports.

In Chapter Three, the theory underlying SE studies was explored. Studies to date on the SE in Saudi Arabia were also examined and found to be too limited in their ability to assist policymakers in Saudi Arabia. This is because they focused too much on tax as an SE determinant and not enough on other variables, such as government spending important to a developing country oil exporter like Saudi Arabia, which is not heavily dependent on taxes for government revenues. This chapter observed that researchers and theorists of the SE have usually characterized it from either a definitional or behavioral point of view, depending on their interest and focus. It noted a tendency to classify SE activities into illegal and legal, associated with monetary and nonmonetary transactions. This chapter also drew powerful input for the methodology and fit variables developed in this dissertation from a literature review.

In Chapter Four, the estimation methodology and data of the dissertation were presented. The two main method categories were analyzed: the direct approach (surveys and tax auditing) and indirect approaches. The latter included national income accounts discrepancies; electricity use; multiple indicators, multiple causes (MIMIC); SEM modeling; and the currency demand approach (CDA). This chapter engaged in a more detailed discussion of the currency deposit ratio variant of CDA, which is the specific method adopted for this study. Here the econometric manner of determining the proportion of cash used in the SE was explained, including how and why specific variables such as GDP, inflation, tax, government expenditure, SARIE (dummy variable), and money outflow abroad are key to sizing the SE in Saudi Arabia. This chapter also described the various validation tests deployed in this study, including ADF (unit root) and ARDL (co-integration). As part of this process, the model hypotheses were examined, including the null hypothesis (no co-integration between the variables) and alternative hypothesis (co-integration exists between the variables) versions.

In Chapter Five, the estimation results were elucidated. Here the SE in Saudi Arabia was sized, for the period 1975–2018, deploying the ARDL model to determine excess demand for currency beyond normal official transaction expectations. It was shown that the alternative hypothesis (co-integration exists between the dependent variable and independent variables) can be accepted. This chapter highlighted the positive relationships among the outflow of money, tax rate, regulation, and currency demand. It also highlighted a negative relationship among GDP, government expenditure, inflation, SARIE implementation, and currency demand with its consequent negative impact on the

SE in Saudi Arabia. This chapter pointed out that the serial correlation in the study's model was addressed using the Breusch-Godfrey LM Test and White's heteroscedasticity test. Normality was covered by a normality test. These tests revealed that there was no serial correlation problem and no heteroscedasticity or normality issues with the model. Chapter Five also explained in detail the model process of arriving at a sizing of SE, which is estimated to be 19.23% of GDP on average for the period (1975–2018), with the highest ratio at 39.77% in 1975 and the lowest at about 7% in 2018. This reflects a downward trend punctuated by strong intermittent cyclical increases and decreases. The chapter concluded by highlighting the importance, in these cyclical SE in Saudi Arabia to GDP ratio undulations, of leadership changes, oil price fluctuations, the impact of SARIE, domestic policy initiatives, and global events such as economic crises.

6.2 Conclusion

This dissertation has attempted to size the SE in Saudi Arabia during the period 1975–2018. In so doing it illustrates the significance of SE for the Saudi Arabian economy. Based on the estimated results using our CDA methodology, we find that the absolute value of SE in Saudi Arabia has decreased during the examined time span while still remaining an important percent of official GDP. We find that, on average, during the period 1975–2018, the ratio of SE to GDP was 19.23%, with the maximum at 39.77% in 1975 and the minimum about 7% in 2018.

In line with other studies, our work demonstrates that the SE has a distorting effect on the accuracy of a country's national accounts statistics. In particular, unreported shadow economic activities underestimate the officially published GDP by the size of the

SE. Consequently, all indicators that are expressed as a percentage of GDP, such as the budget deficit, the current account deficit, and the public debt, will be overestimated. At the same time, since most people who work in the SE are not included in the official labor statistics, the published unemployment rates will also be overestimated. Overstated, too, will be the official inflation rate. This is because the prices of goods and services produced in the SE—not included in official statistics—are lower than prices in the formal economy.

In the case of Saudi Arabia, getting a more accurate sizing and comprehensive understanding of the SE can help policymakers to improve their allocation of resources and implement better incentives that can encourage the SE participant activities to function in support of their policy goals.

It is no easy task to identify factors that drive the size and disposition of the SE in oil-exporting developing countries that, like Saudi Arabia, do not depend significantly on tax revenues. This study identified the variables of government spending, the implementation of automated financial transactions under SARIE, money outflows, and the intensity of regulation as a key to SE in Saudi Arabia's evolution after careful analysis, research, and testing. The availability of reasonably reliable data for the long period covered was critical to our results. Those results are also consistent with the findings of another study, although they are using different methods (Figure 6.1).

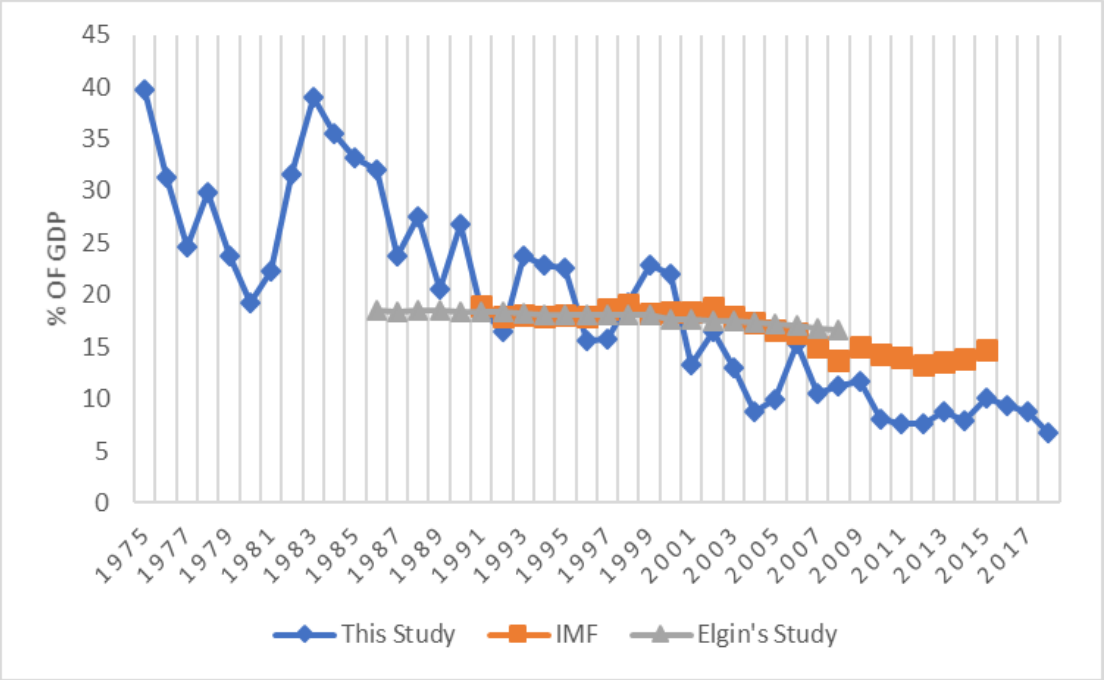

Figure 6.1. Comparison of various studies estimates of the shadow economy in Saudi Arabia.

It is our view that this dissertation can open up new directions in research on the dynamics of the SE in Saudi Arabia and its relationship to the official economy there, including employment/unemployment, healthy growth, and its sought-after diversification. It can also assist in a further necessary investigation into the relationship between legal and illegal immigration and the size of SE in Saudi Arabia, as well as explore the relationship between the growth of the private sector and the SE there.

APPENDIX

Table A.1: Summary of the Study Variables

Variable	Obs	Mean	Std.Dev.	Min	Max
lnCR	44	2.601	.581	1.704	3.476
lnTR	44	1.972	.385	1.195	2.771
lnTRAN	44	1.677	.54	.167	2.595
lnREG	44	2.491	.187	2.181	2.875
lnGDP	44	14.175	.34	13.565	14.783
lnSPEN	44	3.196	.211	2.676	3.562
INF	44	5.202	11.335	-26.87	37.814
SR	44	.5	.506	0	1

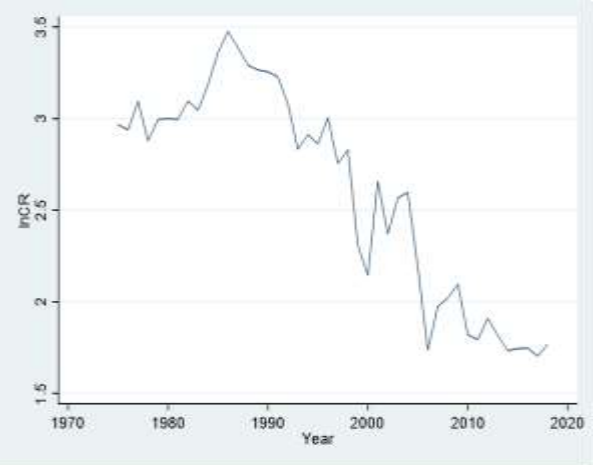

Figure A.1: The trend of the currency ratio demand variable over the study period.

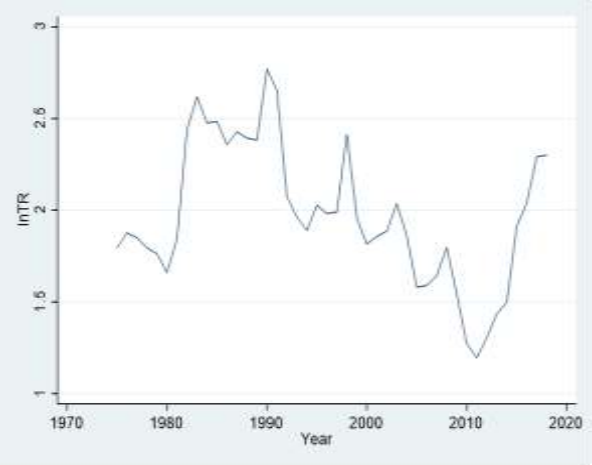

Figure A.2: The trend of the tax rate variable over the study period.

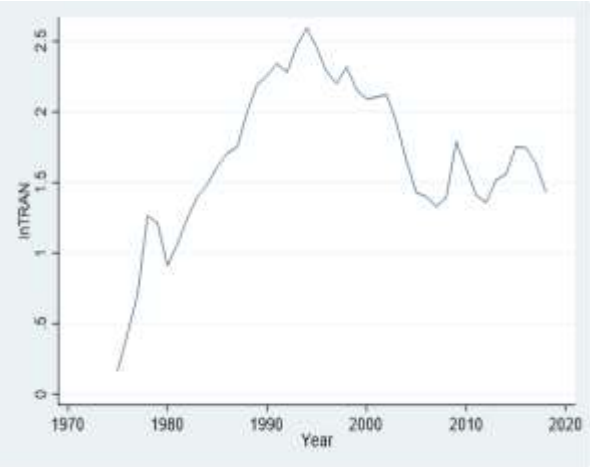

Figure A.3: The trend of outflow of money variable over the study period.

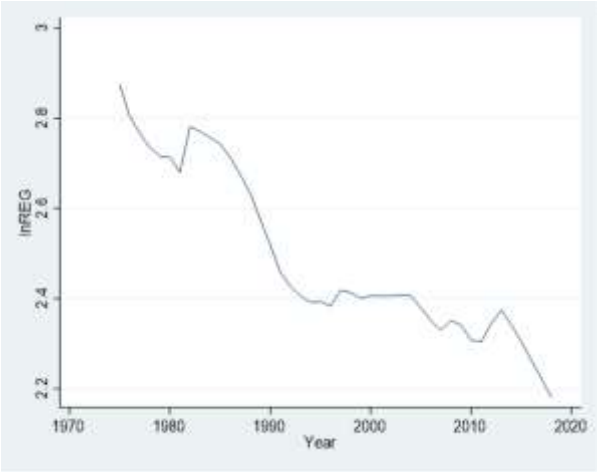

Figure A.4: The trend of the intensity of regulation variable over the study period.

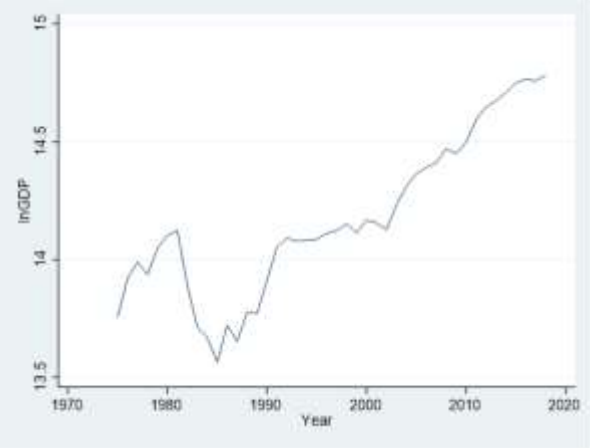

Figure A.5: The trend of the GDP variable over the study period.

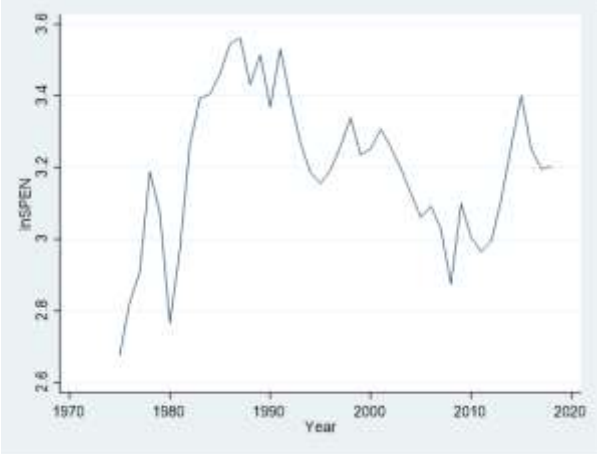

Figure A.6: The trend of the government expenditure variable over the study period.

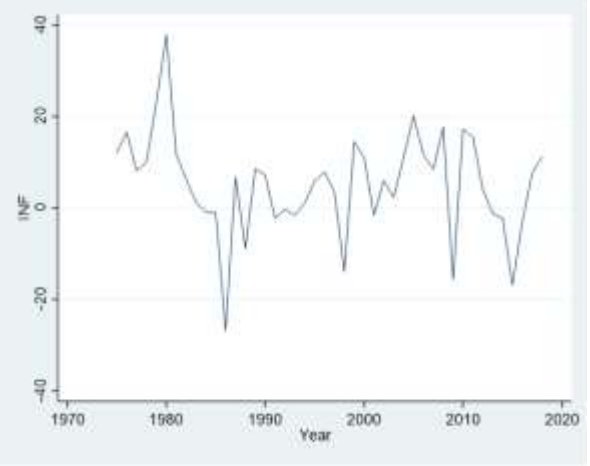

Figure A.7: The trend of the inflation variable over the study period.

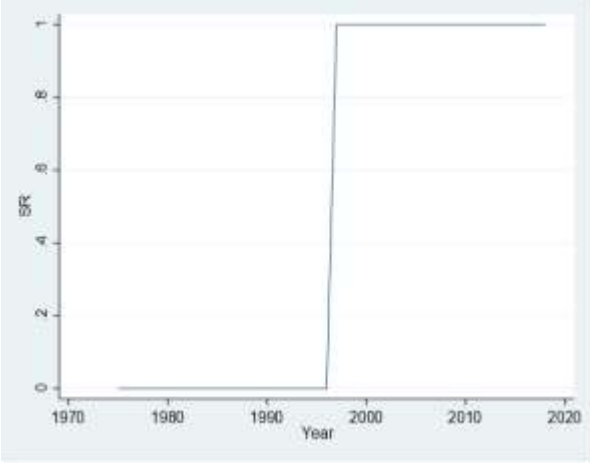

Figure A.8: The dummy variable (0 before 1997 and 1 from 1997).

Table A.2: Selection-order criteria for the variable (lnCR)
Sample: 5 - 44 Number of obs = 40

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-35.618				0.365	1.831	1.846	1.873
1	9.253	89.742*	1	0.000	.040744*	-.362643*	-.332111*	-.278199*
2	9.712	0.917	1	0.338	0.042	-0.336	-0.290	-0.209
3	10.376	1.329	1	0.249	0.043	-0.319	-0.258	-0.150
4	10.461	0.169	1	0.681	0.045	-0.273	-0.197	-0.062

Table A.3: Selection-order criteria for the variable (lnTR)
Sample: 5 - 44 Number of obs = 40

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-19.738				0.165	1.037	1.052	1.079
1	4.654	48.782*	1	0.000	0.051	-0.133	-0.102	-.048237*
2	6.043	2.778	1	0.096	.050301*	-.152136*	-.106337*	-0.025
3	6.244	0.403	1	0.526	0.052	-0.112	-0.051	0.057
4	6.297	0.105	1	0.745	0.055	-0.065	0.011	0.146

Table A.4: Selection-order criteria for the variable (lnTRAN)
Sample: 5 - 44 Number of obs = 40

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-22.392				0.189	1.170	1.185	1.212
1	18.014	80.813*	1	0.000	0.026	-0.801	-0.770	-.716272*
2	19.195	2.361	1	0.124	0.026	-0.810	-0.764	-0.683
3	20.891	3.392	1	0.066	.025179*	-.844536*	-.783471*	-0.676
4	20.956	0.132	1	0.717	0.026	-0.798	-0.721	-0.587

Table A.5: Selection-order criteria for the variable (lnREG)
Sample: 5 - 44 Number of obs = 40

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	15.359				0.029	-0.718	-0.703	-0.676
1	83.621	136.520	1	0.000	0.001	-4.081	-4.050	-3.997
2	85.633	4.0254*	1	0.045	.00094*	-4.13166*	-4.08586*	-4.005*
3	85.866	0.466	1	0.495	0.001	-4.093	-4.032	-3.924
4	85.879	0.025	1	0.875	0.001	-4.044	-3.968	-3.833

Table A.6: Selection-order criteria for the variable (lnGDP)
Sample: 5 - 44 Number of obs = 40

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-13.481				0.121	0.724	0.739	0.766
1	46.190	119.34*	1	0.000	.006427*	-2.20952*	-2.17899*	-2.12507*
2	46.881	1.381	1	0.240	0.007	-2.194	-2.148	-2.067
3	48.116	2.471	1	0.116	0.006	-2.206	-2.145	-2.037
4	48.538	0.843	1	0.359	0.007	-2.177	-2.101	-1.966

Table A.7: Selection-order criteria for the variable (lnSPEN)
Sample: 5 - 44 Number of obs = 40

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	10.556				0.036	-0.478	-0.463	-0.436
1	29.762	38.414*	1	0.000	.014612*	-1.38811*	-1.35758*	-1.30367*
2	29.934	0.343	1	0.558	0.015	-1.347	-1.301	-1.220
3	30.705	1.542	1	0.214	0.015	-1.335	-1.274	-1.166
4	30.761	0.113	1	0.736	0.016	-1.288	-1.212	-1.077

Table A.8: Selection-order criteria for the variable (INF)
Sample: 5 - 44 Number of obs = 40

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-154.489				139.296	7.774	7.78974*	7.81669*
1	-153.447	2.084	1	0.149	139.013*	7.77236*	7.803	7.857
2	-153.234	0.426	1	0.514	144.622	7.812	7.858	7.938
3	-153.213	0.043	1	0.835	151.931	7.861	7.922	8.030
4	-153.044	0.338	1	0.561	158.478	7.902	7.979	8.113

Table A.9: Selection-order criteria for the variable (SR)
Sample: 5 - 44 Number of obs = 40

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-28.831				0.260	1.492	1.507	1.534
1	18.101	93.864*	1	0.000	.026177*	-.80507*	-.774537*	-.720626*
2	18.101	0	1	.	0.028	-0.755	-0.709	-0.628
3	18.101	0	1	.	0.029	-0.705	-0.644	-0.536
4	18.101	0	1	.	0.030	-0.655	-0.579	-0.444

REFERENCES

Acemoglu, D., 1995. Reward structures and the allocation of talent. European Economic Review 39, 17–33.

Al-Ruithe, M., Benkhelifa, E., 2017. Cloud data governance in-light of the Saudi Vision 2030 for digital transformation, 2017 IEEE/ACS 14th International Conference on Computer Systems and Applications (AICCSA). IEEE, pp. 1436–1442.

Alderslade, J., Talmadge, J., Freeman, Y., 2006. Measuring the informal economy: One neighborhood at a time. Citeseer.

Alm, J., Embaye, A., 2013. Using dynamic panel methods to estimate shadow economies around the world, 1984–2006. Public Finance Review 41, 510–543.

Alshuaibi, A., 2017. Technology as an important role in the implementation of Saudi Arabia's Vision 2030. International Journal of Business, Humanities and Technology 7, 52– 62.

AnaMaria, A.A., Ion, D., Catalin, G., 2009. Estimating the size of the Romanian shadow economy using the currency demand approach. ANALELE UNIVERSITĂŢII DIN ORADEA, 622.

Ardizzi, G., Petraglia, C., Piacenza, M., Schneider, F., Turati, G., 2012. Estimating money laundering through a "cash deposit demand" approach, XXIV Conferenza Società italiana di economia pubblica: Economia informale, evasione fiscale e corruzzione. Pavia, IT.

Ashok, S., Haq, A., Mehmood, K., 2017. Modeling the shadow economy and its dynamics in case of Pakistan, 33rd AGM and Conference on Redefining Prosperity Paths in Changing Global Economy: Opportunities and Challenge for Pakistan, pp. 12–14.

Asiedu, E., Stengos, T., 2014. An empirical estimation of the underground economy in Ghana. Economics Research International 2014.

Bajada, C., Schneider, F., 2003. The size and development of the shadow economies in the Asia-Pacific. Discussion Paper.

Berdiev, A.N., Saunoris, J.W., Schneider, F., 2018. Give me liberty, or I will produce underground: Effects of economic freedom on the shadow economy. Southern Economic Journal 85, 537–562.

Breusch, T., 2005. Estimating the underground economy using MIMIC models. Citeseer.

Breusch, T., 2016. Estimating the underground economy using MIMIC models. Journal of Tax Administration 2, 41–72.

Cagan, P., 1958. The demand for currency relative to the total money supply. Journal of Political Economy 66, 303–328.

Carolina, M.G., Pau, L., 2007. The shadow economy in the Netherlands Antilles. Social and Economic Studies, 46–81.

Chen, H., Schneider, F., 2018. Size and causes of shadow economy in China over 1978–2016: based on the currency demand method.

Chen, W.Y., Jim, C.Y., 2012. Contingent valuation of ecotourism development in country parks in the urban shadow. International Journal of Sustainable Development & World Ecology 19, 44–53.

Çiçek, D., Elgin, C., 2011. Cyclicality of fiscal policy and the shadow economy. Empirical Economics 41, 725–737.

Cowell, F.A., 1989. The consequences of progressive income taxation for the shadow economy, The political economy of progressive taxation. Springer, pp. 177–179.

Cziráky, D., 2004. LISREL 8.54: A program for structural equation modelling with latent variables. JSTOR.

Dabla-Norris, M.E., Feltenstein, M.A., 2003. An analysis of the underground economy and its macroeconomic consequences. International Monetary Fund.

Del'Anno, R., 2003. Estimating the shadow economy in Italy. Department of Eco.

Dell'Anno, R., 2004. Estimating the shadow economy in Italy: A structural equation approach.

Dell'Anno, R., Schneider, F., 2009. A complex approach to estimate shadow economy: The structural equation modelling, Coping with the Complexity of Economics. Springer, pp. 111–130.

Del Boca, D., Forte, F., 1982. Recent empirical surveys and theoretical interpretations of the parallel economy in Italy. The underground economy in the United States and abroad, Lexington (Mass.), Lexington, 160–178.

Dickey, D.A., Fuller, W.A., 1979. Distribution of the estimators for autoregressive time series with a unit root. Journal of the American Statistical Association 74, 427–431.

Dobre, I., Davidescu, A.A., 2013. Long-run demand for money and the size of shadow economy in Romania: An Application of ARDL model. Economic Computation & Economic Cybernetics Studies & Research 47.

Doeringer, P., Piore, M., 1971. Internal labor markets and manpower analysis, Lexington, Mass. Health.

Dreher, A., Schneider, F., 2010. Corruption and the shadow economy: An empirical analysis. Public Choice 144, 215–238.

Elgin, C., 2010. Political turnover, taxes and the shadow economy. Bogazici University Institute of Social Sciences Workin Paper Series ISS/EC 8.

Elgin, C., Oztunali, O., 2012. Shadow economies around the world: Model-based estimates. Bogazici University Department of Economics Working Papers 5, 1–48.

Feige, E.L., 1979. How big is the irregular economy? Challenge 22, 5–13.

Feige, E.L., 1989. The meaning and measurement of the underground economy. Feige, EL (1989a), 13–56.

Feige, E.L., 1990. Defining and estimating underground and informal economies: The new institutional economics approach. World development 18, 989–1002.

Feige, E.L., 1994. The underground economy and the currency enigma. Public Finance= Finances publiques 49, 119–136.

Feige, E.L., 2016. Professor Schneider's shadow economy: What do we really know? A rejoinder. Forthcoming in the Journal of Tax Administration 2.

Feld, L.P., Larsen, C., 2005. Black activities in Germany in 2001 and 2004: A comparison based on survey data. Rockwool Foundation Research Unit.

Feld, L.P., Larsen, C., 2008. "Black" activities low in Germany in 2006. News from the Rockwool Foundation Research Unit, March, 1–12.

Feld, L.P., Larsen, C., 2009. Undeclared work in Germany 2001–2007–Impact of deterrence, tax policy, and social norms: An analysis based on survey data. Springer, Berlin et al.

Fleming, M.H., Roman, J., Farrell, G., 2000. The shadow economy. Journal of International Affairs, 387–409.

Foley, S., 2017. When oil is not enough: Sino-Saudi relations and Vision 2030. Asian Journal of Middle Eastern and Islamic Studies 11, 107–120.

Françoise De Bel-Air, D., "Migration and labour market in Saudi Arabia 2018," Explanatory Note No. 5/2018, Gulf Labour Markets, Migration and Population Programme (GLMM) of the Migration Policy Center (MPC) and the Gulf Research Center (GRC), http:// gulfmigration.org.

Frey, B.S., Pommerehne, W.W., 1984. The hidden economy: State and prospects for Measurement 1. Review of income and Wealth 30, 1–23.

Friedman, E., Johnson, S., Kaufmann, D., Zoido-Lobaton, P., 2000. Dodging the grabbing hand: The determinants of unofficial activity in 69 countries. Journal of Public Economics 76, 459–493.

Gamal, A.A.M, Dahalan, J., 2015. Estimating the size of the underground economy in Saudi: Evidence from Gregory-Hansen cointegration based currency demand approach. Handbook on Economics, Finance and Management Outlooks.

Gamal, A.A.M., Rambeli, N., Jalil, N.A., Viswanathan, K.K., 2019. A modified currency demand function and the Malaysian shadow economy: Evidence from ARDL bounds testing approach. Economic Analysis and Policy 64, 266–281.

Giles, D.E., 1999. Measuring the hidden economy: Implications for econometric modelling. The Economic Journal 109, 370–380.

Godfrey, P.C., 2011. Toward a theory of the informal economy. The Academy of Management Annals 5, 231–277.

Gutmann, P.M., 1977. The subterranean economy. Financial Analysts Journal 33, 26–27.

Haigner, S.D., Jenewein, S., Schneider, F., Wakolbinger, F., 2013. Driving forces of informal labour supply and demand in Germany. International Labour Review 152, 507–524.

Hametner, B., Schneider, F., 2007. The shadow economy in Colombia: Size and effects on economic growth. Johannes Kepler University of Linz. Working paper, 1–39.

Harris, R., Sollis, R., 2003. Applied time series modelling and forecasting. Wiley.

Hart, K., 2008. Between bureaucracy and the people: A political history of informality. DIIS Working paper.

Hashimzade, N., Heady, C., 2016. Reflections on the meaning and measurement of unobserved economies: An editorial comment. Univ Exeter Business School Streatham Court Rennes Dr, Exeter, EX4 4PU, England.

Hassan, M., Schneider, F., 2016a. Modelling the Egyptian Shadow Economy: A MIMIC model and a currency demand approach. Journal of Economics and Political Economy 3, 309–339.

Hassan, M., Schneider, F., 2016b. Size and development of the shadow economies of 157 countries worldwide: Updated and new measures from 1999 to 2013.

Hatipoglu, O., Ozbek, G., 2011. On the political economy of the informal sector and income redistribution. European Journal of Law and Economics 32, 69–87.

Helberger, C., Knepel, H., 1988. How big is the shadow economy? A re-analysis of the unobserved-variable approach of BS Frey and H. Weck-Hannemann. European Economic Review 32, 965–976.

Ihrig, J., Moe, K.S., 2004. Lurking in the shadows: The informal sector and government policy. Journal of Development Economics 73, 541–557.

Isachsen, A.J., Strøm, S., 1985. The size and growth of the hidden economy in Norway. Review of Income and Wealth 31, 21–38.

Johnson, S., Kaufmann, D., Shleifer, A., Goldman, M.I., Weitzman, M.L., 1997. The unofficial economy in transition. Brookings papers on economic activity 1997, 159–239.

Johnson, S., Kaufmann, D., Zoido-Lobaton, P., 1998. Regulatory discretion and the unofficial economy. The American Economic Review 88, 387–392.

Kaliberda, A., Kaufmann, D., 1996. Integrating the unofficial economy into the dynamics of post-socialist economies: A framework of analysis and evidence. The World Bank.

Kanniainen, V., Pääkönen, J., Schneider, F., 2004. Fiscal and ethical determinants of shadow economy: Theory and evidence. Helsinki Center of Economic Research, Discussion Paper n 30.

Kazemier, B., 2006. Monitoring the underground economy: A survey of methods and estimates. Jahrbuch Schattenwirtschaft 7, 11–53.

Lackó, M., 1998. The hidden economies of Visegrad countries in international comparison: A household electricity approach. Hungary: Towards a market economy, 128–152.

Lackó, M., 1999. Do power consumption data tell the story? Electricity intensity and hidden economy in post-socialist countries. Budapest Working Papers on the Labour Market.

Lackó, M., 2000. Hidden economy–an unknown quantity? Comparative analysis of hidden economies in transition countries, 1989–95. Economics of Transition 8, 117–149.

Lizzeri, C., 1979. Mezzogiorno in Controluce. Enel, Naples.

Loayza, N.V., 1996. The economics of the informal sector: A simple model and some empirical evidence from Latin America, Carnegie-Rochester Conference Series on Public Policy. Elsevier, pp. 129–162.

London, T., Hart, S.L., 2004. Reinventing strategies for emerging markets: Beyond the transnational model. Journal of International Business Studies 35, 350–370.

Losby, J.L., Else, J.F., Kingslow, M.E., Edgcomb, E.L., Malm, E.T., Kao, V., 2002. Informal economy literature review. ISED Consulting and Research, 1–55.

Macias, J.B., Cazzavillan, G., 2009. The dynamics of parallel economies. Measuring the informal sector in Mexico. Research in Economics 63, 189–199.

Malaczewska, P., 2013. Useful government expenditure influence on the shadow economy. Metody Ilościowe w Badaniach Ekonomicznych 14, 61–69.

Maloney, W.F., 1999. Does informality imply segmentation in urban labor markets? Evidence from sectoral transitions in Mexico. The World Bank Economic Review 13, 275–302.

Maloney, W.F., 2004. Informality revisited. World development 32, 1159–1178.

Medina, L., Schneider, F., 2018. Shadow economies around the world: What did we learn over the last 20 years?

Moscoso-Boedo, H.J., D'Erasmo, P.N., 2012. Misallocation, informality, and human capital. University of Virginia, Department of Economics.

Mughal, K., Schneider, F., 2018. Shadow economy in Pakistan: Its size and interaction with official economy.

Muhammad, I., 2019. Analysis of Zakat System in high-income Islamic countries. The Journal of Muamalat and Islamic Finance Research, 1–11.

Narayan, P.K., Smyth, R., 2004. The relationship between the real exchange rate and balance of payments: Empirical evidence for China from cointegration and causality testing. Applied Economics Letters 11, 287–291.

Navickas, M., Juščius, V., Navickas, V., 2019. Determinants of shadow economy in Eastern European countries. Scientific Annals of Economics and Business 66, 1–14.

Nchor, D., Adamec, V., 2015. Unofficial economy estimation by the MIMIC model: The case of Kenya, Namibia, Ghana and Nigeria. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis 63, 2043–2049.

Nikopour, H., 2003. Measuring the size of underground economy in Iran with emphasis on the incentives for evasion of insurance premium payment (1961–2001).

Pedersen, S., 2003. The shadow economy in Germany, Great Britain and Scandinavia: A measurement based on questionnaire surveys. Rockwool Foundation Research Unit.

Pesaran, M.H., Shin, Y., 1998. An autoregressive distributed-lag modelling approach to cointegration analysis. Econometric Society Monographs 31, 371–413.

Pesaran, M.H., Shin, Y., Smith, R.J., 2001. Bounds testing approaches to the analysis of level relationships. Journal of Applied Econometrics 16, 289–326.

Portes, A., Castells, M., Benton, L.A., 1989. The informal economy: Studies in advanced and less developed countries. JHU Press.

Putniņš, T.J., Sauka, A., 2011. Size and determinants of shadow economies in the Baltic States. Baltic Journal of Economics 11, 5–25.

Raut, N.K., Chalise, N., Thapa, P., 2014. Measurement of the underground economy in Nepal: A currency demand approach. Economic Journal of Development Issues, 105–127.

Renooy, P., Ivarsson, S., Gritsai, O., Meijer, R., 2004. Undeclared work in an enlarged Union. An analysis of undeclared work: An in-depth study of specific items.

Routh, S., 2011. Building informal workers agenda: Imagining 'informal employment'in conceptual resolution of 'informality'.

Saint-Paul, G., 1997. Is labour rigidity harming Europe's competitiveness? The effect of job protection on the pattern of trade and welfare. European Economic Review 41, 499–506.

Sanyal, K., Bhattacharyya, R., 2009. Beyond the factory: Globalisation, informalisation of production and the new locations of labour. Economic and Political Weekly, 35–44.

Schneider, F., 1994. Measuring the size and development of the shadow economy. Can the causes be found and the obstacles be overcome? Essays on economic psychology. Springer, pp. 193–212.

Schneider, F., 2005. Shadow economies of 145 countries all over the world: What do we really know? Citeseer.

Schneider, F., 2006. Shadow economies and corruption all over the world: What do we really know?

Schneider, F., 2011. The shadow economy and shadow economy labor force: What do we (not) know?

Schneider, F., 2016. Comment on Feige's paper "Reflections on the meaning and measurement of unobserved economies: What do we really know about the 'shadow economy'?"

Schneider, F., Buehn, A., 2017. Estimating a shadow economy: Results, methods, problems, and open questions. Open Economics 1, 1–29.

Schneider, F., Buehn, A., 2018. Shadow economy: Estimation methods, problems, results and open questions. Open Economics 1, 1–29.

Schneider, F., Buehn, A., Montenegro, C.E., 2010. Shadow economies all over the world: New estimates for 162 countries from 1999 to 2007. World Bank policy research working paper.

Schneider, F., Enste, D., 2002. Hiding in the shadows: The growth of the underground economy. International Monetary Fund.

Schneider, F., Enste, D.H., 2000. Shadow economies: size, causes, and consequences. Journal of Economic Literature 38, 77–114.

Shima, I., 2004. The shadow economy in Norway: Demand for currency approach. Memorandum.

Tanzi, V., 1980. The underground economy in the United States: Estimates and implications. PSL Quarterly Review 33.

Tanzi, V., 1983. The underground economy in the United States: Annual estimates, 1930–80. Staff Papers 30, 283–305.

Tedds, L.M., 2005. Revisiting the latent variable/MIMIC Model approach to measuring the size of the Canadian Underground Economy. Size, causes and consequences of the underground economy, Chris Bajada and Friedrich Schneider, eds., Ashgate Pub., UK.

Thomas, J., 1999. Quantifying the black economy: "Measurement without theory" yet again? The Economic Journal 109, 381–389.

Trebicka, B., 2014. The size of underground economy in Albania. Academic Journal of Interdisciplinary Studies 3, 503.

Van Eck, R., Kazemier, B., 1988. Features of the hidden economy in the Netherlands. Review of Income and Wealth 34, 251–273.

VanderBerg, N., 2014. The informal economy: A literature review. Unpublished paper. Retrieved from http://www. westnh. org/wpcontent/uploads/2014/06/PHASE-1-_-Appendix-B_Informal_Economy_Literature-Review. pdf.

Yamada, M., 2016. Vision 2030 and the birth of Saudi solar energy. Middle East Institute Policy Focus 15, 2016.

ABSTRACT

ESTIMATING THE SIZE OF THE SHADOW ECONOMY IN THE KINGDOM OF SAUDI ARABIA

by

ALI ALSUBAIE

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Advisor: Prof. Li Way Lee

Major: Economics

Degree: Doctor of Philosophy

The shadow economy (SE), as unreported economic activity, is a challenge for researchers and policymakers worldwide because of its size, consequences for economic development, and the difficulty of evaluating it. This dissertation makes an original contribution to SE research by estimating the size of the shadow economy in Saudi Arabia for the period 1975–2018.

This dissertation uses a modified version of the most widely used method currently available for SE estimation: the Currency Demand Approach (CDA). This approach focuses on identifying excess cash used in an economy not accounted for in the official statistics on the assumption that shadow activities are mostly conducted in cash.

Ours is the first study using the CDA that covers the entire period under study in Saudi Arabia. It is also the first study that hypothesizes and substantiates the significance of a combination of government spending, money outflows, intensity of regulation,

inflation, taxes, GDP, and the SARIE digital banking system in determining the extent of excess cash demand and, hence, the shadow economy in Saudi Arabia.

The results of this study are consistent with the findings of the best research done on developing and developed countries, including Saudi Arabia and other MENA countries with significant oil and gas exports. Our results are more refined because they take into account the special features of the Saudi economy, including a very large foreign workforce, the importance of its energy economy to the world, and a history of government planning.

The research imperative of this dissertation is to better understand the SE in Saudi Arabia in order to improve its productive management by policymakers. This includes a more detailed view of the SE dynamics, and the factors that drive those dynamics, than previous studies have achieved. These previous studies have examined the impact of limited common factors on SE in Saudi Arabia among other countries over more important and determinative factors found in the present study.

AUTOBIOGRAPHICAL STATEMENT

Ali Alsubaie is from Riyadh, the Kingdom of Saudi Arabia. He received his bachelor's degree in security science in 2001 from King Fahad Security College, Riyadh, the Kingdom of Saudi Arabia. In 2006, he received his bachelor's degree in public administration from King Abdulaziz University, Jeddah, the Kingdom of Saudi Arabia. He received a master's degree in Economics in 2012 from King Saud University, Riyadh, the Kingdom of Saudi Arabia.