DISSERTATION

ESTIMATING THE SHADOW ECONOMY IN JORDAN:

CAUSES, CONSEQUENCES, AND POLICY IMPLICATIONS

Submitted by

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In partial fulfillment of the requirements

For the degree of Doctor of Philosophy

Colorado State University

Fort Collins, Colorado

Fall 2011

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ABSTRACT

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Economists have been paying increasing attention to the study of the shadow economy in many developed and developing countries in recent years. This attention is due to the consequences and the policy implications related to the shadow economy. Due to the unobserved and hidden nature of the shadow economy, it is difficult to get accurate estimates of its size. However, there are some techniques that have been used by economists to indirectly estimate the size of the shadow economy.

This dissertation estimates the annual size of the shadow economy in Jordan during the period 1976-2010 using two methodologies: the currency approach and the multiple indicators multiple causes (MIMIC) approach. It also analyzes the economic consequences and the policy implications of the shadow economy, estimating the amount of tax evasion in Jordan during the aforementioned time period. This is the first study that differentiates the effect of taxes on imports (custom duties) on the shadow economy from the effect of other taxes (income and sales taxes). It hypothesizes, unlike other studies, that taxes on imports negatively affect the size of the shadow economy. The currency approach results are consistent with this hypothesis. This study is also the first one to take into consideration religious factors as one of the determinants of the demand for money in circulation which is used in the currency approach to estimating the

shadow economy. It is hypothesizes that the number of Islamic banks in Jordan negatively affects the demand for money in circulation. The coefficient of this variable has a negative sign, which is consistent with this hypothesis; however, this variable is insignificant at the 10 percent level. The other determinants of the demand for money in circulation in Jordan are: the effective tax rate on sales, the effective income tax rate, the effective tax rate on imports, the weighted average of interest rates on savings, and a dummy variable for the depreciation of the Jordanian dinar in 1988.

According to the MIMIC approach, the causal variables for the shadow economy in Jordan are found to be: the total effective tax rate (tax revenues/GDP), the unemployment rate, the extent of government regulation (government intervention in the economy), and depreciation of the Jordanian dinar in 1988. The growth rate of real GDP and the growth rate of real private consumption are found to be indicators of the shadow economy in Jordan. The MIMIC approach results are consistent with previous studies that have found taxes and regulations to be the main causes of the shadow economy. The results also support the hypothesis that the depreciation of the Jordanian dinar in 1988 has a positive effect on the shadow economy in Jordan. The unemployment rate is found to have a negative effect on the shadow economy in Jordan. This indicates that the income effect of unemployment is greater than the substitution effect.

In this dissertation, the main consequences and the policy implications of the shadow economy are analyzed. Tax evasion in Jordan is estimated for the period of study based on the results of the currency demand and the MIMIC approaches. It has been shown that the shadow economy has a distorting effect on the accuracy of a country's national accounts statistics. In addition, some policy recommendations are presented to reduce the distorting impact of the shadow economy. Taking into consideration the existence of the shadow economy when

conducting the economic policy will increase the efficiency of this policy. There is a need for further research into the impact of the shadow economy on some economic policy issues in Jordan.

Acknowledgements

This dissertation would not have been possible without the contributions of many people who provided me with support throughout my graduate studies. I'm grateful to those who enabled me to move ahead and motivated me to accomplish this project.

First of all, I would like to express my great thanks to my mother, Labeebah, who has taught me the love of learning. Thank you for your prayers and providing endless encouragement. I would like to give my special thanks to my wife, Maysa, who is always near me, providing support when I need it and encouragement when I'm down. Thank you for your patience, for sharing my dream, and for taking care of our children during my educational journey. I owe many thanks to my lovely children Dana, Firas, Ahmad, and Lama. You have no idea how much you helped along the way.

I would like to express my deep thanks to my advisor and committee chair, Dr. Alexandra Bernasek who has guided me to complete this dissertation. I have shared many ideas with you along the way. Your sound advice and unfailing support and enthusiasm bolstered me throughout this project. I also wish to thank my dissertation committee members; Dr. Chuen-mei Fan, Dr. Robert Kling, Dr. Gamzeh Cavdar, and Dr. Anita Pena for all of their helpful feedback and encouragement over the development and course of this dissertation. I extend a special thanks to Dr. Roberto Dell'Anno from Department of Economics, Mathematics, and Statistics at University of Foggia, Italy, who has provided me with great help in understanding the MIMIC approach.

Dedication

In loving memory of my father Ahmad Alkhdour

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1. CHAPTER ONE: INTRODUCTION

1.1. Introduction

The shadow economy is a broad concept. It has different names in the economic literature; underground, hidden, black, informal, unofficial, unreported, or unrecorded economy. It relates to the economic activities that are not included in the formal measurement of GDP. Increasing attention has been paid by many developed and developing countries in recent years to the shadow economy and its consequences. A recent study by Schnider et. al. (2010), for 162 developed and developing countries overall the world between 1999 and 2006/2007, found that the shadow economy has reached remarkable proportions, with an average value of 34.5% of official GDP of those countries. Almost all studies of the shadow economy phenomena find that the main cause of this phenomenon is a high tax and social security burden.

The existence of the shadow economy creates a distortion in the market competition as a result of the unequal production situations between the producers in the formal economy compared to the producers in the shadow economy. This leads to significant distortions in official economic and social indicators. Most economists agree that there is a strong bidirectional causal relationship between the tax system and the size of shadow economy. The shadow economy reduces government revenues due to tax evasion, which, in turn, reduces the quality and quantity of public goods and services provided by governments. In order to cover its overall need for tax revenue, the government may raise tax rates. The result is often an increase in the size of the shadow economy and more tax evasion. This can increase the distortions in the

economy even more and can have serious distributional consequences. Furthermore, the shadow economy may be associated with underestimates of the true economic growth rate and the national income, and may overestimate the true unemployment rate. Policy makers will tend to base their decisions on inaccurate information, reducing the efficiency of public policy. For example, effective monetary and fiscal policy require a level of precision in the estimates of key statistics (such as: income, consumption, unemployment, etc.), and the existence of the shadow economy can distort these measures, (Albu, 1995). Therefore, efforts should be made to estimate the size of the shadow economy. The purpose of this study is to do so in the context of Jordan, in order to supplement official national accounts statistics and provide more accurate information for policy makers for the purpose of understanding and reducing the size of the shadow economy.

1.2. Definition of the shadow economy

There is no unique definition for the shadow economy. According to Feige (1989), it "consists of those economic activities and the income derived from them that circumvent or otherwise elude government regulation, taxation, or observation". Smith (1994, p.15) presents four alternative definitions of the shadow economy ranging from a narrow definition; "market-based production of legal goods and services that escapes detection in the official estimates of GDP', to a broad definition; "market-and non-market-based production of goods and services, whether legal or illegal, that escapes detection in or is intentionally excluded from the official estimates of GDP". According to the United Nations System of National Accounts (SNA 1993, Para 6.34), the shadow economy (called the underground economy) "consists of activities which may be both productive in an economic sense and also quite legal (provided certain standards or regulations are complied with) but which are deliberately concealed from public authorities (e.g. to avoid the payment of taxes and/or social security contributions or to avoid meeting certain

standards or administrative requirements)". While Schneider (1986, p. 646) defines it as ''all economic activities that contribute to value added and should be included in national income in terms of national accounting conventions, but are presently not registered by national measurement agencies". Schneider and Enste (2002, p.79), concentrate in their definition on the "legal value-added creating activities which are not taxed or registered and where the largest part can be classified as "black" or clandestine labor". Table (1-1) shows the various classifications of shadow economic activities according to monetary and legal status of the activity.

Table 1. 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 Lippert and Walker (1997), with additional remarks from Schneider (2002).

Due to the various definitions of the shadow economy and due to its unobserved and hidden nature, it is difficult to get accurate estimates for its size in the economy. Hence, as Schnider et. al. (2010) say; "doing research in this area can be considered a scientific passion for knowing the unknown". Although the shadow economy in Jordan was previously estimated for limited years, within the context of a large group of countries, by Schneider (2005) and Schneider et al. (2010), there is no previous economic study that has focused exclusively on the Jordanian economy, and analyzed the size of the shadow economy and its consequences and policy implications. In this dissertation, we will estimate the annual size of the shadow economy in Jordan during the period 1976-2010, and analyze the economic consequences and the policy implications of the shadow economy, concentrating on estimating the amount of the tax evasion in Jordan during the aforementioned time period.

Because it is impossible to estimate all aspects of the shadow economy (legal and illegal) due to the lack of information required for such an estimate, we will concentrate in this dissertation on the legal activities of the shadow economy that mainly relate to tax evasion and that can be estimated indirectly by using some macroeconomic indicators. Therefore, for the purpose of this study, we define the shadow economy as 'all legal economic activities with monetary transactions that are subject to tax but are not reported to the tax authorities and to the statistical institutions in order to avoid the government regulations and evade paying tax on the sales and income result from this type of activities". We will not take into consideration illegal activities that relate to criminal actions like stealing, robbery, drug dealing, etc. We will also exclude the household economic activities which consist of all household services and production that are not sold in the market. The employee discounts and fringe benefits that are

legally tax avoided will be excluded as well. By adopting this definition, we take into consideration, at least, the lower bound of the shadow economy.

1.3. Statement of the problem

The presence of shadow economy causes many difficulties in designing and conducting economic and social policies by the decision makers as those policies will depend on inaccurate economic indicators. Therefore, it is very important to estimate the size of the shadow economy in order to reduce the distortion in those policies. Despite the growing interest in estimating the size of shadow economic activities in many countries, no attempt has been made to estimate the shadow economy, its consequences, and its policy implications particularly for the Jordanian economy.

The main statement of the problem in this dissertation is to estimate the annual size of the shadow economy in Jordan during the period 1976-2010, in addition to analyzing the economic consequences and the policy implications of this phenomenon, concentrating on estimating the amount of the tax evasion on Jordan during that period. Jordan is selected the case study in this dissertation for the following reasons:

- Jordan has implemented an economic adjustment program supported by the International Monetary Fund (IMF) and the World Bank (WB) during the period 1989-2004. One objective of the program was to reform the tax system and increase its efficiency. Investigating the developments and trends in the shadow economy in Jordan before, during, and after the tax reform is an important topic of research.
- Taxes are the main source of government revenue in Jordan, unlike most countries in the region which depend on natural resources, particularly oil, as the main source of government

revenue. Given the dependence of government spending on tax revenues, it is important to see if reforms have had a positive or negative effect on the ability of the Jordanian government to undertake spending.

- There are no previous studies that have estimated the annual shadow economy in Jordan during the period 1976-2010.

- The availability of consistent and recent time series data that are needed in estimating the shadow economy is readily available for the Jordanian economy.

The previous literature on the shadow economy indicates that there is a positive relationship between all types of taxes and social security payments and the size of shadow economy. Decomposing taxes, we believe that the relationship between the shadow economy and income and sales taxes is positive, while it is negative with tax on imports. On the other hand, we believe that the social security contributions has no effect on shadow economy in Jordan during the period of study because the social security system in Jordan was optional for firms that have less than 50 workers since its establishment in 1980 until 1987, and it excluded workers in many sectors, especially agriculture. It is now optional for firms that have less than 5 workers. For this reason, social security contributions will be excluded in this study.

In this study we will examine the relationship between taxes and shadow economy in Jordan, summarized as follows:

- As the result of high Income and sales tax rates, individuals and firms will have economic incentives to hide their activities to avoid paying those types of taxes, which leads to an increase in the size of the shadow economy.

- High tax rates on imports (customs duties) on the other hand, provide a significant protection to domestic economic producers. Therefore, a reduction of this type of tax reduces that protection and decreases the competitiveness of domestic goods against foreign goods. This is likely to induce some local producers to exit from the official markets and work informally in order to reduce their costs through avoiding paying taxes. As a result, the size of shadow economy will increase. Likewise, an increase in imports taxes provides protection for domestic production against imported goods which reduce the incentive to work in the shadow economy.

- An increase in government regulation in the economy is expected to induce people to work in the shadow economy.

1.4. Questions of the study

In this dissertation, we will investigate the following questions:

1. What is the size of the shadow economy in Jordan?

    We will use two methodologies to estimate the annual size of the shadow economy in Jordan as absolute values and percents of GDP during the period 1976-2008. The first methodology is the currency approach while the second one is the Multiple Indicators Multiple Causes (MIMIC) approach.

2. What is the relationship between the different types of taxes and the shadow economy in Jordan?

    We will examine the effect of income tax, general sales tax, and customs duties tax on the shadow economy in Jordan.

3. What are the main determinants of the shadow economy in Jordan?

We will check other possible causes of the shadow economy in Jordan, including the degree of regulation in the economy, the unemployment rate, the inflation rate, and depreciation of the Jordanian Dinar in 1988.

4. What is the annual size of tax evasion in Jordan during the period 1976-2008?

We will apply the annual effective tax rate to the estimated size of shadow economy to get an approximate size of annual amount of tax evasion that took place in Jordan during that period.

5. What are the consequences and the policy implications of the existence of the shadow economy in the Jordanian economy?

We will analyze the macroeconomic impacts of the existence of the shadow on various sides of Jordanian economy, particularly; the national accounts, fiscal policy, and monetary policy.

1.5. Study contributions

There would be several contributions from my dissertation which motivate study of the shadow economy and tax evasion in Jordan.

First, while studies that have estimated the shadow economy in various countries assumed that all types of taxes positively affect the size of the shadow economy, this study is the first one that differentiates the effect of taxes on imports (customs duties) on the shadow economy from the effect of other taxes (on income and sales). This study hypothesizes that taxes on imports will negatively affect the size of the shadow economy. As tax on imports decrease, protection of domestic production decreases which induce the domestic producer to exit from the official markets and to work in the shadow economy.

Second, as I mentioned above, there are no previous economic studies that have estimated the shadow economy and tax evasion for the Jordanian economy. Although Schneider (2005) and Schneider et al (2010) estimate the shadow economy in Jordan as a percent of GDP for a few years (within a study for 145 countries and 162 countries respectively), this study will be the first attempt to measure the annual size of the shadow economy and its consequent tax evasion in Jordan for the period 1976-2008, and to analyze the causes, consequences, and policy implications of this phenomena.

Third, some Jordanians prefer not to engage in the traditional banking transactions for religious reasons. The majority of the Jordanian people are Muslims, and some of them refuse to be involved in interest rate transactions of traditional banks because charging interest is strictly forbidden in Islam. Consequently, they prefer to keep money in the form of cash if there are no alternative Islamic banks. This study will be the first one that takes into consideration this religion factor as one of the determinants of demand for money in circulation which will be used in estimating the shadow economy through the "currency approach". It hypothesizes that the number of Islamic banks (per thousand of persons) negatively affects the per capita demand for money in circulation in Jordan. This institutional, context-specific feature, is missing in studies focusing on several countries at once.

1.6. Organization of the study

This dissertation is structured as follows: chapter two presents an overview about the Jordanian economy, concentrating on analyzing the economic growth and the structure of the tax system in Jordan during the period of the study. Chapter three reviews the economic literature on the shadow economy. Chapter four analyses the two methodologies that are used in estimating the shadow economy in Jordan (the currency demand approach and the MIMIC approach).

Chapter five explains the data used in the estimation process and their resources. Chapter six presents the estimation results of the annual size of the shadow economy in Jordan using the currency approach during the period 1976-2010. Chapter seven presents the estimation results of the annual size of the shadow economy in Jordan during the same period using the MIMIC approach. Chapter eight analyzes the consequences and the policy implications of the shadow economy in Jordan. Chapter nine presents the summary and the conclusion of this study.

2. CHAPTER TWO: THE JORDANIAN ECONOMY [1]

2.1. An overview

The Hashemite Kingdom of Jordan is a small country located in the Middle East. According to the Jordanian Department of Statistics, Jordan's geographical area is 89,213 sq. km and its population was 6.1 million as of 2010 with an urbanization rate of 82.6 percent and 37.3 percent of the population under 15 years old. The Jordanian population growth rate was 2.2 percent in 2010. Jordan is classified by the World Bank as a "lower middle income country". the per capita GDP was US $4,512 in 2010, and 12.5 percent of the economically active Jordanian population is unemployed. The percentage of Jordanians living below the poverty line was 13.3 percent in 2008. Education and literacy rates and measures of social indicators are relatively high compared to other countries in similar income levels. According to the Jordanian Ministry of Education, the literacy rate in Jordan was 93.2 percent in 2010, which is one of the highest among the Arab countries.

Jordan is rich in some natural resources; phosphate and potash are two of the most important. Jordan is classified as one of the largest producers and exporters of phosphate, potash and chemical fertilizers at the global level. In 2010, Jordan was the world's sixth largest phosphate rock producer, the second largest exporter, and the seventh largest potash producer.

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1 : The source of data used in this chapter is the websites of the Jordanian Department of Statistics, Central bank of Jordan, and the Jordanian Ministry of Finance.

The key challenges that Jordan faces are the scarcity of energy and water. Unlike most of its neighbor countries, Jordan is a non-oil country; around 97 percent of its energy needs are imported. Furthermore, Jordan has one of the lowest levels of water resources in the world.

During the last two decades Jordan has moved from large government intervention in the economy toward an open and free market system where the ownership of enterprises is largely private and the market forces determine prices, interest rates, and wages. However, the exchange rate of the Jordanian dinar has been pegged with the US dollar since 1994 (JOD 1 = US $1.4).

The Jordanian economy depends largely on services sectors. Those sectors account for 68 percent of GDP and 75 percent of jobs, on average, during the last ten years. Despite that the Jordanian economy is dominated by the services sectors, service exports account for only 20 percent of total exports.

Jordan is highly interrelated with other neighbor countries in the region. Arab Gulf states are considered the main job market for Jordanian labor. The number of Jordanians working abroad has been increasing over time due to a huge demand for skilled and highly qualified workers in the Arab Gulf states. There are no accurate statistics about the Jordanians working abroad, but the Jordanian Department of Statistics estimated the number to be 0.7 million in 2008. The bulk of these workers are skilled laborers that work mostly in Saudi Arabia, followed by the United Arab Emirates, Kuwait, Qatar, Oman and other Arab Gulf countries. Consequently, remittances from Jordanians working abroad constitute a main source of the national income. The annual average of remittances from Jordanians working abroad during the last ten years constituted about 17 percent of the gross national income (GNP). In addition, Arabic countries are considered the primary trade partners of Jordan. Jordanian exports to the Arabic countries

constituted on average 45 percent of total exports during the last ten years, while the Jordanian imports from those countries constituted on average 31 percent of total imports during the same period. Historically, Jordan has largely benefited from foreign grants, especially from Iraq and some of the Arab Gulf countries (Saudi Arabia, Kuwait, and United Arab Emirates). The golden period of foreign grants received by Jordan was during the oil boom of the mid 1970s and early 1980s. Due to the fall in world oil prices in the second half of the 1980s, Arab grants and Jordanian workers' remittances have witnessed notable reduction, which led to slow down in real economic growth. During the war between Iraq and Iran in the 1980s, however, Iraq became Jordan's main trade partner. Jordan's exports to Iraq accounted for more than 20 percent of total Jordanian exports during that period. Furthermore, Iraq supplied Jordan with cheap oil, oil and financial grants, and low-interest loans. Iraq remained the major supplier of discounted oil and financial grants to Jordan and continued to be the largest market for Jordanian products until the second Gulf war in 2003.

2.2. Economic growth in Jordan

The Jordanian economy displayed fluctuating trends during the period 1976-2010, affected by local, regional, and global economic and political situations. This period can be divided into four sub-periods according to the economic features and growth for each one.

<u>1976-1982</u>

This first sub-period is characterized by the oil boom when oil prices recorded sharp increases, causing huge capital inflows to the Arabic oil countries. The oil boom had positive direct and indirect effects on the Jordanian economy during this sub-period. The most important effect was the significant increase in the foreign grants to Jordan from Arabic oil countries. The

annual average of foreign grants during that period accounted for 44 percent of the total public budget revenue, or 15 percent of GDP, and reached a high of 53 percent of total public budget revenue, or 21.5 percent of GDP, in 1979. The other positive effects of the oil boom were the increases in demand from Arabic countries for the Jordanian labor force and Jordanian products, which boosted the foreign capital inflow and remittances to the Jordanian economy.

As a result of those developments, the economy achieved high growth rates. The growth of real GDP during this sub-period reached an annual average of roughly 12 percent. Consequently, the unemployment rate was very low during this sub-period; it averaged about 3 percent. On the price side, the oil boom during the sub-period 1976-1982 caused sharp increases in the consumer price index. The annual average inflation rate during that sub-period was 11 percent.

1983-1991

During the second sub-period, foreign grants to Jordan declined significantly in comparison to the 1976-1982 sub period due to the fall down in world oil prices. The annual average of foreign grants during this sub-period decreased to 24 percent of total public budget revenue, or 7.5 percent of GDP, and reached a high of 19 percent of total public budget revenue, or 6 percent of GDP, in 1987. Therefore, the public government budget deficit increased and the consequent foreign debt began to accumulate. As a result, Jordan faced a sharp economic crisis in 1988. The public budget deficit, as a percent of GDP, reached about 22 percent, and the foreign debt exceeded 188 percent of GDP, which forced the government to stop repayments of foreign debt. Consequently, the Jordanian dinar depreciated by about 50 percent. Due to those problems in the Jordanian economy, the Jordanian Government began debt rescheduling

negotiations with the IMF and the Paris Club countries in 1989, and agreed to implement the first IMF economic adjustment program for the years 1989-1992. The program was designed to gradually overcome the major imbalances and to regain macroeconomic stability as a precondition for sustainable economic growth.

The Iraq-Kuwait crisis that began in August 1990, however, forced Jordan to stop the IMF program and to stop most foreign debt payments as well as suspend rescheduling negotiations. The significant decrease in foreign grants from Arab Gulf countries and the Jordanian worker remittances, as well as flooding of hundreds thousands of Jordanians and refugees from Kuwait and Iraq to Jordan, caused significant balance of payment problems. This led to a fall down in GDP growth and straining government resources.

All those negative developments were reflected in the performance of the Jordanian economy. The average annual growth of real GDP during the sub-period 1983-1991 approached zero percent, compared with about 12 percent during the sub-period 1976-1982. The unemployment rate witnessed a sharp increase; it jumped to an average of 10 percent, compared to 3 percent during the previous sub-period. As for the price level, the consumer price index witnessed dramatic fluctuations during this sub-period. At the beginning of the sub-period, the inflation rate began to fall down; it reached zero in 1986 and -0.2 in 1987. However, due to the sharp depreciation in the Jordanian dinar in 1988, the inflation rate jumped dramatically to more than 25 percent in 1989. The annual average inflation rate during the sub-period 1983-1991 was 7.5 percent compared to 10 percent during the previous sub-period.

1992-2004

The third sub-period is characterized mainly by implementing multiple IMF economic adjustment programs in order to increase the efficiency and independence of the Jordanian economy by implementing significant structural economic reforms. On the fiscal side, the programs particularly aimed at reducing the budget deficit and achieving a self-sustaining budget. This would be accomplished by increasing the efficiency of the tax system and raising the ratio of domestic revenues to total public expenditures as a measure to decrease the dependence of the public budget on foreign grants. On the external economy side, the programs aimed at reducing the external imbalances through reducing the deficit of the balance of payments. During those adjustment programs, Jordan continued to secure rescheduling and write-offs of its heavy foreign debt. Under the adjustment programs, the Jordanian government has adopted many structural procedures aimed at reforming the tax system, developing the performance of the public sector, implementing a program to privatize the public corporations, and liberalizing external trade. As a result of the adjustment reforms, Jordan joined the World Trade Organization (WTO) in 2000, signed an Association Agreement with the European Union (EU) in 2001, and signed the bilateral Free Trade Agreement (FTA) with the U.S. in 2001.

The structural reforms that were implemented under the economic adjustment programs contributed to enhancing economic growth in Jordan. The average annual growth of real GDP during this sub-period increased to 5.4 percent, compared with zero percent during the sub-period 1983-1991. However, after flooding of hundreds thousands of Jordanians from Kuwait after the Iraqi-Kuwaiti crisis in 1990, the Jordanian economy witnessed high unemployment. The annual average unemployment rate during the sub-period 1992-2004 was around 15 percent compared to 10 percent during the previous sub-period. The economic adjustment programs

period was characterized by implementing tough fiscal and monetary policies by the Jordanian government, which in turn contained the general price level. Consequently, the annual average inflation rate during this sub-period was only 2.7 percent compared to 7.5 percent during the previous sub-period.

2005-2010

The fourth sub-period can also be called the post economic adjustment program sub-period. It is characterized by the large, challenging external environment that faced the Jordanian economy (rapidly rising world oil and food prices, political and economic instability in Iraq, and volatile foreign grants). Despite this environment, the Jordanian economy performed remarkably well during this sub-period, mainly due to high inflow of foreign direct investment (FDI). The annual average growth of real GDP during this sub-period increased to 6.3 percent. The unemployment rate continued to fall further to reach 12.5 percent at the end of the sub-period. The annual average rate of unemployment during this sub-period was 13.3 percent. As for the price level, inflation started to pick up again during this sub-period after a significant slowdown in the previous period; it jumped to about 14 percent in 2008, mainly due to the large increase in world oil and food prices and to the high inflow of FDI. In 2009, however, the lower world commodity prices and weak domestic demand had reduced the CPI sharply, causing the inflation rate to be negative by 1 percent. The annual average inflation rate during the sub-period 2005-2010 was 5.5 percent. This is approximately 3 percentage points higher than its annual average during the previous sub-period.
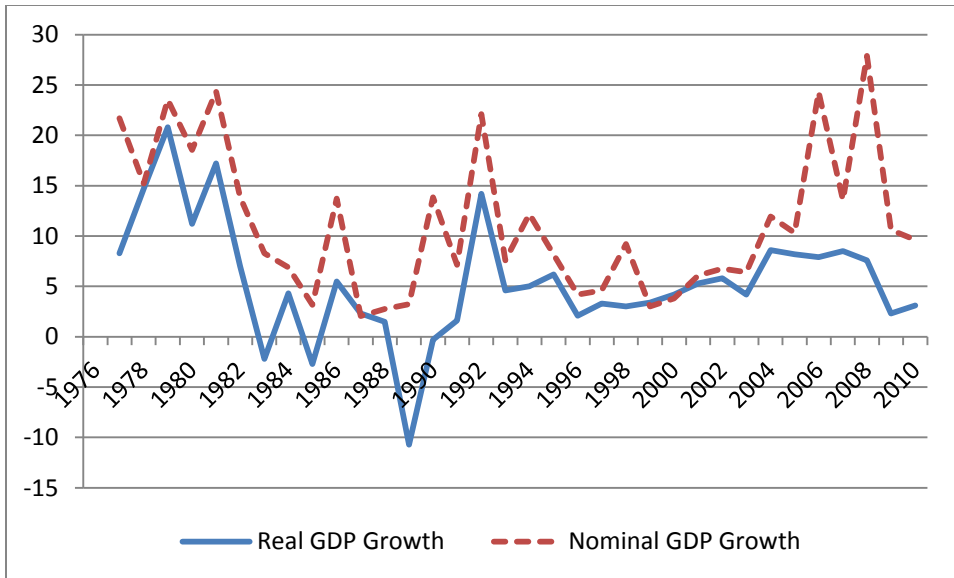
Figure 2. 1: Trends of GDP growth rates in Jordan.
Source: Central Bank of Jordan and the Jordanian Department of Statistics
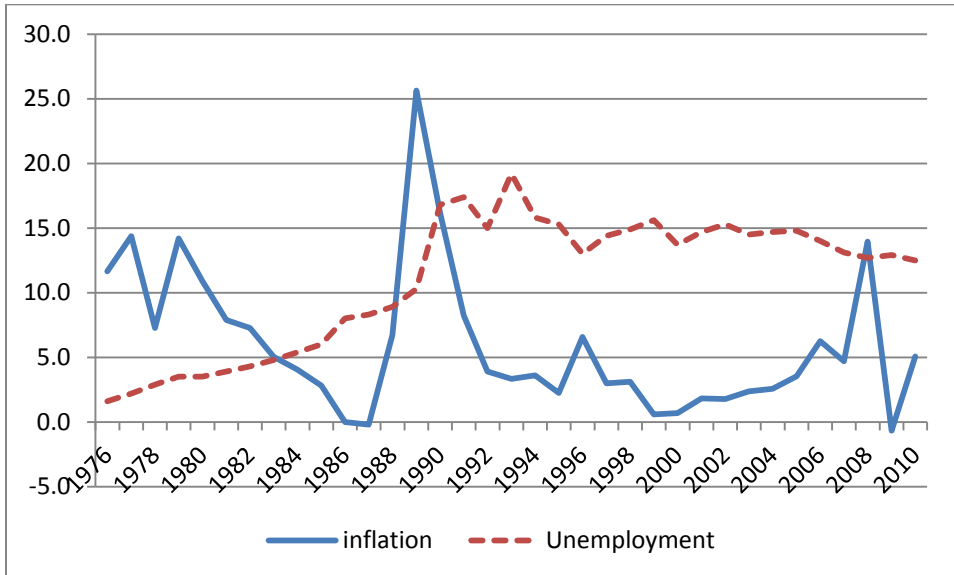
Figure 2. 2: Trends of inflation and unemployment rates in Jordan.
Source: Central Bank of Jordan and the Jordanian Department of Statistics

Table 2. 1: Some indicators of the Jordanian economy

	Growth rate of Real GDP	Growth rate of Nominal GDP	Inflation rate	Unemployment rate
1976	-	-	11.6	1.6
1977	8.3	21.7	14.4	2.2
1978	14.7	15.2	7.3	2.9
1979	20.8	23.5	14.2	3.5
1980	11.2	18.6	10.9	3.5
1981	17.2	24.4	7.9	3.9
1982	7.0	13.9	7.3	4.3
1983	-2.2	8.3	5.0	4.8
1984	4.3	6.9	4.0	5.4
1985	-2.7	3.2	2.8	6.0
1986	5.5	13.7	0.0	8.0
1987	2.3	2.1	-0.2	8.3
1988	1.5	2.7	6.7	8.9
1989	-10.7	3.2	25.6	10.3
1990	-0.3	13.8	16.2	16.8
1991	1.6	7.1	8.2	17.4
1992	14.2	22.1	3.9	15.0
1993	4.6	7.6	3.3	19.2
1994	5.0	12.2	3.6	15.8
1995	6.2	8.2	2.2	15.3
1996	2.1	4.2	6.6	13.0
1997	3.3	4.6	3.0	14.4
1998	3.0	9.2	3.1	14.9
1999	3.4	3.0	0.6	15.6
2000	4.2	3.8	0.7	13.7
2001	5.3	6.1	1.8	14.7
2002	5.8	6.8	1.8	15.3
2003	4.2	6.4	2.4	14.5
2004	8.6	11.9	2.6	14.7
2005	8.1	10.3	3.5	14.8
2006	7.9	24.3	6.3	14.0
2007	8.5	13.6	4.7	13.1
2008	7.6	27.9	13.9	12.7
2009	2.3	10.6	-0.7	12.9
2010	3.1	9.6	5.1	12.5

Source: Central Bank of Jordan and the Jordanian Department of Statistics

2.3. Structure of the tax system in Jordan

As in most non-oil counties, taxes are considered the main source of government revenue in Jordan. The role of taxes in Jordan has increased following the year of the sharp economic crisis in 1988. Since the adoption of the first IMF economic adjustment program in 1989, the Jordanian government has made significant efforts aimed at reforming the efficiency of the tax system, increasing buoyancy in tax revenue, and reducing its dependence on non-tax revenue.

2.3.1. The tax system before 1989

Before 1989, the tax system in Jordan suffered from a high level of inefficiency and over-complexity. The tax base was narrow with many tax tranches and low tax collection. Government revenues were dependent on inelastic and volatile sources such as foreign grants and non-tax revenues from public corporations' profits and government fees and licenses. During the 1980s, the weakness of tax efficiency and the consequent shortfall in tax collection, in addition to the fall in the foreign grants and the increase in public expenditures, contributed to raising the government budget deficit to unprecedented levels. The deficit reached approximately 22 percent of GDP in 1988.

One indicator of the inefficiency of tax collection in Jordan before 1989 was the low ratio of tax revenue to the GDP, as shown in Table (2-2). The table shows that the average ratio of tax revenue to GDP during the sub-period 1976-1988 was 11.8 percent, while the highest ratio was 13.9 percent in 1977. During the last three years of that sub-period (1986, 1987, 1988), the efficiency of tax collection was at its lowest level. The ratio of tax revenue to GDP was less than 11 percent during those years.

The tax structure in Jordan before 1989 prompted the tax revenue to be dependent mainly on three tax categories: income and profit tax, domestic production fees (consumption tax), and custom duties. The average contribution of those three sources of taxes during the sub-period 1976-1988 was approximately 88 percent of total tax revenues. The vast majority of those revenues came from custom duties, which accounted for approximately 54 percent on average of total tax revenues. The average contributions of income tax and consumption tax (domestic production fees) during that period were 19 percent and 15 percent of total tax revenues respectively.

Tax over-complexity was another indicator of tax inefficiency in Jordan during the 1980s. The complexity was represented by the multiple numbers of tranches and tax rates. On the income and profit tax side, Income Tax Law No. 57 was applied. This law included 12 tranches for individuals with rates ranging from 5 to 55 percent, and 5 tranches for corporations with rates ranging from 35 to 55 percent. On the custom duty side, there were 32 tranches with various rates ranging from zero to 340 percent (cigarettes and alcohol drinks were subject to the highest tariff rates). On the other hand, the domestic production fees (tax) were levied on a limited number of commodities, while all services were exempted (CBJ annual reports, various years).

2.3.2. The tax system after 1989

The sharp economic crisis in 1988 forced the Jordanian government to adopt various measures to face and absorb the negative consequences of the crisis. The urgent objective of the government was to reduce the budget deficit, which reached around 22 percent of GDP in 1988. To achieve economic stability, Jordan adopted structural economic adjustment programs through cooperation with the IMF and the World Bank. Fiscal stability was one of the main objectives of those programs. The programs aimed at enhancing tax revenues as well as rationalizing public

expenditures. Reforming the tax system and broadening the tax base have been the key priorities in the pursuit to achieve fiscal stability. Specifically, the approach was to increase both the efficiency and the simplicity of the different types of taxes in Jordan. The final goal for reforming the tax system in Jordan (as mentioned above) was to increase buoyancy in tax revenue and reduce its dependence on inelastic and volatile revenue sources, such as non-tax revenues. To achieve those objectives, the government adopted some urgent fiscal measure. The following are the main ones (CBJ annual reports, various years):

-   Replacing the domestic production fees with a consumption tax in 1989 and gradually broadening the base of this tax in the later few years to include 106 commodities in 1993.

-   Imposing a new additional tax of 10 percent on some services (mainly hotels and restaurants) and 5 percent on flight tickets in 1992. Furthermore, broadening the base of the additional taxes originally imposed on other services.

All of the above procedures were insufficient to reach the required increase in the efficiency of the tax system or to improve tax revenues to the desired level. Therefore, the government decided, following the recommendation of the IMF economic adjustment program, to replace the consumption tax with a general sales tax (GST) in mid-1994. Under the new GST, most domestic and imported commodities and a limited number of services were subject to a 7 percent sales tax, while some luxury commodities were subject to a 20 percent tax. According to the new GST law, most necessary commodities and most services were exempted from the sales tax. In 1995, the government decided to raise the GST rate from 7 percent to 10 percent and to broaden the GST base by increasing the number of services subject to this tax. Further raises in the GST rate and in its base were undertaken in the years thereafter. In 1999, the GST rate was

increased from 10 percent to 13 percent, and the number of goods and services exempted from the GST was reduced. At the beginning of 2001, the government implemented the second stage General Sales Tax law, which effectively converted the GST into a VAT. In 2002, the government decided to extend the GST at a rate of 2 percent to all previously exempted or zero-rated products and to petroleum products. The last increase in the GST rate was implemented in April 2004, when the government decided to raise it from 13 percent to 16 percent.

As for income tax, the government implemented consecutive amendments on the income and profits tax law in the year 1985. The amendments included reducing the number of tax tranches for individuals and corporations. In 1991, individual tranches were reduced from 12 tranches, with rates ranging from 5 to 55 percent, to 10 tranches, with rates ranging from 5 to 45 percent. Corporate tranches were reduced from 5 tranches, with rates ranging from 35 to 55 percent, to 4 tranches, with rates ranging from 38 to 55 percent. Aiming at rationalizing the income tax system by harmonizing and simplifying tax rates and broadening the tax base, significant amendments to the income and corporate tax laws were implemented in 1996; the individual tranches were reduced to 6 tranches, with a maximum rate of 30 percent, and the corporate taxes were reduced to 3 rates (15%, 25%, 35%) according to the economic sector of the corporation. In 2001, further amendments to the income tax law were undertaken; the individual tranches were reduced again to 4 tranches, with a maximum rate of 30 percent.

Regarding reforming tax administration in Jordan, the ministry of finance integrated the Income Tax and Sales Tax Departments into a unified, function-based revenue department in early 2000, with procedures based on the principles of self assessment and taxpayer segmentation. Furthermore, the ministry of finance adopted a financial management plan for the period 2004-2006 to improve fiscal management and tax administration.

As for custom duties, the government has implemented many reforms in this regard since 1989. As part of the trade liberalization program, significant reductions on custom duties have been implemented, especially on raw inputs and intermediate goods. The most important procedure was in 1997, which included reducing the custom duties on all imported commodities to a maximum rate of 40 percent, as well as reducing the custom duties tranches to only 6 tranches. Furthermore, in 1999 the maximum custom duty on imported goods was reduced from 40 percent to 35 percent, and on intermediate goods to 10 percent. In 2002, the government decided to reduce the tariff rate on industrial inputs to only 3 percent, from previous rates ranging from 5 to 10 percent.

As a result of all those tax reform measures, the effective tax rate (the percent of tax revenues to GDP) witnessed an upward trend during the adjustment programs period. It increased from 10.8 percent in 1988 to 19.8 percent 2005. However, during post-program years, the effective tax rate decreased to 15.3 percent. That decrease was due to the growth of GDP by higher rates than the growth of tax revenues. Consequently, the contribution of tax revenues to domestic government revenues increased from 46.8 percent in 1988 to 68.9 percent in 2005, and to 70.1 percent in 2010.

The aforementioned tax measures caused significant changes to the relative importance of the main taxes in the Jordanian tax system. The key change was in the GST, which witnessed a continuous increase in its contribution to the total tax revenues overtime. GST proceeded to more than double from 24 percent of total tax revenues in 1988 (when it was domestic production fees) to 58 percent in 2005, and then to 66.6 percent in 2010. In contrast, the importance of import tariff proceeds (custom duties) to total tax revenues shrunk from 46.1 percent in 1988 to 17.3 percent in 2005, and further to only 9.2 percent in 2010. The importance

of income tax proceeds fluctuated; it decreased from 17 percent in 1988 to 16.1 percent in 2005, and then increased to 20.9 percent in 2010. All those changes reflected the objective of the economic adjustment programs that were implemented by the Jordanian governments, which aimed at enhancing external trade liberalization through reducing custom tariff, as well as adopting tax on expenditure instead of tax on imports as a main source of tax revenues. Figure (2-4) shows trends of the relative importance of GST, income tax, and custom tariffs during the period 1976-2010.
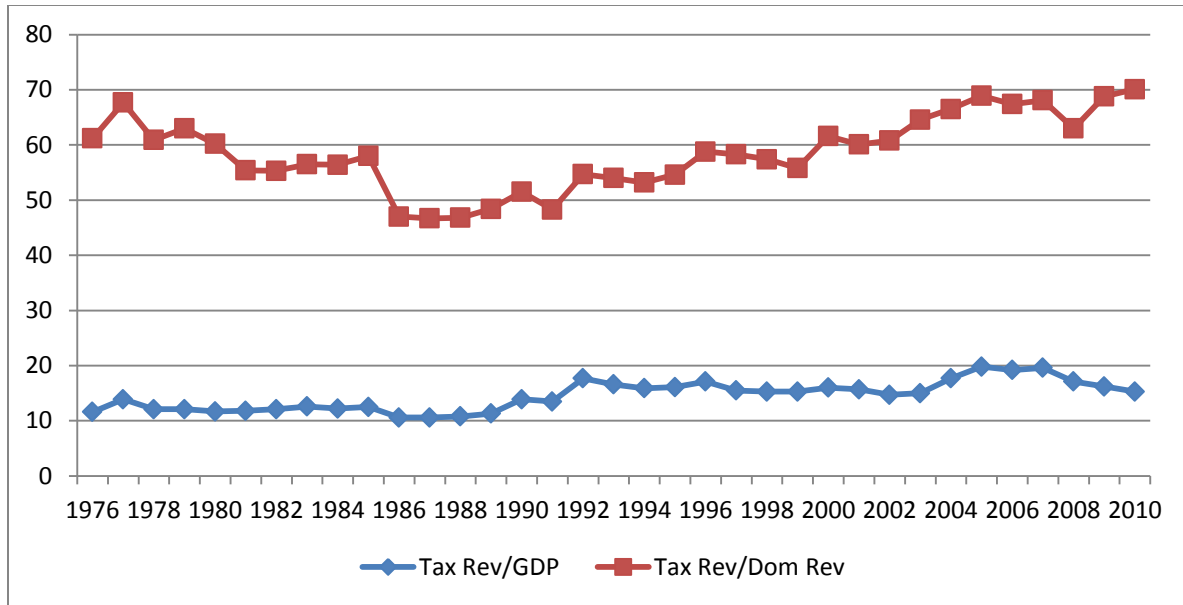
Figure 2. 3: Tax revenue indicators in Jordan (%).
Source: Central Bank of Jordan and researcher calculations.
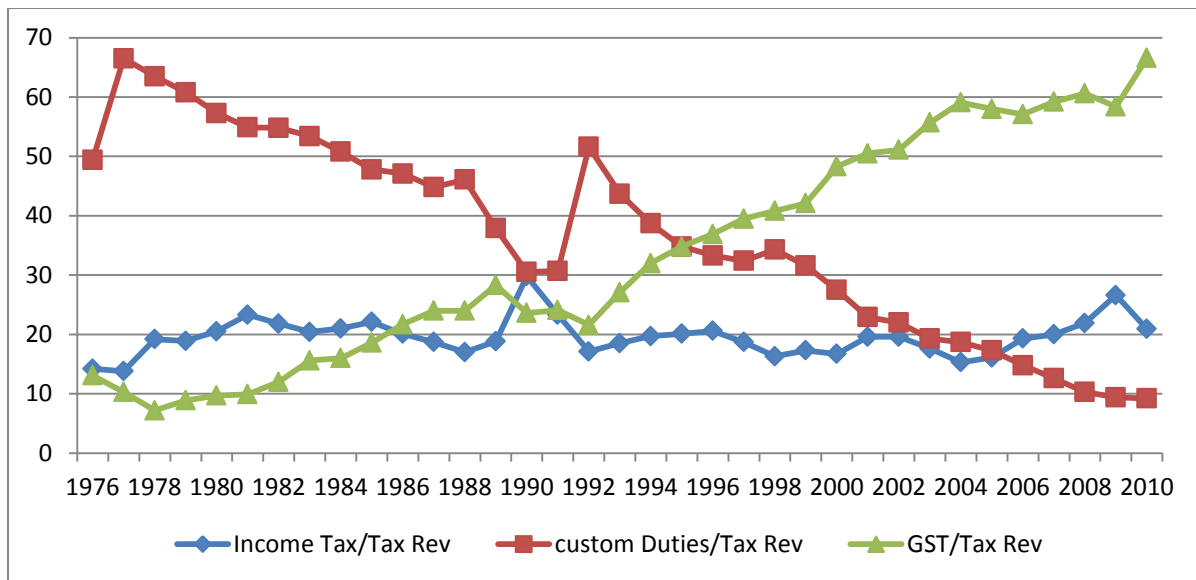
Figure 2. 4: Trends of the relative importance of GST, income tax, and custom duties.
Source: Central Bank of Jordan and researcher calculations.

Table 2. 2: Percentages of income tax, custom duties, and GST in total tax revenues

	Tax Rev/GDP	Tax Rev/Dom Rev	Income Tax/Tax Rev	custom Duties/Tax Rev	GST/Tax Rev
1976	11.6	61.2	14.2	49.4	13.1
1977	13.9	67.7	13.8	66.5	10.3
1978	12.1	60.9	19.2	63.5	7.2
1979	12.1	63.0	18.9	60.8	8.9
1980	11.7	60.2	20.5	57.3	9.7
1981	11.8	55.4	23.3	54.9	9.9
1982	12.1	55.3	21.8	54.8	12
1983	12.6	56.5	20.4	53.4	15.6
1984	12.2	56.4	21.0	50.8	16
1985	12.5	58.0	22.1	47.8	18.6
1986	10.6	47.0	20.1	47.1	21.7
1987	10.6	46.7	18.7	44.8	24
1988	10.8	46.8	17.0	46.1	24
1989	11.3	48.4	18.8	37.9	28.3
1990	13.9	51.5	29.8	30.5	23.6
1991	13.5	48.3	23.3	30.7	24.1
1992	17.7	54.7	17.1	51.6	21.6
1993	16.6	54.0	18.5	43.7	27.1
1994	15.9	53.2	19.7	38.7	32
1995	16.1	54.6	20.1	34.8	34.8
1996	17.1	58.8	20.6	33.3	36.9
1997	15.5	58.3	18.7	32.4	39.5
1998	15.3	57.4	16.3	34.3	40.8
1999	15.3	55.8	17.3	31.6	42.1
2000	16.0	61.6	16.7	27.5	48.3
2001	15.7	60.1	19.6	22.9	50.5
2002	14.7	60.8	19.6	22.0	51.1
2003	15.0	64.6	17.6	19.3	55.7
2004	17.7	66.5	15.3	18.7	59.1
2005	19.8	68.9	16.1	17.3	58
2006	19.2	67.4	19.3	14.8	57.1
2007	19.6	68.1	20.0	12.6	59.2
2008	17.1	63.0	21.9	10.3	60.6
2009	16.2	68.8	26.6	9.4	58.4
2010	15.3	70.1	20.9	9.2	66.6

Source: Central Bank of Jordan and researcher calculations.

2.4. Human Development Index (HDI)

According to the United Nation's Human Development Index (HDI) report (2010), Jordan is classified in the category of the "high human development" countries in the world. In 2010, Jordan was ranked 82nd out of 169 countries, compared with a rank of 96th in 2009. Jordan's HDI value for 2010 was 0.681, which is above the Arab countries' average of 0.588 and the world's average of 624, while it is below the average of "very high development" category of 0.878. Compared with the Arab countries, Jordan ranked eighth after the Arab oil-countries. The report shows that the average life expectancy in Jordan is 73.1, while expected years of schooling stand at 13.1. As for the Gender Inequality Index (GII) in Jordan, the report indicated that that 58 percent of adult women have a secondary or higher level of education, in 2008, compared with 74 percent of their male counterparts.

Table 2. 3: Human Development Index indicators

	1980	1990	1995	2000	2005	2009	2010
Jordan	**0.509**	**0.564**	**0.595**	**0.621**	**0.652**	**0.677**	**0.681**
Arab Countries	0.396	0.470	0.505	0.525	0.562	0.583	0.588
Very high human development	0.753	0.797	0.827	0.851	0.867	0.875	0.878
World	0.445	0.526	0.554	0.570	0.598	0.619	0.624

Source: United Nation's Human Development Index (HDI) report (2010).
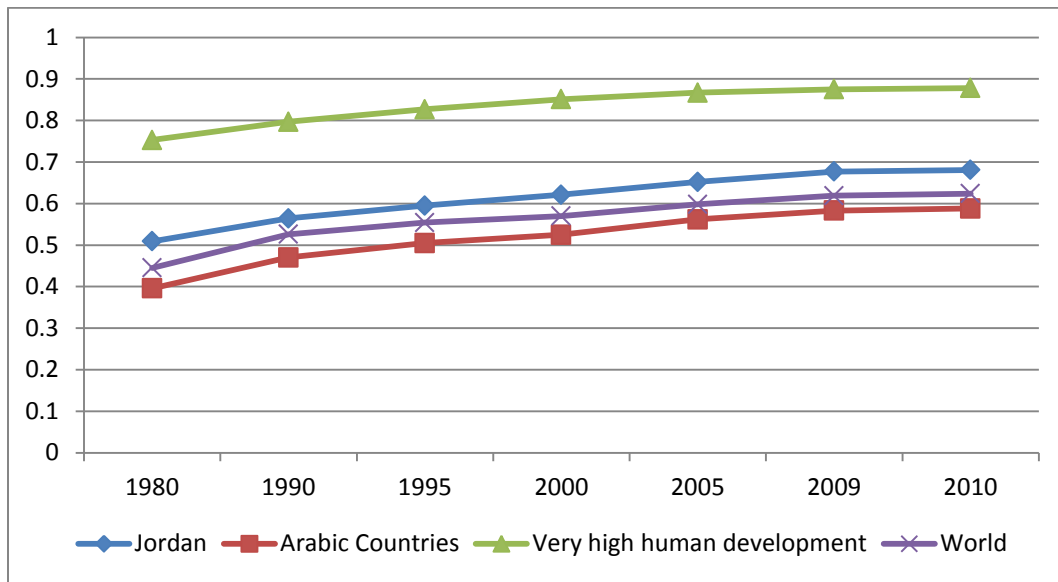
Figure 2. 5: Human Development Index trends.
Source: United Nation's Human Development Index (HDI) report (2010).

3. CHAPTER THREE: LITERATURE REVIEW

Much theoretical and empirical research has been carried out related to the shadow economy, reflecting the importance of this phenomenon in the functioning of the economies. Since estimating the size of shadow economic activities is very difficult using direct methods due to the secret nature of such activities, researchers have concentrated on developing indirect methodologies to obtain. In this chapter, we will review the most important literature that concentrates on estimating the shadow economy and analyzing its determinants, consequences, and implications.

Lippert and Walker (1997) collect and edit 18 studies [2] of the shadow economy and its evidences and implications in various countries, mainly on Canada. The studies show that there is a wide range in the estimates of the size of shadow economy in various countries due to the differences in the definitions that are used to calculate the shadow economy. The majority of studies argue that high taxes and unfairness in the distribution of the tax burden as well as regulations are the main causes of the shadow economy. Those studies conclude that increasing the strictness of tax enforcement or increasing the effective tax to higher rates induces economic agents to evade paying tax which leads to an increase in the size of the shadow economy.

Schneide and Enste (2000) estimate the size of the shadow economy in 76 developing, transition, and OECD countries. They use various methods and different time periods for single

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(2) The studies were presented in the Fraser Institute's conference in Vancouver/Canada in April 1994.

countries, and sometimes for a group of countries. They find that high taxes and social security contributions combined with rising state regulations (measured in the numbers of laws and regulations) are the main causes for the increase of the shadow economy, especially in OECD countries. Their estimates show that for most of their 76 countries the shadow economy has been growing overtime and reached a remarkably large size.

Sevgin (2009) tests the effect of high tax rates, regulatory burden, corruption, weak legal environment, and income inequality on the size of the shadow economy. He uses ordinary least squares regression to test his hypothesis when the dependent variable is the ratio of the shadow economy to GDP, while the independent variables include the above mentioned variables. The data for the dependent variable came from the work of Schneider (2004), which has estimates for 145 countries, while the data on independent variables are collected by the author. His study covers 133 countries, for different years, mostly ranging from 2003 to 2005. He finds that there is a negative relationship between rule of law and the shadow economy. Furthermore, he finds that corruption, regulatory burden, and income inequality have a positive association with the underground economy. In contrast to the majority of studies, his results do not support the argument that high tax rates induce people to stay in the shadow economy to avoid those taxes. He finds a moderate negative correlation between the tax burden and the shadow economy which is the opposite of what he expected. He argues that this may be due to better institutions and enforcement of taxation in countries which also have high tax rates.

3.1. Literature on the currency approach

In the currency approach, demand for money in circulation is used as an indicator of the shadow economy. According to that approach, taxes are considered the key cause of the shadow economy. It assumes that people who are involved in the shadow economy use cash in their

transactions in order to evade paying taxes on their shadow economic activities. An equation for the demand for money in circulation is estimated where taxes are included. Then, the estimated equation is used to determine the excess demand for currency resulting from the tax rates. The shadow economy is calculated by multiplying the excess currency by the velocity of money in circulation.

Guttman (1977) is considered first economist who estimates the size of the shadow economy (or the "subterranean economy" as he called it) using the currency in circulation method. He notices that currency in circulation has been growing more rapidly than demand deposits in the United States in 1976, and argues that "currency is the only form of cash suitable for transactions that go unrecorded and untaxed; the disparity is a reflection of growth in the subterranean, extra-legal economy". He calculates the ratio of the currency in circulation to demand deposits in the period 1937-1940 as a benchmark period, where, according to his assumption, there are no subterranean transactions, and assumes that the amount of currency required for legal transactions in 1976 is the same percentage of demand deposits as in 1937-41. The excess ratio in 1976 is the amount of currency required for subterranean transactions. By taking the ratio of the money in circulation to the size of GNP, he estimated the size of the shadow (subterranean) economy in that year.

Tanzi (1983) is considered one of the pioneers in developing the "monetary approach" in estimating the size of the shadow economy and income tax evasion. He assumes that high income tax rates are the main cause of the shadow economic transactions. Tanzi's method is based on estimating an econometric model for the demand for money in circulation in the economy which is used to estimate the effect of income tax rates on that demand, and then, under specific assumptions, the level of the shadow economy, and income tax evasion in the US during

1930-1980. He assumes that the ratio of the currency in circulation to money supply (C/M2) is a function of income tax rate in addition to other explanatory variables as in the following model:

$$\ln(C/M2)_t = \beta_o + \beta_1\ln(1+TW)_t + \beta_2 \ln(W_s/Y)_t + \beta_3\ln(R_t) + \beta_4\ln(Y/N)_t + \mu_t$$

Where, C/M2 is the ratio of currency in circulation to broad money supply, TW is the weighted average income tax rate, WS/Y is the proportion of wages and salaries in national income, R is the interest paid on saving deposits, and Y/N is the per capita income.

Bajada (1999) modifies Tanzi's model by using the error correction model (ECM) and including a welfare benefits variable, along with the other variables, in the estimated demand for money in circulation in Australia using quarterly data for the period 1967-1996. This period is divided into five business cycles. He aimed at estimating the "excess sensitivity" of this variable and the tax rate variable on the shadow economy during the business cycles. He finds that the increase in average tax rates and the rise in welfare benefits in Australia induced Australian people to be involved in the shadow economic activities to supplement their disposable income. His results show that the shadow economy in Australia increases from 13.9 percent of GDP in the first business cycle (late 1960s) to approximately 15 percent of GDP by mid-1996 in the fifth business cycle (1994-1996), and reaches a peak of about 15.7 percent by 1974 in the second business cycle (1974-1980). He concluded that "a significant and volatile shadow economy was shown to have adverse implications on the nature of the business cycle in Australia, namely that the existence of a non-negligible shadow economy generated more volatile business cycles" (p.380).

Simanjuntak (2008) discussing Bajada's work, analyzes some weakness of using the ECM method in estimating the shadow economy. He argues that applying Bajada's excess sensitivity method using the single-step error correction model (ECM) is unreliable and leads to very weak results because there is no cointegration as the prerequisite to the ECM mode. Simanjuntak presents an alternative approach by using the vector error correction model (VECM). His preliminary results suggest that the size of underground economy in Australia is much lower than Bajada's results suggest. However, Simanjuntak argues that reliable inference cannot be made as the coefficients from VECM estimation are plugged into the excess sensitivity formula. He concludes that there is a need to make significant revisions in the excess sensitivity method and to develop a new reliable method in order to find credible estimates of the shadow economy.

Ahumada et. al. (2008) builds a formal aggregation framework to show that the currency approach is accurate only when the income elasticity of the demand for money is one. He presents some estimates from other papers to apply his correction and to show that "the assumption of equal velocities together with income elasticity estimates lower (higher) than one result in figures biased upwards (downwards) for the shadow economy". Ahumada et al (2008) reviews the monetary method within the aggregation framework shown in Ahumada et al. (2007) to show that if a short run money demand model is used to estimate the shadow economy and if that model includes a lagged dependent variable then there will be a need for a known initial period of time in which there is no shadow economy and there is zero demand for informal currency. They conclude that "the only way to avoid ad hoc assumptions about previous values of registered currency is to restrict the measures of the shadow economy size to those based on the long-run estimates of the money demand".

Arby et. al. (2010) establish a long run cointegrating relationship between the currency ratio and other related variables via a autoregressive distributed lag (ARDL) model, instead of the simple OLS, and then use it to estimate the size of the shadow economy in Pakistan. They include the education index as one of the factors that negatively affects the shadow economy. Their results show that the shadow economy in Pakistan increased until end of the 1990s during the period of the most fragile and weak political regimes, and then shows a declining trend since the beginning of the 2000s. It was below 30 percent during the 1960s and 1970s, increased to 33 percent in the 1990s and then declined to 23 percent in the decade of the 2000s.

Kanao and Hamori (2010) use the dynamic ordinary least squares method (DOLS) by adding lead and lag differences for each explanatory variable to estimate the shadow economy in Japan for the period 1971-2007. They take into consideration the impact of laws on the shadow economy by including two dummy variables in the model related to two economic laws. They find that the size of the shadow economy in Japan peaked in the early 1990s, reached a maximum size (25% of the nominal GDP) in 1993 and has been declining since that. Furthermore, they find that the two laws have negative contributions to the size of the shadow economy.

Cebula and Feige (2011) employ a modified version of Fegie's (1989) general currency ratio model to obtain a time series estimate of the ratio of unreported (shadow) income to reported income. Then, they calculate the income tax evasion in the U.S. from 1940-2008 and investigate the extent of non compliance with the tax code and the determinants of federal income tax evasion in the U.S. In their empirical study, they drop the common assumption that in some particular year the income tax evasion is zero. As for the currency ratio variable in their model, they take account of Feige's (2009) new estimates of overseas dollar holdings and

derived estimates of the temporal pattern of domestic U.S. currency holdings. Furthermore, they take into consideration holdings over time independent of changes in noncompliance behavior. Their estimates suggest that between 18-19 percent ($2 trillion) of total reportable income is not properly reported to the IRS. The estimated unreported income caused an approximate annual tax gap of $450-500 billion. They conclude that federal income tax evasion in the U.S. is an increasing function of the average effective federal income tax rate, the percentage unemployment rate of the civilian labor force, per capita real GDP, and the public's dissatisfaction with government. They also find that the 'Tax Reform Act of 1986 acted to briefly discourage/diminish aggregate personal income tax evasion, whereas the IRS audits rate may have modestly acted to discourage that tax evasion".

3.2. Literature on the MIMIC approach

The MIMIC model is considered as a special case of the structural equation model (SEM). It uses some observed variables to estimate the value of an unobserved (latent) variable. In this study, the latent variable is an index of the ratio of the shadow economy to the official estimate of GDP. The observed variables in the MIMIC model are divided into two groups; causes and indicators for the latent variable (the shadow economy).

In regard to the estimation techniques, Joreskog and Goldberger (1975) present a significant contribution to the development of the MIMIC model by coming up with a maximum likelihood procedure for estimating a model with one single latent variable. Their model consists of a mixture of econometric and psychometric themes. As for the economic application, Frey and Weck-Hannemann (1984) are considered the pioneers in applying the MIMIC model to estimate the shadow economy based on the works of Zellner (1970) and Goldberger (1972). They use this model to estimate the relative size and development time of the shadow economy of OECD

countries. They find that regulations, tax burdens, and tax morality were the main determinants of the shadow economy in those countries.

Giles (1999) developed the MIMIC model by taking into consideration the unit root test and the cointegration analysis of the data in generating an historical time series index of the shadow economy and the tax gap in New Zealand, for the period 1968 to 1994. The causal variables in this study include measures of the average and marginal tax rates, inflation, real income and the degree of regulation in the economy. Indicators include changes in the (male) labor force participation rate and in the cash/money supply ratio. Giles (1999) finds that the introduction of the goods and services tax (GST) in New Zealand in 1986 caused an immediate downward shift in the relative size of the shadow economy, and the shadow economy follows the direction of the business cycle. His estimates show that shadow economic activity increased from around 6.8 percent of official real GDP in 1986 to a peak of 11.3 percent in 1987, then fell to 8.7 percent of GDP in 1992 before increasing to around 11.3 percent in 1994. As shadow economic activities are untaxed, Giles estimated the tax gap between the actual and potential tax revenues (tax evasion) by multiplying the shadow/measured GDP ratio by total tax revenues. His estimates show that tax evasion in New Zealand ranged from 6.4 percent to 10.2 percent of the total tax liability during the period 1968-1994.

Dell'Anno (2007) applies the MIMIC model in estimating the Portuguese shadow economy from 1977 to 2004. He suggests that the shadow economy is caused by government employment of labor force (government intervention in the economy as proxy of economic freedom), the tax burden measured by the total taxes and social contributions as a percentage of (official) gross domestic product, subsidies (payments) that paid by government to enterprises, social benefits (transfers) that paid by the government to households, the self-employed, and the

unemployment rate. Dell'Anno specifies the indicators of the shadow economy as the real gross domestic product index and the labor force participation rate. He starts his model with MIMIC 6-1-2 specification (six causes, one latent variable, and two indicators). After deleting the not significant paths, he considers the MIMIC 4-1-2 specification as the best model. This specification reveals that social benefits/GDP, the proxy of (lack) economic freedom, the unemployment rate and self-employment/labor force are the main causes of the shadow economy dynamics. His results show that the size of the shadow economy with respect to GDP in Portugal ranges from 29.6 percent, in 1978, to 17.6 percent of official GDP in 2004. It slightly decreased except for two periods, from 1983 to 1984 and from 1992 to 1994. He provides economic recommendations for policy makers and proposes an appraisal of the reliability of estimates and an alternative benchmark strategy for the MIMIC approach.

Alañón and Gómez-Antonio (2005) apply the MIMIC approach in estimating the size of the shadow economy in Spain for the period 1976-2002. They find that the tax burden, the degree of regulation, and unit labor costs are the main causes of the shadow economy in Spain during that period. They also find that there is a positive correlation between GDP, money demand and the level of the shadow economy. Their estimates show that the shadow economy in Spain ranged between 8 and 18.8 percent of GDP during the period 1976-2002.

Buehn and Schneider (2008) develop a MIMIC model with an error correction model (ECM) as an alternative method of transforming the time series into the first difference to overcome the stationary problem. They test for the cointegration relationship among the causes and indicators variables and employ their long run equilibrium relationships in estimating the size and development of the shadow economy in France using quarterly data from the period 1981 to 2006. They use the MIMIC 4-1-2 specification where the included causal variables are

the ratio of tax and social security contributions burden/GDP, unemployment rate, the degree of regulation in the economy (government employment/labor force), and hours worked per employee in total economy. They use the monetary aggregate M1 and a GDP volume index as indicators for the shadow economy. Their results show that the shadow economy in France increased from 12.9 percent in Q1 1982 to 15.9 percent in Q4 2006. They argue that their model "better quantifies the size of the shadow economy because it considers both the long run equilibrium relationships and the short run dynamic error corrections at the same time" (p. 18).

Macias and Cazzavillan (2010) apply the MIMIC model to estimate and investigate the evolution of the Mexican shadow economy for the period 1970-2006. They use tax burden, salary levels, inflation, unemployment and excessive regulation as the causes of the shadow economy in Mexico, whereas real GDP (the scale variable) and real currency in hands of the public were used as indicators of the shadow economy. They find that there is a positive relationship between the shadow economy and formal GDP in Mexico confirming the importance of salaries and excessive regulation as causes of the shadow economy. Their estimates show that the shadow economy in Mexico decreased from around 40 percent of GDP at the beginning of 1970's to stabilize at around 30 percent of GDP from the late 1980's onwards.

Dobre et. al. (2010) examine the causality between the shadow economy and the unemployment rate in the United States for the period 1980-2007 by conducting Granger causality tests. They apply the MIMIC with four causal variables (tax on corporate income, social security contributions, unemployment rate, and self employment) and two indicators (index of real GDP and civilian labor force participation). They find clear evidence of causality from the unemployment rate to shadow economy, and no "reverse causation" from the shadow economy to unemployment rate.

3.3. Literature related to Jordan

Literature of the shadow economy indicates that Jordan was included, among many countries, in two studies that estimated the shadow economy in those countries for short periods. In this section, we will review those studies.

Schneider (2007) estimates the shadow economy for 145 countries, including Jordan; countries at various stages of development and in different geographical locations, including developing Eastern European, Central Asian, and high-income countries, over the period 1999 to 2005. He uses the MIMIC model for the econometric estimation and the currency demand approach for calibrating the values into absolute terms. In the currency approach, the ratio of cash holdings to current and deposit accounts is used as the dependent variable in the currency demand equation, while the independent variables are the average tax rate, the proportion of wages and salaries in national income, the interest paid on savings deposits and the per capita income. As for the MIMIC approach, the causal variables of the shadow economy were the direct taxation as a percent of GDP, the indirect taxation and customs duties as a percent of GDP, burden of state regulation (measured as public administrative employment/total labor force), unemployment rate, and per capita GDP. While the indicators of the shadow economy are the employment rate (in percent of population 18-64 year), growth rate of GDP, change of local currency in circulation (per capita). Schneider's results show that the shadow economy in Jordan as a percent of GDP increased from 19.4 percent in 1999/00 to 20.4 percent in 2004/05. It reached a peak value of 21.6 percent in 2002/03. For the world as a whole, the average size of the shadow economy of all countries reached a peak value of 35.2 percent of official GDP in 2002/03 and then declined to 34.5 percent in 2004/05. Table (3-1) shows Schneider's estimates

of the size of the shadow economy in Jordan as a percent of GDP compared to its size in other Arabic countries.

Schneider et. al. (2010) update the Schneider (2007) estimates and extend both the countries sampled to 162 countries, including Jordan, and change the period of study to 1999-2006. As in the previous study, MIMIC model is used for the econometric estimation and the currency demand approach for calibrating the values into absolute ones. Due to data limitations, they use different causes and indicators of the shadow economy for various groups of countries depending on the availability of data in each country. They conduct four estimations for different groups of countries. For the developing countries, they used a group of the following six cause variables: (i) share of direct taxation (direct taxes as a percentage of overall taxation); (ii) size of government (general government final consumption expenditure, as a percentage of GDP) as proxy for indirect taxation; (iii) fiscal freedom (an index consisting of top individual income tax rate, top individual corporal tax rate, and total tax revenues as a percentage of GDP) as three tax burden variables in a broad sense; (iv) regulatory intensity for state regulation; (v) the business freedom index (which is composed of the following components: time to open a business, financial costs to start a business, minimum capital stock to start a business, and costs for obtaining a license); and (vi) the state of economy with the two variables: the unemployment rate and GDP per capita. As indicator variables, they use the growth rate of GDP per capita, the labor force participation rate (people over 15 economically active as a percentage of total population), and the ratio of M0 to M1. Due to the fact that the direct taxation variable is only available for a smaller sample of developing countries, they conduct two different sets of estimates for those countries. In addition, they analyze the main causes of the shadow economy, and find that "the driving forces of the shadow economy are an increased burden of taxation (both direct and

indirect), combined with labor market regulations and the quality of public goods and services, as well as the state of the official economy" (p.1). The results of this study show that the shadow economy in Jordan was relatively smaller than the level in the Schneider (2007) estimates and had an opposite trend. The average size of the shadow economy in Jordan for the period 1999-2006 was 18.7 percent of official GDP. It modestly decreased from 19.5 percent in 1999 to 17.7 percent in 2006. As for the 162 selected countries, the study shows that the average size of the world shadow economy increased only modestly from 33.7 percent of official GDP in 1999 to 35.5 percent of official GDP in 2007. Table (3-2) shows the size of the shadow economy in Jordan as percent of GDP compared in size with other Arab countries and some other countries in the rest of the world.

Table 3. 1: Schneider's (2007) estimates of the size of the shadow economy in Jordan and some Arab countries

	1999/00	2001/02	2002/03	2003/04	2004/05
Saudi Arabia	18.4	19.1	19.7	19.3	18.4
Syria	19.3	20.4	21.6	21.7	21.2
Jordan	**19.4**	**20.5**	**21.6**	**21.2**	**20.4**
Kuwait	20.1	20.7	21.6	21.2	20.7
United Arab Emirates	26.4	27.1	27.8	27.2	26.5
Yemen	27.4	28.4	29.1	28.2	27.3
Algeria	34.1	35.0	35.6	34.8	33.9
Lebanon	34.1	35.6	36.2	36.5	37.1
Egypt	35.1	36.0	36.9	36.3	35.4
Morocco	36.4	37.4	37.9	37.3	36.7
Mauritania	36.1	37.2	38.0	37.4	36.8
Tunisia	38.4	39.1	39.9	39.4	38.3

Source: Schneider (2007)

Table 3. 2: Schneider et. al.'s (2010) estimates of the size of the shadow economy in Jordan and some Arab countries

	1999	2000	2001	2002	2003	2004	2005	2006	2007	Country Average
Bahrain	18.2	18.4	18.6	18.8	19.0	19.3	19.7	-	-	18.9
Saudi Arabia	18.1	18.4	18.0	17.5	18.5	19.1	19.4	19.5	20.0	18.7
Syria	19.3	19.3	19.4	19.5	19.3	19.5	19.6	19.9	20.1	19.6
Jordan	**19.4**	**19.4**	**19.6**	**19.9**	**20.1**	**20.6**	**20.9**	**21.4**	**21.7**	**20.3**
Kuwait	20.1	20.1	19.9	19.9	20.9	21.5	22.2	22.5	-	20.9
United Arab Emirates	26.5	26.4	25.8	25.3	26.5	27.5	28.0	29.4	-	26.9
Yemen	27.1	27.4	27.5	27.6	27.7	27.8	28.2	28.0	28.0	27.7
Algeria	34.0	34.1	34.4	34.9	35.8	36.6	37.3	37.3	37.1	35.7
Lebanon	34.1	34.1	34.5	34.7	35.0	35.9	35.9	35.4	36.2	35.1
Sudan	34.1	-	-	-	-	-	-	-		34.1
Egypt	34.7	35.1	35.0	34.5	34.8	35.2	35.4	36.1	37.0	35.3
Morocco	36.6	36.4	37.1	37.3	37.8	38.7	37.9	39.8	39.8	37.9
Mauritania	35.9	36.1	36.1	35.7	35.9	35.1	34.5	-		35.6
Tunisia	38.1	38.4	38.9	39.0	39.4	39.9	40.0	40.9	41.4	39.5

Source: Schneider et al (2010)

3.4. Literature on the consequences and implications of the shadow economy

Houston (1990) develops a flexible-price macroeconomic model incorporating the shadow economy, for the purpose of comparative static analysis. He investigates the effect of the changes in tax, monetary policy, and business cycle movements on the shadow economy. In his model, he considers a two-sector economy where an "aboveground" good is produced in the first sector, while an "underground" (shadow) good is produced in the other sector. In each sector, output is modeled as a Cobb-Douglas production function which is a function of labor supplied in that sector, other fixed unspecified factors of production, productivity shocks in that sector, and the price of good in that sector relative to the aggregate price level. His model allows him to assess the impact of business cycles, government spending, changes in tax rates, and changes in monetary policy on the shadow economy. He finds that the shadow economy is an endogenous variable which is affected by macroeconomic policies, particularly high tax rates and regulatory costs. He suggests that the traditional macroeconomic models may be limited if they do not take into consideration the shadow economy. He concludes that macroeconomic policy makers should consider the existence of the shadow economy when they conduct their policies.

Elijah and Uffort (2007) try to analyze the relationship between poverty rates and the size of shadow economy in developed and developing countries. They mainly use secondary data of the size of the shadow economy and poverty from previous publications for different countries. Nigeria is taken as a case study to empirically investigate the relationship between poverty and the shadow economy. For this purpose, they collected cross sectional data through primary sources by conducting interviews to get respondents' perceptions about underground economies and the possible causes that may motivate them into such activities. They face technical problems in linking the shadow economy and poverty due to the hidden nature of the shadow

economy. They find that poverty increases the shadow economy especially in developing and transition countries with common social and economic situations such as high unemployment and corruption rates.

Thomas (1999) argues that instead of the "guestmation" of the size of shadow economic activities based on strong assumptions, economists should analyze the microeconomic framework and the policy implications of these activities in order to develop a sound quantitative foundation based on good economic theories. He argues that estimating the size of the shadow economy, without knowing who is doing what, where, how, and why, has limited value for a policy maker. He concludes that "the search for the magic number corresponding to the size of the black economy as a percentage of GNP without providing economic theories to explain the determinates and structure of the black economy has led economists into a blind alley in which the question of size has become an end in itself and more important issues are not addressed" (p.387).

Thieben (2001) investigates the impact of fiscal policy and deregulation on shadow economies in transition countries where he takes Ukraine as a case study. He uses the currency approach to estimate the size of the shadow economy in Ukraine for the period 1993-2000. He analyzes the dynamics of the shadow economy and assesses the effectiveness of state measures undertaken to reduce its size. He concludes that reducing the size of shadow economy can be achieved by reforming the tax system particularly through reducing the burden of personal income tax and small business tax, in addition to simplifying the tax system by reducing the number of taxes and exemptions.

Katsios (2006) studies the interaction between the shadow economy and corruption in Greece, focusing on the regional dimensions of the problem in south-eastern Europe. He

concentrates on the determinants of the shadow economy, tax and national insurance burdens, and the intensity of the relevant regulations, in Greece. For this purpose, he collects data about the size of the shadow economy and corruption from previous publications. He argues that there is a strong and consistent relationship between the shadow economy and corruption. The existence of corruption among local government bureaucrats induces people who are not willing or cannot afford to pay a bribe for those bureaucrats to work in the shadow economy. Therefore, the shadow economy is considered to be complementary to corruption. In order to reduce the size of shadow economy, Katsios suggests that the Greek government should implement urgent procedures that contribute to reducing corruption, particularly by reforming the tax system through simplifying the regulating framework, and improving the quality of institutions, as well as rationalizing administrative-compliance costs.

4. CHAPTER FOUR: METHODOLOGY

In this study, we will use two methodologies for estimating the annual size of the shadow economy in Jordan for the period 1976-2010.

4.1. The currency demand approach

This approach depends on estimating the demand for money in circulation in the country and uses this demand in the estimation of the shadow economy. The currency demand approach includes three main assumptions. First, the shadow economic activities mainly result from high tax rates in the economy. Second, people use cash money, instead of formal banking accounts, in their shadow transactions in order to evade paying tax. An increase in tax rates thus induces people to increase their shadow economic activities, which, in turn, leads to an increase in the demand for money in circulation in the economy. Third, the currency demand approach assumes that the velocities of money in circulation in the official economy and in the shadow economy are equal. We believe that the velocity in the shadow economy is higher than the velocity in the official economy. Adopting this assumption, however, results in estimating a lower bound of the shadow economy in Jordan.

We will estimate the following model which represents the demand for currency in circulation in Jordan:

$$RCRP_t = \beta_0 + \beta_1 TS_t + \beta_2 TI_t + \beta_3 TM_t + \beta_4 RGNPP_t + \beta_5 RS_t +$$

$$\beta_6 ISBP_t + \beta_7 XD_t + \mu \qquad (4\text{-}1)$$

Where RCRP is the per capita real currency in circulation, TS is the effective tax rate on sales (general sales tax revenues/GDP), TI is the effective income tax rate (income tax revenue/GDP), TM is the effective tax rate on imports (custom duties revenues/imports), RS is the weighted average of interest rates on saving, ISBP is the number of Islamic banks (per one thousand of person), and XD is a dummy variable for the depreciation of the Jordanian dinar in 1988 (XD equals one for the years 1988-2010 and zero for the years 1976-1987) .

4.1.1. Hypotheses of the currency approach

In the currency demand approach, we will test the following hypothesis:

1. We will examine the effect of income tax on the demand for currency in circulation which is considered as an indicator for the shadow economy in Jordan

   - Null Hypothesis (H_0): Income tax has no effect on the shadow economy in Jordan.

   - Alternative Hypothesis (H_1): The income tax has an effect on the shadow economy in Jordan

2. We will examine the effect of general sales tax on the demand for currency in circulation, and then on the shadow economy in Jordan.

   - Null Hypothesis (H_0): General sales tax has no effect on the shadow economy in Jordan.

   - Alternative Hypothesis (H_1): General sales tax rate has an effect on the shadow economy in Jordan

3. We will examine the effect of custom duties on the demand for currency in circulation, and then on the shadow economy in Jordan.

- Null Hypothesis (H₀): Custom duties (tax on imports) have no effect on the shadow economy in Jordan.

- Alternative Hypothesis (H₁): Custom duties (tax on imports) have an effect on the shadow economy in Jordan.

The currency demand model will be estimated using ordinary least squares (OLS) method via the econometric program E-views. Once this model is estimated, we take the following steps to estimate the excess (informal) currency in circulation that results from imposing taxes and transfer it on shadow transactions.

1. Forecast the annual per capita US dollar value of real currency in circulation (*RCRP*) for the period of the study based on the model above, and from which we estimate the annual total currency in circulation TCt.

2. Re-forecast the annual per capita US dollar value of real currency in circulation for the same period using the same model under the assumption that the income and sales tax rates are zero and the tax rates on imports is fixed at its maximum rate, while keeping other variables and their coefficients unchanged. From which we estimate the annual formal (legal) currency in circulation FCt.

3. Calculate the annual excess (informal or illegal) currency in circulation ECt, which represents the amount of currency held to avoid paying taxes.

$$ECt = TCt - FCt \tag{4-2}$$

To estimate the annual size of the shadow economy, we then do the following

1. Calculate the annual velocity of money in circulation, Vt, which is assumed to be equal for both formal and informal money:

$$Vt = GDP/Money\ in\ circulation \tag{4-3}$$

2. Multiply the annual velocity of money in circulation, Vt, by the annual amount of the excess (informal) currency ECt to get the size of the annual shadow economy SEt:

$$SEt = ECt \text{ x } Vt \tag{4-4}$$

To estimate the annual size of tax evasion, TEt, we simply apply the annual effective tax rates (Tt=Tax revenues/GDP) to the annual size of the shadow economy, SEt:

$$TEt = SEt \text{ x } Tt \tag{4-5}$$

4.2. The MIMIC approach.

The MIMIC model is a special case of the structural equations model (SEM). It consists of two equations: the structural equation and the measurement equation. The structural equation defines the relationship between the latent variable and its causes. It is given by:

$$\eta = \gamma'x + \zeta \tag{4-6}$$

Where, η is the unobservable "latent" variable, which represents the index of the shadow economy, γ is (q×1) vector of parameters describing the relationships between the shadow economy, η, and its causes $x = (x_1, x_2, \dots x_q)$, while ζ is (q×1) vector of the random errors.

The measurement equation defines the relationship between the shadow economy (latent variable) and its indicators. It is given by:

$$y = \lambda\,\eta + \epsilon \tag{4-7}$$

Where, $y = (y_1, y_2, ..., y_p)$ is a vector of indicators of the shadow economy (η), λ is ($p \times 1$) vector of parameters describing the relationships between the latent variable and its indicators, and ϵ is a ($p \times 1$) scalar of random errors.

Substituting equations (4-6) into equation (4-7), we get the reduced form of the MIMIC model, which can be viewed as the following multivariate regression model:

$$y = \lambda(\gamma'x + \zeta) + \epsilon$$

$$= \Pi x + v \qquad\qquad (4\text{-}8)$$

Where, $\qquad \Pi = \lambda\gamma', \qquad\qquad\qquad v = \lambda\zeta + \epsilon$

We cannot estimate all parameters λs and γs individually. Therefore, we include a normalization condition for one of the indicator's coefficients ($\lambda = 1/-1$). According to Tedds (2005), the choice of which λ to normalize "is arbitrary as the normalization does not identify the dependent variable in any formal or causal sense. The relative impacts of η on the other indicator variables are then measured relative to this pre-assigned value". Real GDP is usually chosen as the variable of scale that is normalized in the model by fixing its coefficient (λ_1) at (+1) or (-1). According to Dell'Anno (2006), "in the MIMIC model the vector of structural coefficients is proportional to the coefficient of scale, when the sign of λ_1 is changed, the structural parameters (γs) of the causes changes from positive to negative (and vice versa)" (p.262). Therefore, if we fix $\lambda_1 = +1$ and the estimation of the model shows that the signs of γs are inconsistent with the economic theory then we change the sign of λ_1 to -1.

Graphically, we can explain the structural relations of the model in the following path diagram where the arrows, which represent the causal relationship, go from the causes of the shadow economy (x_1, x_2, …,x_q) to the latent variable η (shadow economy), and then from the shadow economy to its indicators (y_1, y_2, …, y_p).
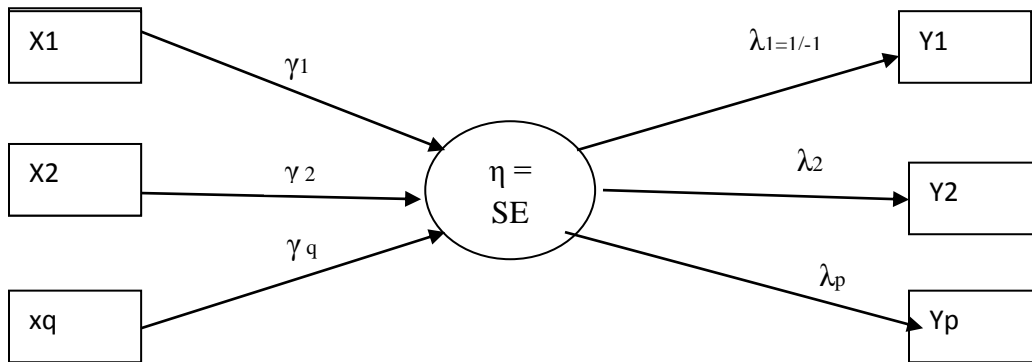
Figure 4. 1: Schematic figure shows the MIMIC model.

The MIMIC model, as a special case of SEM models, concentrates on analyzing the covariance structure. In the MIMIC model there are $(p+q)(p+q+1)/2$ equations to be estimated, which include all coefficients, variances of the observed variables, and co-variances between observed variables. Due to the large number of path equations, they are usually solved by an iterative (or repetitive) process using computer programs starting with initial values of the path (Loehlin, 2004). Estimating the best fitting model requires minimizing the residual (ψ) between the covariance matrix of the observed data ($\sum$) and the covariance matrix predicted by the model ($\sum(\theta)$).

$$(\textstyle\sum) = (\textstyle\sum(\theta)) + (\psi) \tag{4-9}$$

In this study, the MIMIC model will be estimated using the maximum likelihood estimator via a special computer program for structural equations models called LISREL8.80.

The MIMIC estimation process requires estimating more than one specification of the model to achieve the best fitting model. Alexandru et. al. (2010) start with a MIMIC 8-1-3 specification (eight causes, one latent variable and three indicators) and by gradually omitting the variables which are not statistically significant they obtain the MIMIC 4-1-2 specification as the best model to estimate the US shadow economy. Dell'Anno's (2007) conducts three specifications of the MIMIC model for Portugal, starting with a MIMIC 6-1-2 and after removing the statistically insignificant variables he considers the 4-1-2 specification as the best model. In this study, we start with 6-1-3 specification and then omit the insignificant variables to reach the best fitting model for Jordan.

With three indicators (y_1, y_1, and y_2) and with normalizing $\lambda_1 = +/-1$, the model consists of the following two reduced form equations:

$$y_{1t} = \gamma' x_t + v_{1t} \qquad\qquad (4\text{-}10)a$$

$$y_{2t} = \lambda_2 \gamma' x_t + v_{2t} \qquad\qquad (4\text{-}10)b$$

$$y_{3t} = \lambda_3 \gamma' x_t + v_{3t} \qquad\qquad (4\text{-}10)c$$

From equation (4-6) and (4-10)a we can see that estimating the shadow economy (latent variable) is identical to the estimated value of the normalized indicator variable y_1, and equations (4-10)b and (4-10)c show that the estimated value of the second and the third indicator variables y_2 and y_3 are rescaled (by λ_2 and λ_3 respectively) of the first indicator y_1.

4.2.1. The causes and indicators of the shadow economy

Determining the final causal variables (x) and indicator variables (y) of the shadow economy in Jordan by the MIMIC model will depend on the model fit results conducted by using the LISREL program. We will examine the following causes and indicators:

4.2.1.1. The causes of the shadow economy

- The effective tax rates (income tax, GST, custom duties).

  Taxes are considered a main determinant of the shadow economy. As explained in the currency approach above, income and sales taxes are expected to have positive effects on the shadow economy, while custom duties are expected to have a negative effect.

- The degree of regulation in the economy.

  We will take government intervention in the economy, represented by government employees as a percent of total labor force, as an indicator of the degree of regulation in the economy. An increase in government intervention in the economy means an increase in the degree of regulation of the economic system which reduces freedom in the economic environment, which may induce economic agents to work in the shadow economy.

- Unemployment rate.

  In the literature, the effect of unemployment on the shadow economy is ambiguous due to the opposing effects of income and substitution effects. On one hand, the reduction of income due to unemployment reduces demand in both the shadow and official economy, which represents a negative income effect. On the other hand, the increase in unemployment induces unemployed workers to look for and accept job in the shadow economy where wages are less and prices of goods are cheaper, which represents a

positive substitution effect. The final effect of unemployment on the shadow economy depends on the net effect of income and substitution effects.

- Inflation rate.

We will include the official inflation rate represented by the percentage change in the consumer price index. Most economists argue that high inflation rates increase the size of the shadow economy for two reasons. First, higher official inflation increases the demand for cheaper goods and services in the shadow economy. Second, the effect of "tax-bracket-creep", where inflation pushes income into higher tax bracket, constitutes an additional incentive for tax payers to work in the shadow economy in order to evade paying the additional tax (Cassar, 2001).

- A dummy variable for the depreciation of the Jordanian Dinar in 1988 that equals one in 1989 and onwards and zero in the years before 1989.

As the accurate specification of the MIMIC model depends on the variety of causes and indicators of shadow economy, and due to the small size of the sample in the study compared with the number of variables to be estimated (degree of freedom= (p+q) (p+q+1)/2), it is possible that the MIMIC model may not converge if the three types of taxes and all other possible causal variables are included in the model. Therefore, we may combine all types of taxes in one causal variable to give a place for other causal variables to be included in the model.

4.2.1.2.   The indictors of the shadow economy
- Growth rate of real GDP.

There is no consensus among economists about the correct relationship between the official economy (GDP) and the shadow economy. This relationship is different from country to country. For example, Tedds (2005), Schneider and Bajada (2003), and Giles

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(1999) find that there is a positive relationship between official GDP and the shadow economy. According to those economists, an increase in the official level of GDP increases the demand for goods and services in official economy as well as in shadow economy. Other economists, for example Frey and Weckhannemann (1984), Schnieder and Enste (2000), and Dell'Anno (2003) found that there is a negative relationship between official GDP and shadow economy; a contraction in GDP increases unemployment which in turn pushes unemployed people to work in the shadow economy. Real GDP is usually chosen as the variable of scale that is normalized in the model by fixing its coefficient (λ_1) at (+1) or (-1).

- Growth rate of real currency in circulation.

As assumed in the currency approach above, agents in the shadow economy use cash money, instead of formal banking accounts, in their transactions in order to evade paying tax. Therefore, the increase in the demand for real currency in circulation is considered as an indicator of an increase in the size of shadow economy.

- Growth rate of real private consumption.

Real consumption is considered one of the indicators of the shadow economy. Working in the shadow economy generates income for people. Following typical economic theory of the positive relationship between income and consumption, an increase in the size of shadow economy will be reflected in a proportional increase in real consumption.

4.2.2. Hypotheses of the MIMIC model:

1. We will include the effective income tax rate as a causal variable in the MIMIC model and examine the effect of this variable on shadow economy in Jordan.

- Null Hypothesis (H_0): Income tax has no effect on the shadow economy in Jordan.

- Alternative Hypothesis (H_1): Income tax has an effect on the shadow economy in Jordan

2. We will include the general sales tax rate as a causal variable in the MIMIC model and examine the effect of this variable on shadow economy in Jordan

- Null Hypothesis (H_0): General sales tax has no effect on the shadow economy in Jordan.

- Alternative Hypothesis (H_1): General sales tax has an effect on the shadow economy in Jordan.

3. We will include the customs duties as a causal variable in the MIMIC model and examine the effect of this variable on shadow economy in Jordan.

- Null Hypothesis (H_0): Customs duties (tax on imports) have no effect on the shadow economy in Jordan.

- Alternative Hypothesis (H_1): Customs duties (tax on imports) have an effect on the shadow economy in Jordan.

4. We will take government intervention in the economy as an indicator of the degree of regulation in the economy which is considered as a causal variable in the MIMIC model and examine the effect of this variable on the shadow economy in Jordan.

- Null Hypothesis (H_0): The degree of regulation in the Jordanian economy has no effect on the shadow economy in Jordan.

- Alternative Hypothesis (H_1): The degree of regulation in the Jordanian economy has an effect on the shadow economy in Jordan.

5. We will include the unemployment rate as a causal variable in the MIMIC model and examine the effect of this variable on shadow economy in Jordan.

- Null Hypothesis (H_0): Unemployment rate has a rate on the shadow economy in Jordan.

- Alternative Hypothesis (H1): Unemployment rate has an effect on the shadow economy in Jordan.

6. We will include inflation rates as a causal variable in the MIMIC model and examine the effect of this variable on shadow economy in Jordan.

- Null Hypothesis (H0): The inflation rate has no effect on the shadow economy in Jordan.

- Alternative Hypothesis (H1): The inflation rate has an effect on the shadow economy in Jordan.

7. We will include the depreciation of the Jordanian dinar in 1989 as a dummy causal variable in the MIMIC model and examine the effect of this variable on shadow economy in Jordan.

- Null Hypothesis (H0): The depreciation of the Jordanian Dinar in 1989 has no effect on the shadow economy in Jordan.

- Alternative Hypothesis (H1): The depreciation of the Jordanian Dinar in 1989 has an effect on the shadow economy in Jordan.

There is more than one test that is usually used to choose the best fitting model (see appendix B). In addition to the statistical significance of parameters, we will use the Root Mean Square Error of Approximation (RMSEA), the Normed Fit Index (NFI), the Non-Normed Fit Index (NNFI), goodness-of-fit index (GFI), and the adjusted goodness-of-fit index (AGFI).

4.2.3. The benchmarking procedure

By estimating the coefficients of the MIMIC model, and using the assumption that the expected value of the error term $\zeta = 0$, we determine only annual indexes, not values, of the shadow economy. The estimated indexes will be in the same transformation of independent

variables (same difference). To convert those indexes to absolute values of the annual shadow economy, and as a percent of official GDP, we need an external estimation of the shadow economy in Jordan for one year during the period of study, and then we can use this in implementing a benchmarking or calibration procedure. We will use the average rate of the shadow economy as a percent of GDP in Jordan for the year 1999 from Schneider (2007) and Schneider et. al. (2010), which equals 19.4 percent of GDP, as a reference indicator to benchmark (calibrate) the estimated annual cardinal indexes of the shadow economy in Jordan for the period of the study. We will follow Dell' Anno's (2007) procedure in the benchmarking process. According to that procedure, the estimated index of the shadow economy, which has the same scale as the reference indicator, for a specific year (t) measured as percentage of GDP in the base year (T=1999) will be linked to the index of changes in real GDP in the same base year by substituting the two indexes (index of changes in GDP respect to 1999 and index of changes in SE/GDP respect to 1999) in the measurement equation (4-10)a:

$$\frac{GDP_t - GDP_{t-1}}{GDP_T} = \frac{\tilde{\eta}_t - \tilde{\eta}_{t-1}}{GDP_T} \qquad (4\text{-}11)$$

By forecasting the structural equation (4-6) for the period of study, we will get an ordinal time series index for the shadow economy (the latent variable η) according to the following equation:

$$\frac{\Delta \tilde{\eta}_t}{GDP_T} = \gamma 1 \Delta X_{1t} + \gamma 2 \Delta X_{2t} + \ldots\ldots + \gamma 6 \Delta X_{6t} \qquad (4\text{-}12)$$

Once we get the indexes for all years of the study, we scale the index of the base year to get the ratio of the shadow economy (as a percent of formal GDP) in that year, then we scale each year

index to get a time series of the shadow economy as a percent of formal GDP according to the following equation:

$$\frac{\tilde{\eta}_t}{GDP_{1999}} \left[\frac{\eta^*_{1999}}{GDP_{1999}} \frac{GDP_{1999}}{\tilde{\eta}_{1999}} \right] \frac{GDP_{1999}}{GDP_t} = \frac{\hat{\eta}_t}{GDP_t} \tag{4-13}$$

where:

$\dfrac{\tilde{\eta}_t}{GDP_{1999}}$ is the index of shadow economy calculated by equation (4-12).

$\dfrac{\eta^*_{1999}}{GDP_{1999}}$ is the external estimate of shadow economy in 1999 (=19.4%).

$\dfrac{\tilde{\eta}_{1999}}{GDP_{1999}}$ is the value of index in 1999 estimated by equation (4-12).

$\dfrac{GDP_{1999}}{GDP_t}$ is to convert the index of changes respect to the GDP in base year to a time series of shadow economy as a percent of official GDP .

$\dfrac{\hat{\eta}_t}{GDP_t}$ is the estimated shadow economy as a percentage of official GDP.

Equation (4-13) can be simplified to:

$$\frac{\tilde{\eta}_t}{\tilde{\eta}_{1999}} \left[\frac{\eta^*_{1999}}{GDP_t} \right] = \frac{\hat{\eta}_t}{GDP_t} \tag{4-14}$$

Consequently, by applying this benchmarking procedure for all years, we get annual estimates of the shadow economy in Jordan for the period 1976-2008.

To estimate the annual size of the tax evasion, we simply apply the annual effective tax rates on to the estimated annual size of the shadow economy.

5. CHAPTER FIVE: DATA

5.1. Data used: variables explanation and sources

Annual time series data of the Jordanian economy for the period 1976–2010 were used to estimate the shadow economy in Jordan for that period by two approaches: the currency approach and the MIMIC approach. The time period of the study is selected based on the availability of consistent national accounts data from Jordan and on the most recent available data. The data were collected from different sources, mainly the Central Bank of Jordan, the Jordanian Ministry of Finance, and the Jordanian Department of Statistics. Explanations for variables used in each approach and data sources are described below.

5.1.1. Data of the currency approach model

The currency approach requires the use of equation (4-1), which represents the demand for money in circulation. For this purpose, the following data are used:

As for the dependent variable, different measures for demand for money in circulation were used in various studies. As real demand for money in circulation partially reflects the average person's activity in the shadow economy, we follow Pajada (1999) in using per capita real currency in circulation (RCRP) as a dependent variable in equation (4-1). This measure represents the average demand for money in circulation after ignoring the effect of inflation on that demand. Money in circulation and the consumer price index (CPI), which is used to get the real value of money in circulation, are drawn from the Central Bank of Jordan's monthly

bulletins and the yearly statistical series. Population of Jordan is drawn from the website of the Jordanian Department of Statistics.

As for the independent variables, the following seven variables are used in estimating equation (4-1):

- Effective sales tax rate (TS): This variable represents the tax revenues on goods and services (with various names) imposed in Jordan during the period of the study divided by the nominal GDP. It includes domestic production fees (tax) before 1989, the consumption tax between 1989 and 1994, and the general sales tax (GST) after 1994. The sources of these types of tax revenues and the GDP are the Central Bank of Jordan's monthly bulletins and the yearly statistical series.

- Effective income tax rate (TI): This variable represents the tax revenues from employees' wages and salaries, individuals' income, and corporations' profits divided by the nominal GDP. The source of the income tax revenues is the Ministry of Finance's monthly bulletin and the Central Bank of Jordan's monthly bulletins and the yearly statistical series.

- Effective imports tax rate (TM): This variable represents the custom duties revenues divided by the total imports. The source of the custom duties revenues and the total imports is the Central Bank of Jordan's monthly bulletins and the yearly statistical series.

- Per capita real GNP (RGNPP): This variable represents the real gross national product (GNP) divided by the Jordanian population. We use GNP instead of GDP as an indicator for the national income in Jordan because GNP includes net remittances of the Jordanian employees working abroad, which is considered a main source of national income for

Jordan. The source of GNP data is the Central Bank of Jordan's monthly bulletins and the yearly statistical series.

- Weighted average interest rates on saving (RS): This variable represents the weighted average interest rate paid by the banks in Jordan on savings deposits. Interest rate on savings is considered a proxy for the opportunity cost of holding cash money. The source of this variable is the Central Bank of Jordan's monthly bulletins and the yearly statistical series.

- The number of Islamic banks (ISBP): This variable represents the number of Islamic banks in Jordan per one thousand people. This indicator reflects the religion factor as one of the determinants of holding currency in circulation in Jordan. The source of this variable is the Research Department at the Central Bank of Jordan.

- XD: This is a dummy variable for the depreciation of the Jordanian dinar in 1988 (XD = 1 for the years 1988-2010, and XD = 0 for the years before 1988).

5.1.2. Data of the MIMIC approach model

The MIMIC approach requires the use of structural equation (4-6) and the measurement equations (4-10)a, (4-10)b, and (4-10)c simultaneously. Unlike the ordinary least square model (OLS), it is necessary in the MIMIC approach to conduct more than one specification using various variables until the best fit model is reached. For this purpose, the following variables are used:

- Taxes (income tax, GST, customs duties): explanations and sources of those variables are given above.

- Government intervention in the economy (LG): This variable is represents the number of Jordanian government employees as a percentage of the total labor force. Government employees include all employees with various degrees and qualifications who work under the Jordanian civil service system. The source of this variable is the Jordanian General Budget Department, the International Labor Organization, and the Jordanian Department of Statistics. According to the International Labor Organization, the total labor force represents the quantity of a country's population 15 years old and over who contribute to the production of goods and services, either employed or unemployed. Those who are neither employed nor unemployed (for example housewives, students, disabled or retired persons) are not considered a part of the labor force. The source of the labor force variable is the Jordanian Department of Statistics.

- Unemployment (U): This variable represents the country's unemployment rate. The source of this variable is the Jordanian Department of Statistics.

- Inflation (P): This variable represents the percentage change in the consumer price index. The source of this variable is the Central Bank of Jordan's monthly bulletins and the yearly statistical series.

- Growth rate of per capita real GDP (GRGDP): This variable represents the growth rate of gross domestic products (GDP) of all goods and services in constant prices divided by the Jordanian population.

- Growth rate of the real currency in circulation (GRCR): This variable represents the nominal money in circulation divided by the consumer price index. The source of the nominal currency in circulation data is the Central Bank of Jordan's monthly bulletins and the yearly statistical series.

- Growth rate of the real private consumption (GRCON): This variable represents the nominal private consumption divided by the consumer price index. The source of the nominal private consumption data is the Central Bank of Jordan's monthly bulletins and the yearly statistical series.

- XD: This is a dummy variable for the depreciation of the Jordanian dinar in 1988 (explained above).

5.2. Unit Root test

Before employing the above variables for estimating the models according to both methodologies, the stationary of data is checked to identify which variables follow a random walk. For this purpose, an Augmented Dickey-Fuller (ADF) test is used to check for the existence of a unit root in the variables (except the Dummy variable).

5.2.1. ADF test for the currency approach variables

The ADF test results of the currency approach variables show that all levels of those variables exhibit evidence of a unit root. To overcome this problem, those variables were converted to the first difference. Consequently, Dickey-Fuller tests show that all variables, except RGNPP, become stationary at 1% whereas RGNPP becomes stationary at 5%. Therefore, all variables used in the currency approach model are I(1). Table (5-1) shows the results of Dickey-Fuller unit root test for the variables of the currency approach.

5.2.2. ADF test for the MIMIC approach variables

Unlike the currency approach variables, the ADF test results of the MIMIC approach variables show that some of those variables are stationary at their levels. GRCON and GRCR are stationary at 1% while GRGDP is stationary at 5%. As for T, U, and LG, the ADF test results

show that those variables exhibit evidence of a unit root. To overcome this problem, those variables were converted to the first difference. Consequently, Dickey-Fuller tests show that T and U became stationary at 1% whereas LG became stationary at 5%. Table (5-2) shows the results of the Dickey-Fuller unit root test for the variables of the MIMIC approach.

Table 5. 1: ADF test results for the currency approach variables

Variable	Level				1st Difference			
	1%	5%	10%	ADF test stat	1%	5%	10%	ADF test stat
RCRP	-3.6394	-2.9511	-2.6143	**-1.0284**	-3.6463	-2.9540	-2.6158	**-3.8389**
TI	-3.6463	-2.9540	-2.6158	**-2.1750**	-3.6537	-2.9571	-2.6174	**-6.3417**
TM	-3.6394	-2.9511	-2.6143	**-1.2305**	-3.6463	-2.9540	-2.6158	**-6.7570**
TS	-3.6793	-2.9677	-2.6229	**-2.2553**	-3.6701	-2.9639	-2.6210	**-5.3095**
RGNPP	-3.6463	-2.9540	-2.6158	**-1.6379**	-3.6463	-2.9540	-2.6158	**-3.3519**
ISBP	-3.6394	-2.9511	-2.6143	**-0.7310**	-3.6463	-2.9540	-2.6158	**-4.3762**
RS	-3.6394	-2.9511	-2.6143	**-1.7764**	-3.6537	-2.9571	-2.6174	**-5.4184**

Table 5. 2: ADF test for the MIMIC approach variables.

Variable	Level				1st Difference			
	1%	5%	10%	ADF test stat	1%	5%	10%	ADF test stat
GRGDP	-3.6463	-2.9540	-2.6158	**-3.2852**				
GRCR	-3.6463	-2.9540	-2.6158	**-4.5890**				
GRCON	-3.6463	-2.9540	-2.6158	**-4.9297**				
T	-3.6463	-2.9540	-2.6158	**-1.6575**	-3.6537	-2.9571	-2.6174	**-6.2004**
U	-3.6463	-2.9540	-2.6158	**-1.8766**	-3.6463	-2.9540	-2.6158	**-6.3710**
LG	-3.6463	-2.9540	-2.6158	**-0.2751**	-3.6537	-2.9571	-2.6174	**-3.1688**

6. CHAPTER SIX: ESTIMATING THE SHADOW ECONOMY IN JORDAN BY THE CURRENCY DEMAND APPROACH

The currency approach is considered the most common and traditional method of estimating the size of the shadow economy in various countries. As mentioned in chapter one, this approach assumes that taxes are the main cause of people engaging in the shadow economy. In addition, it assumes that people use cash money instead of formal banking accounts for their shadow transactions to evade paying taxes. Therefore, the currency approach uses the estimated demand for money in circulation model to determine the excess demand for currency resulting from the tax rates. Then, by applying the velocity of money on the estimated excess demand for currency, the size of the shadow economy in that country is estimated.

This chapter aimed at estimating the annual size of the shadow economy in Jordan using the currency approach during the period 1976-2010. The first step in that process is estimating the demand for money in circulation in Jordan during the same period. For this purpose, equation (4-1) is estimated. This equation represents the demand for money in circulation in Jordan. As the currency approach assumes that the shadow economic activities mainly result from the high tax rates in the economy, the estimated currency demand equation in Jordan will be used to determine the excess demand for currency resulting from imposing taxes in Jordan during the period of study.

After converting the variables to the first difference to overcome the unit root problem, equation (4-1) is estimated by the ordinary least squares (OLS) techniques via E-views software. Table (6-1) shows the regression results of that estimation.

Table 6. 1: Regression results for the demand for money in circulation in Jordan

Dependent Variable: D(RCRP)

Method: Least Squares

Sample (adjusted): 1977 2010

Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.090815	5.727856	1.587124	0.1246
D(TI)	8.965251	4.685144	1.913549	0.0667
D(TM)	-3.946544	1.514146	-2.606448	0.0149
D(TS)	4.070708	2.209180	1.842634	0.0768
D(RGNPP)	16.30908	3.748429	4.350911	0.0002
D(ISBP)	-6.155279	5.663160	-1.086898	0.2871
D(RS)	-11.63518	2.432995	-4.782245	0.0001
XD	-21.46704	6.375865	-3.366922	0.0024
R-squared	0.715581	Mean dependent var		-0.607971
Adjusted R-squared	0.639007	S.D. dependent var		28.24598
S.E. of regression	16.97094	Akaike info criterion		8.703206
Sum squared resid	7488.331	Schwarz criterion		9.062350
Log likelihood	-139.9545	Hannan-Quinn criter.		8.825684
F-statistic	9.344939	Durbin-Watson stat		1.855446
Prob(F-statistic)	0.000009			

The results indicate that the overall model is significant with F-statistic equaling 9.34. The coefficient signs of all variables in the model are as expected. TM coefficient has a negative sign and it is very significant at the 5 percent level. This confirms the assumption that reducing taxes on imports, which reduce protection of domestic production, causes an increase in the demand for money in circulation to be used in the shadow economy. TI and TS coefficients have positive signs and are significant at the 10 percent level. This confirms the assumption that high income and sales tax rates increase the demand for money in circulation to be used in the shadow economy. RGNPP coefficient has a positive sign whereas RS coefficient has a negative sign, and both coefficients are highly significant at the 1 percent level. This is consistent with the typical positive effect of income on money demand and the negative relationship between interest rate and money demand. The dummy variable for the Jordanian dinar depreciation in 1988 has a negative sign and is significant at the 1 percent level, indicating that depreciation causes people to decrease their demand for money in circulation.

By applying the coefficients of the estimated regression, the following equation is developed to represent the long run per capita real demand for money in circulation in Jordan:

$$\Delta(RCRP_t) = 9.090 + 4.070\Delta(TS_t) + 8.965\Delta(TI_t) - 3.946\Delta(TM_t)$$

$$+16.309\Delta(RGNPP_t) - 11.635\Delta(RS_t) - 6.155\Delta(ISBP_t)$$

$$-21.467XD_t \qquad\qquad\qquad\qquad (6.1)$$

As the variables in the above model are all differenced to the same degree, I(1), the level of the dependent variable ($RCRP_t$) can be calculated by multiplying the coefficients of the differenced variables by the level data (Dell'Ano, 2007, p266). This gives the following equation:

$$RCRP_t = 9.090 + 4.070TS_t + 8.965TI_t - 3.946TM_t +$$

$$16.309RGNPP_t - 11.635RS_t - 6.155ISBP_t - 21.467XD_t \qquad (6.2)$$

According to the currency approach, the above equation reflects the total demand for money in circulation in Jordan, which includes money demand for both formal economic activities (formal money) and informal (shadow) economic activities (informal money). To separate the formal money in circulation from the total, the same equation is used with the assumption that the income and sales tax rates are zero and the tax rate on imports is fixed at its maximum rate (TMX). Other variables and their coefficients are kept unchanged. Consequently, the formal per capita real demand for money in circulation (FRCRP) is determined according to the following equation:

$$FRCRP_t = 9.090 - 3.946TMX + 16.309RGNPP_t - 11.635RS_t$$

$$- 6.155ISBP_t - 21.467XD_t \qquad (6.3)$$

By subtracting equation (6.3), which represents the estimated formal demand for money in circulation, from equation (6.2), which represents the estimated total demand for money in circulation, the informal per capita real demand for money in circulation (IFRCRP) is determined by the following equation:

$$IFRCRP_t = 4.070TS_t + 8.965TI_t - 3.946(TM_t - TMX) \qquad (6.4)$$

According to the currency approach, the informal demand for money in circulation is assumed to be used in the shadow economy. From equation (6.4), the annual excess (informal) currency in circulation caused by each type of tax is calculated. The annual velocity of currency in circulation, V_t, which is assumed to be equal for both formal and informal money, is calculated for Jordan by dividing the annual official GDP by the annual actual money in

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circulation. Then, the annual shadow economy caused by each type of tax is calculated by multiplying the annual velocity of money in circulation, Vt, by the annual informal money caused by each type of tax. Table (6.1) shows the estimated US$ value of the annual shadow economy in Jordan during the period 1976-2010, classified according to tax type whereas table (6.2) shows the estimated shadow economy as a percent of official GDP during the same period, classified according to tax type. The relative importance of each type of tax as a cause of the shadow economy in Jordan is calculated in table (6.3).

The currency approach estimates show that the average shadow economy in Jordan during the period 1976-2010 was around 14.7 percent of GDP. It increased from around US $104.9 million, or 6.1 percent of GDP, in 1976 to around US $6086 million, or 22.1 percent of GDP, in 2010. This increase was due to the increase in the total tax burden and to the change in tax structure in Jordan during the period of study. The total tax burden represented by the effective tax rate (total tax revenues/GDP) increased from 11.6 percent in 1976 to 15.3 percent in 2010. Furthermore, the structure of the tax revenues has changed when around 66.5 percent of the tax revenues in 1976 were generated from the tax on imports (custom duties) compared to only 9.2 percent in 2010. Only 13.8 percent and 10.3 percent of the tax revenues in 1976 were generated from income tax and domestic production fees respectively compared to 20.9 percent and 66.6 percent respectively in 2010. Therefore, the relative importance of various tax types as a cause of the shadow economy in Jordan varied during the period of study. The estimates show that the custom duties' contribution to the shadow economy in Jordan increased from around 22.2 percent of the shadow economy in 1976 (US $23.2 million, or 1.4 percent of GDP) to around 41.3 percent of the shadow economy in 2010 (US $2514.2 million, or 9.1 percent of GDP). That increase in the contribution of the custom duties in the shadow economy, which

followed the continuous reduction in custom tariffs in Jordan under the trade liberalization program, supports the study's argument that the taxes on imports negatively affect the size of the shadow economy. As tax on imports is reduced, protection of the domestic production decreases, causing the domestic producer to exit from the official markets and to engage in the shadow economy.

The estimates also show that the general sales tax (domestic production fees) contribution to the shadow economy in Jordan increased from around 23.2 percent of the shadow economy in 1976 (US $24.3 million, or 1.4 percent of GDP) to around 34.8 percent of the shadow economy in 2010 (US $2120.6 million, or 7.7 percent of GDP). The increase in the contribution of the GST to the shadow economy was mainly due to replacing the domestic production fees with a consumption tax in 1989, and then to a GST in 1994. This was followed by gradually raising the GST rate and broadening the base of this tax to include almost all commodities and most services.

On the other hand, despite the increase in the absolute value of the shadow economy caused by the income tax in Jordan from 1976 to 2010, the estimates show that the contribution of income tax to the shadow economy in Jordan witnessed a significant decrease from 54.7 percent of the shadow economy in 1976 to 23.8 percent of the shadow economy in 2010. The increase in the absolute value and percent of GDP of the shadow economy caused by income tax was attributed to the increase of the effective income tax rate (income tax revenues/GDP) from 1.6 percent in 1976 to 4 percent in 2010. The decline in the contribution of income tax to the shadow economy in Jordan was the net outcome of the increase in the contribution of both GST and custom duties to the shadow economy.

The trend of the shadow economy in Jordan shows that it fluctuated between 6.1 percent and 9.7 percent of GDP during the period 1976-1989. Average percent of GDP during that period was 7.2. After the sharp economic crises that faced Jordan in the late eighties, the shadow economy jumped up to 16.1 percent of GDP in 1990. That jump in the shadow economy was mainly attributed to the increase in the tax burden in Jordan due to replacing the domestic production fees with a consumption tax in 1989, in addition to the notable increase in the effective income tax rate. Due to the fall down in the tax burden in 1991 after reducing individual income tax rates from 12 tranches (with rates from 5 to 55 percent) to 10 tranches (with rates from 5 to 45 percent), the shadow economy witnessed some decline during the following three years (1991-1993), when the average shadow economy for those years amounted to 13.6 percent of GDP. In contrast, the shadow economy in Jordan witnessed some increase during the years 1994-1996. The average shadow economy for those three years jumped up to 18.7 percent of GDP and reached a high of 23.7 percent of GDP in 1996. That increase in the shadow economy was due to replacing the consumption tax imposed on a limited number of domestic commodities with a 7 percent GST on most domestic and imported commodities and some services in mid 1994 (20 percent on some luxury commodities), as well as raising the GST rate from 7 percent to 10 percent and broadening its base by increasing the number of services subject to this tax in 1996.
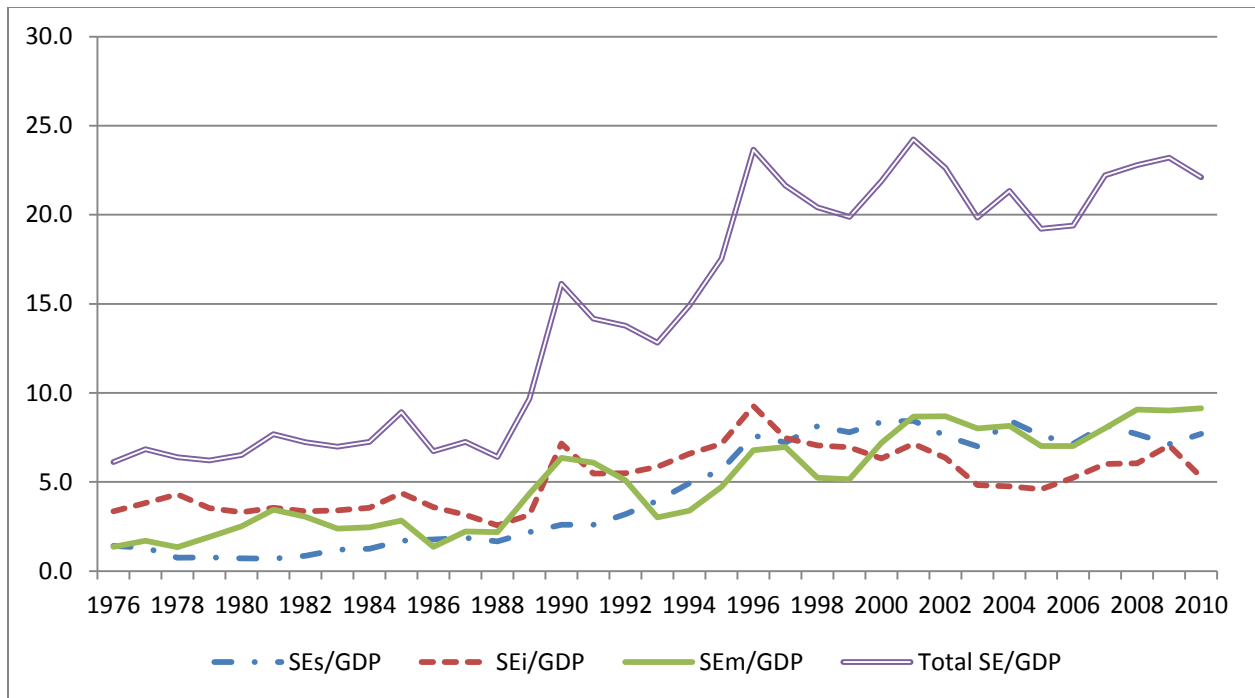
Figure 6. 1: Trend of the shadow economy in Jordan according to the currency approach (% of GDP)
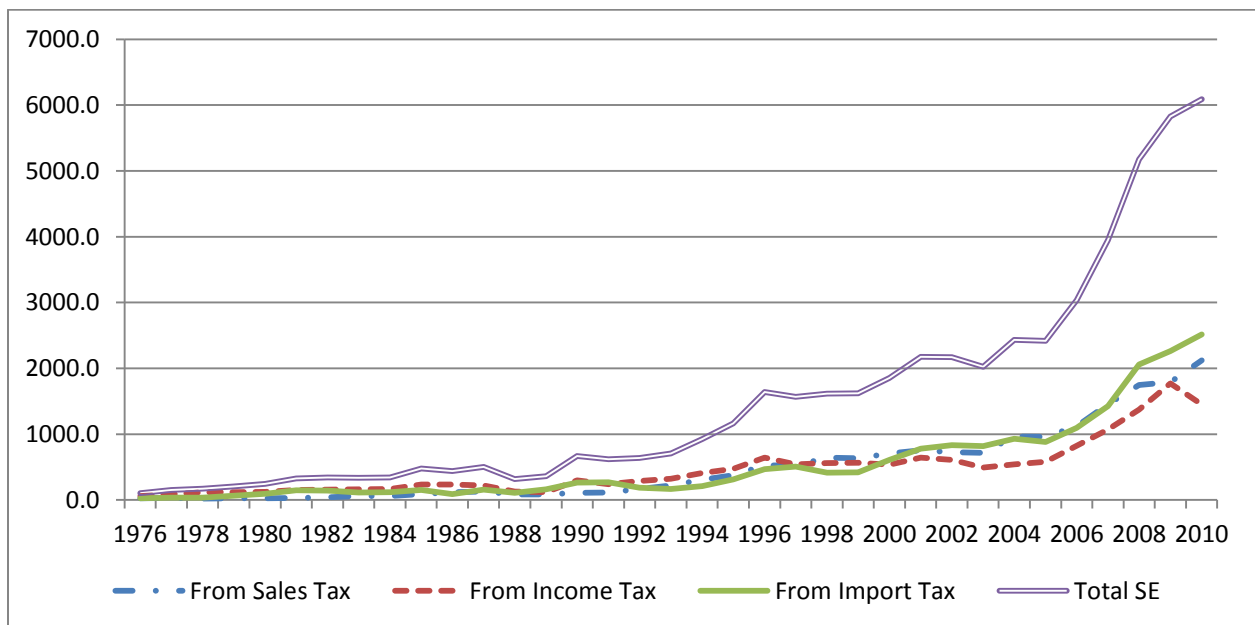
Figure 6. 2: Trend of the shadow economy in Jordan according to the currency approach (US$ million)

The shadow economy in Jordan witnessed remarkable fall down in the years 1997-1999, reaching 19.9 percent of GDP in 1999. That fall was mainly attributable to the significant amendments to the income and corporate tax law implemented in 1996 when the individual tax rates and tranches were reduced from 10 tranches with a maximum tax rate of 45 percent to 6 tranches with a maximum tax rate of 30 percent. Simultaneously, the corporate tax was reduced to only 3 rates (15%, 25%, 35%), according to the economic sector of the corporation.

In 1999, the Jordanian government had undertaken two significant tax measures that contributed to increasing the shadow economy in the years following. The first measure was raising the GST rate from 10 percent to 13 percent and reducing the number of goods and services exempted from the GST, while the second measure was reducing the custom duties on all imported commodities from a maximum rate of 340 percent to a maximum rate of 40 percent. As a result of those two measures, the shadow economy in Jordan increased in the years 2000 and 2001 to reach 21.9 percent of GDP and 24.2 percent of GDP, respectively.

After a further reduction in the individual income tax tranches and rates to 4 tranches with a maximum rate of 30 percent in 2001, the shadow economy in Jordan decreased again in 2002 and 2003 to reach 22.6 percent of GDP and 19.8 percent of GDP respectively. In 2004, the shadow economy in Jordan increased again to reach 21.3 percent of GDP. The main reasons behind that increase were the government decision to extend the GST at a rate of 2 percent to all previously exempted or zero-rated products and to petroleum products and the reduction of the tariff rate on industrial inputs to only 3 percent from previous rates between 5 and 10 percent.

It is worth noting that after raising the GST rate in Jordan from 13 percent to 16 percent in 2005, the absolute value of the shadow economy witnessed remarkable increase by annual average of 22 percent in the years 2006-2008. However, that increase was not equivalently

reflected as a percent of GDP because the official GDP during those years grew by unrecorded rates exceeded on average by 20 percent. The 16.6 percent increase in the absolute value of the shadow economy in 2006 was reflected by only a 0.2 percentage point increase in the shadow economy as a percent of GDP (to reach 19.4 percent). In 2007 and 2008, the 30 percent and 20.6 percent increases in the absolute value of the shadow economy were reflected by increases of only 2.8 percentage points and 0.6 percentage point of the shadow economy as a percent of GDP respectively (to reach 22.2 and 22.8 percent).

It is also worth noting that the shadow economy caused by the income tax in 2010 witnessed a decrease of 1.8 percentage points to reach 5.3 percent of GDP. That decrease was mainly due to the issuance of the new Income Tax Law for the year 2009, which includes cuts at varying ratios on corporate income tax rates in most sectors in order to contribute to creating an attractive investment environment. The law also contained measures to simplify the application of the tax system. On the other hand, the shadow economy caused by the sales tax in 2010 witnessed a notable increase in the absolute value whereas its ratio to GDP increased by only 0.6 percentage points to reach 7.7 percent of GDP. That increase was attributable to raising the special sales tax on some goods and services, mainly gasoline and cellular phone calls, by 12-18 percent in early 2010.

Table 6. 2 Estimated shadow economy in Jordan according to the currency approach (US$ million)

	From Sales Tax	From Income Tax	From Import Tax	Total SE
1976	24.3	57.3	23.2	**104.9**
1977	28.7	83.7	37.3	**149.7**
1978	20.2	116.9	36.3	**173.4**
1979	25.5	117.7	63.8	**207.0**
1980	27.1	124.4	94.8	**246.2**
1981	29.4	151.6	147.1	**328.2**
1982	39.9	157.4	142.6	**339.9**
1983	57.6	163.5	114.9	**336.0**
1984	58.7	167.2	116.1	**341.9**
1985	90.8	234.7	152.1	**477.5**
1986	115.7	233.9	88.8	**438.4**
1987	129.6	219.5	154.8	**504.0**
1988	81.9	126.3	107.2	**315.4**
1989	81.7	117.9	162.3	**361.8**
1990	108.2	297.3	263.6	**669.1**
1991	114.1	240.0	266.7	**620.9**
1992	166.3	286.6	4.4	**457.3**
1993	217.8	323.3	166.6	**707.7**
1994	306.4	409.9	210.7	**927.0**
1995	376.7	474.5	313.8	**1165.0**
1996	527.3	641.4	469.9	**1638.6**
1997	523.2	540.8	504.4	**1568.4**
1998	643.3	558.1	414.8	**1616.2**
1999	634.2	566.1	419.3	**1619.6**
2000	707.9	534.2	609.5	**1851.7**
2001	756.5	640.4	777.6	**2174.6**
2002	727.0	608.2	832.9	**2168.1**
2003	714.0	492.1	816.7	**2022.8**
2004	963.7	541.3	929.5	**2434.5**
2005	958.2	578.4	882.3	**2418.9**
2006	1117.3	821.0	1097.3	**3035.5**
2007	1452.4	1068.7	1426.3	**3947.4**
2008	1745.3	1371.7	2059.0	**5175.9**
2009	1790.9	1772.3	2263.6	**5826.9**
2010	2120.6	1451.2	2514.2	**6086.0**

Table 6. 3: Estimated shadow economy in Jordan according to the currency approach (% of GDP)

	From Sales Tax	From Income Tax	From Import Tax	Total SE/GDP
1976	1.4	3.3	1.4	**6.1**
1977	1.3	3.8	0.8	**6.8**
1978	0.7	4.3	1.3	**6.4**
1979	0.8	3.5	1.9	**6.2**
1980	0.7	3.3	2.5	**6.5**
1981	0.7	3.5	3.4	**7.7**
1982	0.8	3.4	3.0	**7.2**
1983	1.2	3.4	2.4	**7.0**
1984	1.2	3.5	2.5	**7.3**
1985	1.7	4.4	2.8	**8.9**
1986	1.8	3.6	1.4	**6.7**
1987	1.9	3.2	2.2	**7.3**
1988	1.7	2.6	2.2	**6.4**
1989	2.2	3.1	4.3	**9.7**
1990	2.6	7.2	6.3	**16.1**
1991	2.6	5.5	6.1	**14.2**
1992	3.2	5.5	5.1	**13.8**
1993	3.9	5.9	3.0	**12.8**
1994	4.9	6.6	3.4	**14.9**
1995	5.7	7.1	4.7	**17.5**
1996	7.6	9.3	6.8	**23.7**
1997	7.2	7.5	7.0	**21.6**
1998	8.1	7.1	5.2	**20.4**
1999	7.8	6.9	5.1	**19.9**
2000	8.4	6.3	7.2	**21.9**
2001	8.4	7.1	8.7	**24.2**
2002	7.6	6.3	8.7	**22.6**
2003	7.0	4.8	8.0	**19.8**
2004	8.4	4.7	8.1	**21.3**
2005	7.6	4.6	7.0	**19.2**
2006	7.1	5.2	7.0	**19.4**
2007	8.2	6.0	8.0	**22.2**
2008	7.7	6.0	9.1	**22.8**
2009	7.1	7.1	9.0	**23.2**
2010	7.7	5.3	9.1	**22.1**

Table 6. 4: Taxes' contribution in the shadow economy in Jordan
(Percentage points)

	Sales Tax	Income Tax	Custom Duties	Total
1976	23.2	54.7	22.2	100
1977	19.2	55.9	24.9	100
1978	11.7	67.4	20.9	100
1979	12.3	56.9	30.8	100
1980	11.0	50.5	38.5	100
1981	9.0	46.2	44.8	100
1982	11.7	46.3	42.0	100
1983	17.1	48.7	34.2	100
1984	17.2	48.9	34.0	100
1985	19.0	49.1	31.8	100
1986	26.4	53.4	20.3	100
1987	25.7	43.6	30.7	100
1988	26.0	40.1	34.0	100
1989	22.6	32.6	44.8	100
1990	16.2	44.4	39.4	100
1991	18.4	38.7	43.0	100
1992	36.4	62.7	1.0	100
1993	30.8	45.7	23.5	100
1994	33.1	44.2	22.7	100
1995	32.3	40.7	26.9	100
1996	32.2	39.1	28.7	100
1997	33.4	34.5	32.2	100
1998	39.8	34.5	25.7	100
1999	39.2	35.0	25.9	100
2000	38.2	28.9	32.9	100
2001	34.8	29.5	35.8	100
2002	33.5	28.1	38.4	100
2003	35.3	24.3	40.4	100
2004	39.6	22.2	38.2	100
2005	39.6	23.9	36.5	100
2006	36.8	27.0	36.1	100
2007	36.8	27.1	36.1	100
2008	33.7	26.5	39.8	100
2009	30.7	30.4	38.8	100
2010	34.8	23.8	41.3	100

7. CHAPTER SEVEN: ESTIMATING THE SHADOW ECONOMY BY THE MIMIC APPROACH

The use of the MIMIC approach for estimating the shadow economy is relatively recent. The empirical MIMIC method used is very different from the currency method used in chapter six. This approach is based on the idea that the shadow economy is a latent variable which is caused by multiple variables and simultaneously has multiple indicators. Therefore, by using a particular type of a structural equations model (SEM), it is possible to estimate an overtime index for the shadow economy in a particular country. Then, the shadow economy index is transferred, by using a benchmarking procedure and an external value of the shadow economy for that country for some point in the time series, to a time series of shadow economy in that country as percents of official GDP.

The purpose of this chapter is to estimate the annual size of the shadow economy in Jordan during the period 1976-2010 by using the MIMIC approach. The MIMIC estimation process requires conducting more than one specification of the model to reach the best fitting one. Each specification includes a different number of variables. Selecting the total number of causes and variables to start with in the first specification depends on the total sample size and the number of parameters in the model; the number of parameters to be estimated should be less than the total sample size. To estimate the shadow economy in Jordan, we start with a (6-1-3) (six causes, one latent variable, and three indicators). The variables which are not significant are gradually omitted until the best fitting model is reached. The shadow economy is considered the

latent variable in this model. The six causal variables that are used in this specification are different combinations of the following variables:

- The effective tax rate on sales (TS).

- The effective income tax rate (TI).

- The effective tax rate on imports (TM).

- Unemployment rate (U).

- Government intervention in the economy (LG)

- Inflation rate (P).

- A dummy variable for the depreciation of the Jordanian dinar in 1988 (XD = 1 for the years 1988-2010, and XD = 0 for the years before 1988).

As for the indicators, the following three variables are used:

- Growth rate of real GDP (the normalized indicator).

- Growth rate of real currency in circulation.

- Growth rate of real private consumption.

For the (6-1-3) specification, the structural equation to be estimated, which defines the relationship between the latent variable (shadow economy) and its causes, includes six causes of the shadow economy and is given by:

$$SE_t = \gamma_1 x_{1t} + \gamma_2 x_{2t} + \gamma_3 x_{3t} + \gamma_4 x_{4t} + \gamma_5 x_{5t} + \gamma_6 x_{6t} + \zeta \qquad (7\text{-}1)$$

Where SE is the scale of the shadow economy and x_i is different combinations from the above causes of the shadow economy.

In such a specification, we have three measurement equations defining the relationship between the latent variable (shadow economy) and its indicators. The first measurement equation, which links the real GDP with the shadow economy SE, is given by:

$$GRGDP_t = \lambda_1 SE_{t} + \epsilon \qquad\qquad (7\text{-}2)$$

Where GRGDP is the growth rate of gross domestic product in constant prices, which is considered the normalized variable, therefore its coefficient is fixed at one ($\lambda_1=1$).

The second measurement equation, which links the growth rate of currency in circulation in constant prices (GRCR) with the shadow economy, is given by:

$$GRCR_t = \lambda_2 SE_{t} + \epsilon \qquad\qquad (7\text{-}3)$$

The third measurement equation, which links the real consumption (GRCON) with the shadow economy, is given by:

$$GRCON_t = \lambda_2 SE_{t} + \epsilon \qquad\qquad (7\text{-}4)$$

Many specifications were estimated to get the best fitting model by the maximum likelihood estimator (MLE) via the program LISREL 8.80, which is specialized in estimating the structural equations models. In each specification we gradually omitted the statistically insignificant variables. It is worth noting that when the three types of taxes (income tax, sales tax, and custom duties) are used as separate causes in the model, the model either does not converge or the variables are not significant. Therefore, we follow Macias and Cazzavillan (2010) in considering all taxes in one variable as the effective tax rate (total tax revenues/GDP). After conducting many specifications, the end result is the (4-1-2) specification, which is considered

the best fitting model. Table (7-1) shows the model's results, which converged after nine iterations.

There are many tests that examine the model's overall goodness of fit (appendix B). The most popular test is the Root Mean Square Error of Approximation (RMSEA). Accepted models are considered to have a RMSEA of less than 0.10. The results show that the value of the RMSEA is 0.065, which indicates that the model exhibits acceptable and good performance fit. The other popular tests for the goodness of fit are the Bentler Bonett Index, or Normed Fit Index (NFI) and the Tucker Lewis Index, or Non-Normed Fit Index (NNFI). NFI and NNFI vary from 0 to 1, where 1 is the complete fit model. The NFI's problem is that there is no penalty for adding parameters, whereas the NNFI includes such a penalty. The values of NFI and NNFI are 0.93 and 0.91 respectively, which indicate a good model fit. The Goodness-of-Fit Index (GFI) and the Adjusted Goodness-of-Fit Index (AGFI) are also used to test the model goodness of fit. GFI and AGFI vary from 0 to 1. They reflect the percent of observed covariance explained by the covariance implied by the model (similar to R^2 and adjusted R^2 in the multiple regression model). The results show that the GFI and AGFI are high at 0.97 and 0.77 respectively, which indicate a good model fit.

The MIMIC model results indicate that the coefficient sign of the effective tax rate (T) is positive as expected. This variable is significant at the 1 percent confidence level. The coefficient sign of the government intervention in the economy (LG) is also positive and this variable is significant at the 1 percent confidence level as well. These two results are consistent with previous studies that have found taxes and regulations to be the main causes of the shadow economy.

Table 7. 1:The MIMIC model results for the Jordanian economy

Causal Variables	Estimated Coefficients
Effective tax rate (T = tax revenue/GDP)	0.14** (0.04)
Unemployment rate (U)	-0.67* (0.31)
Regulation (LG = government labor/labor force)	4.18** (1.31)
JD depreciation (XD)	2.26* (1.14)
Indicator Variables	
GDP (real growth rate)	1.00
Private consumption (real growth rate)	1.88** 0.46
Test-statistics	NFI= 0.93 NNFI= 0.91 RMSEA= 0.065 GFI= 0.97 AGFI= 0.77

*, ** indicates that t-statistics is significant at 95% or 99% confidence level, respectively.

In the same direction, the dummy variable of the Jordanian dinar depreciation in 1988 has a positive sign and is significant at the 5 percent confidence level. This supports the study hypothesis that this variable has a positive effect on the shadow economy in Jordan. The unemployment rate, however, has a negative sign and is significant at the 5 percent confidence

level. This indicates that the income effect of unemployment, which reduces the shadow economy, is greater than the substitution effect, which increases the shadow economy, in Jordan.

By substituting the estimated coefficients, the MIMIC model for estimating the shadow economy in Jordan is determined according to the following equations:

Measurement equations:

$$GRGDP_t = (1) * SE_t \qquad\qquad (7\text{-}5)$$

$$GRCON_t = 1.88 * SE_t \qquad\qquad (7\text{-}6)$$

Structural equation:

$$SE = 0.14*dT - 0.67*dU + 4.18*dLG + 2.26 * XD \qquad\qquad (7\text{-}7)$$

From equation (7-7), annual indices (ordinal values) for the shadow economy in Jordan are calculated for the period 1976-2010. To convert those indices to the values of the shadow economy as a percentage of the official GDP, an external estimation of the shadow economy in Jordan is needed for one year in the period of study, and then this estimation is used in implementing benchmarking or calibration procedures. For this purpose, the average of the shadow economy in Jordan for the year 1999 from Schneider (2007) and Schneider et al (2010) was used (19.4 percent of GDP). Dell' Anno's (2007) procedure of benchmarking, explained in chapter four, was followed. The annual estimated index of the shadow economy and the external estimation of the shadow economy for Jordan in the year 1999 were substituted in equations 4-14. Consequently, the annual ratios of the shadow economy as percentages of GDP in Jordan were calculated for the period 1976-2010. From those ratios, the US$ values of the shadow economy

were calculated for that period. Table (7-2) shows the estimated US$ value of the shadow economy and the shadow economy as a percentage of GDP in Jordan during the period of study.

The MIMIC approach estimates show that the average shadow economy in Jordan for the period 1976-2010 was 27.7 percent of GDP. Despite the absolute value of the shadow economy during that period witnessed continuous increases, from US$536.4 million in 1976 to US$5534 million in 2010, its percentage to GDP has decreased from 31.3 percent in 1976 to 20.1 percent in 2010. Those developments in the shadow economy were due to the net effect of the change in the causal factors that affect the shadow economy according to our estimated MMIC model for Jordan; namely the total tax burden (represented by the effective tax rate), unemployment rate, the government intervention in the economy, and the depreciation of the Jordanian dinar.

Figure (7-1) shows that the general trend of the shadow economy in Jordan according to the MIMIC approach went downward during the period 1976-2010 despite the upward trend in some years during that period. The shadow economy witnessed a notable increase in the late seventies to reach 37 percent of GDP in 1979. That increase was mainly due to the extension in the government intervention in the Jordanian economy when the ratio of government labor in the total labor force increased from 11.5 percent in 1976 to 13.9 percent in 1979. In contrast to its upward trend in the second half of the seventies, the shadow economy witnessed a downward trend in the first half of the eighties, to reach 32.7 percent of GDP in 1986. This decrease was affected by the remarkable increase of the unemployment rate in the Jordanian economy during that period, which increased from 3.5 percent in 1980 to 8 percent in 1986. After that, the shadow economy increased and reached its peak of 37.1 percent of GDP in 1988 as a result of the depreciation of the Jordanian dinar by 50 percent that year.
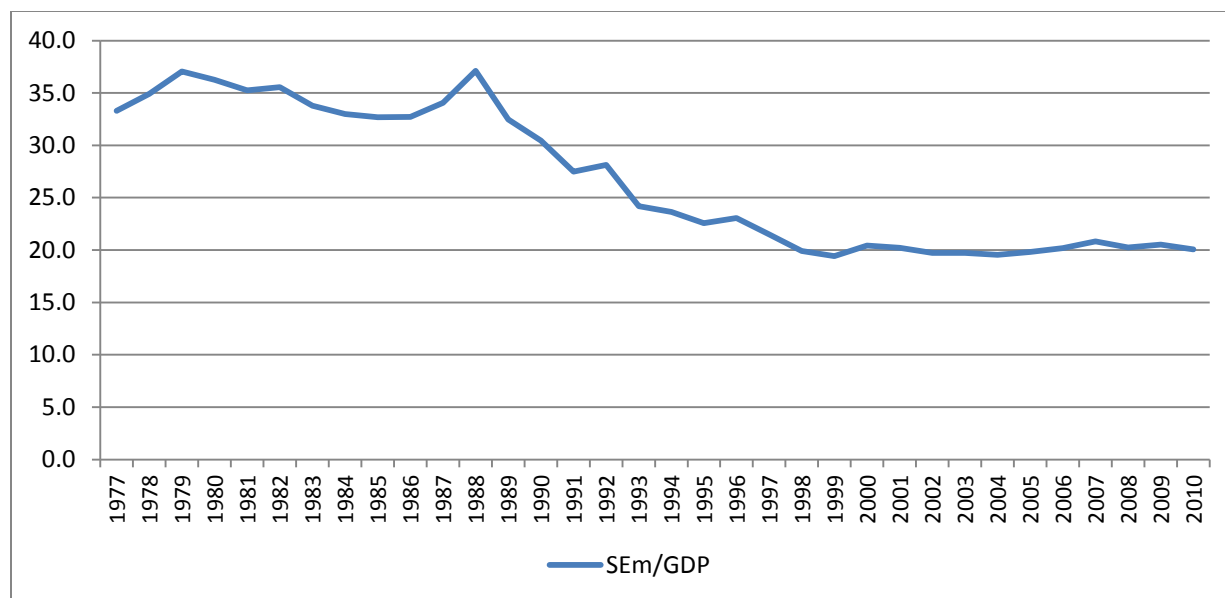
Figure 7. 1: Trend of the shadow economy in Jordan according to the MIMIC approach (% of GDP)

The sharp economic crises in Jordan in the late eighties boosted unemployment to unrecorded rates in the first half of the nineties. This, in turn, caused continuous fall down in the shadow economy during those years to reach 22.6 percent of GDP in 1995. After that, the shadow economy witnessed a slight increase to 23 percent of GDP in 1996, which was due to a net result of the increase in the effective tax rate by 1 percentage point after raising the GST rate from 7 percent to 10 percent in 1995, and to the decrease in the unemployment rate by 2.3 percent. As a result of implementing a privatization program with the aim of rebalancing the role of the public sector in the economy in Jordan in the mid-nineties, the government intervention in the economy shrunk during the second half of nineties which, in addition to the increase in unemployment rates, caused a decline in the shadow economy in those years to reach 19.4 percent of GDP in 1999.

In 2000, the shadow economy increased by one percentage point to 20.4 percent of GDP. That increase was an outcome of the increase in the effective tax rate from 15.3 percent in 1999

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to 16 percent in 2000, after raising GST rate from 10 percent to 13 percent in 1999, and the decrease in unemployment rate from 15.6 percent in 1999 to 13.7 percent in 2000. During the period 2001-2010, the shadow economy witnessed a slight change; it decreased slowly during the years 2001-2004 to reach 19.5 percent of GDP in 2004, then it increased slowly during the years 2005-2007 to reach 20.8 percent of GDP in 2007, and finally it fluctuated between 20.1 percent and 20.5 percent of GDP during the years 2008-2010.
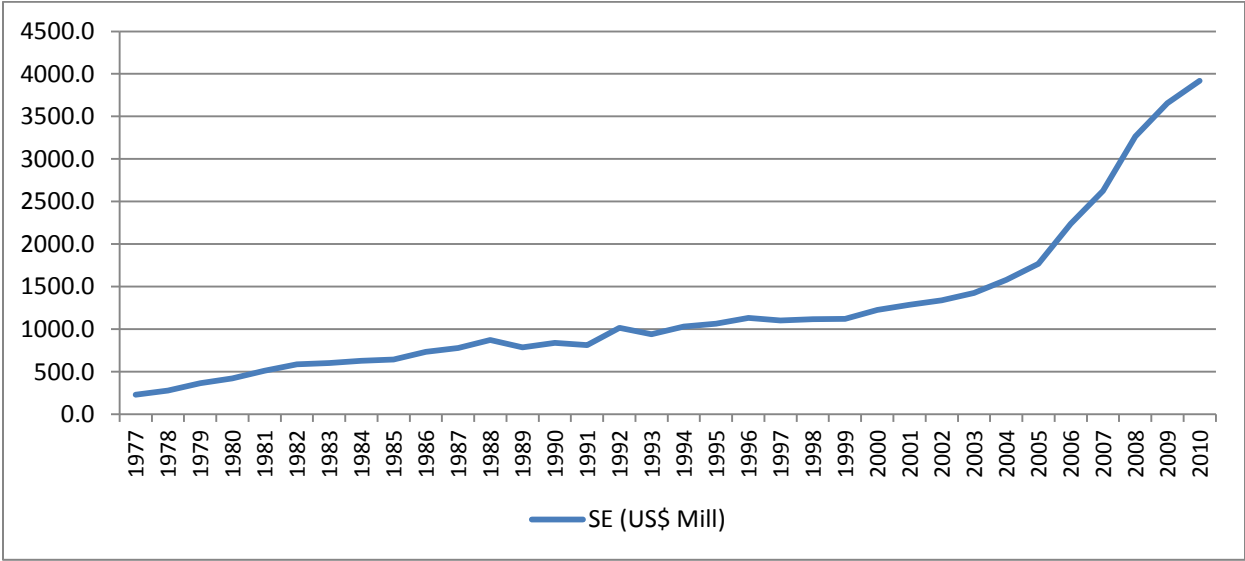
Figure 7. 2: Trend of the shadow economy in Jordan according to the MIMIC approach (US$ million)
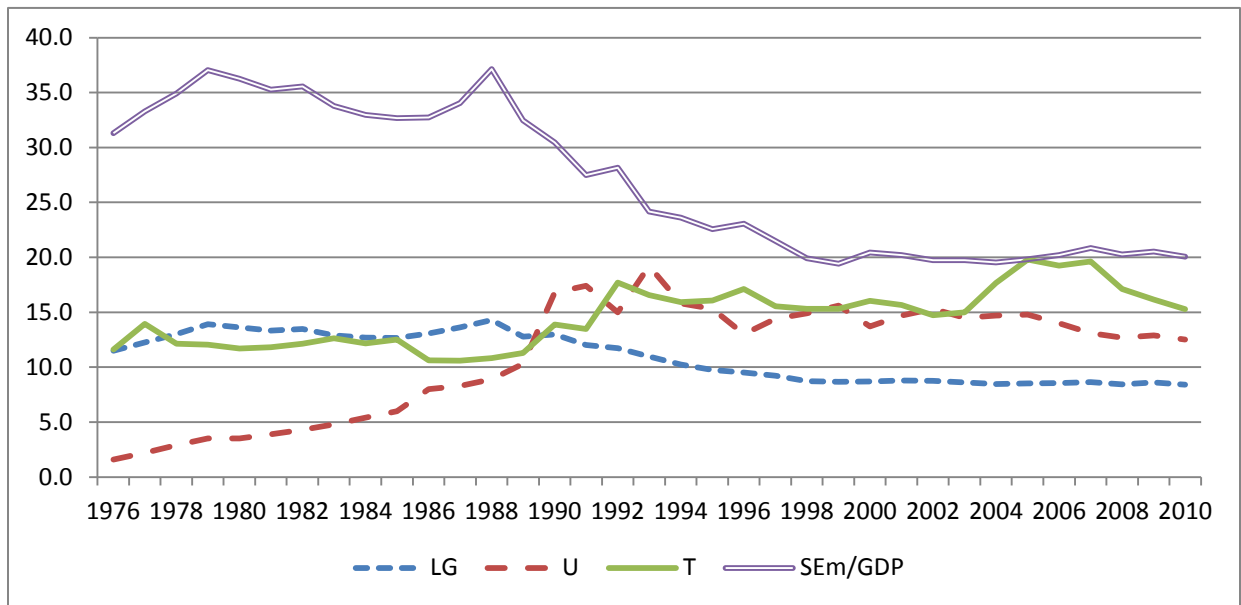
Figure 7. 3: Trends of the shadow economy and its causes according to the MIMIC approach

8. CHAPTER EIGHT: CONSEQUENCES AND POLICY IMPLICATIONS OF THE SHADOW ECONOMY

Despite the increasing interest in estimating the size of the shadow economy in various countries, less attention has been paid to investigating the various consequences of the shadow economy and analyzing its policy implications. As taxes are considered the main cause of the shadow economy, the government's loss of tax revenue is considered the main consequence of this economic activity. Furthermore, the shadow economy negatively affects the accuracy of official economic statistics. Therefore, it is very important for the economic policy makers to consider the existence of the shadow economy in their policy making and statistical collection. In this chapter, we analyze the consequences and the policy implications of the shadow economy in Jordan, estimate the size of tax evasion based on estimates of the size of the shadow economy in Jordan (from chapters seven and eight).

8.1. Consequences of the shadow economy

8.1.1. The tax evasion:

Tax evasion is a secret and illegal activity. It is therefore very difficult to precisely estimate its size in the economy. Although estimating tax evasion needs separate research, many economists, for example Tanzi (1983), Giles (1999), and Faal (2007), conduct some estimates for the size of tax evasion in various countries based on their estimates of the size of the shadow economy in those countries. They do this by assuming that shadow economic activities would have been taxed at the same rates as the official economic activities. According to Tanzi (1983,

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pp. 203), this assumption "yields the most reasonable estimates that can be made in view of the information available". In this section, we follow the methodology of these economists to estimate the size of tax evasion in Jordan by applying the effective tax rates for income and sales to the estimated size of the shadow economy in Jordan. Tables (8-1) and (8-2) show our estimates of the annual size of income and sales tax evasion in Jordan during the period (1976-2010) according to the currency and the MIMIC approaches respectively. Table (8-1) shows that the aggregate tax evasion for both types of tax increased according to the currency approach from US$3.3 million, or about 3.1 percent of the government domestic revenues, in 1976 to US$814 million, or 19.1 percent of the government domestic revenues, in 2010. The total tax evasion in Jordan over the entire period is estimated to be around US$6.1 billion, while the annual average tax evasion for the period is estimated to be US$174.1 million, or about 8.4 percent of domestic government revenues.

On the other hand, table (8-2) shows that the aggregate tax evasion from the income tax and the sales tax increased according to the MIMIC approach from US$16.6 million, or about 15.5 percent of the government domestic revenues, in 1976 to US$741.5 million, or 17.4 percent of the government domestic revenues, in 2010. The total tax evasion in Jordan for the entire period is estimated to be around US$6.7 billion, while the annual average tax evasion for the period is estimated to be US$191.4 million, or about 14.6 percent of the domestic government revenues.

The shortfall in the government tax revenues due to the tax evasion creates a gap between the actual and potential tax revenues which in turn increases the budget deficit. This gap has various harmful consequences for the economy. The shortage in government revenues reduces the quality and quantity of public goods and services the government can provide. In order to

compensate for that shortage in the tax revenues and to cover the overall financing needs of the public budget, the government may have to raise tax rates. This is likely to induce people to increase their engagement in the shadow economy to evade paying more taxes. The result may be a vicious cycle with an increasing size of the shadow economy and the amount of tax evasion, eventually worsening the distortions in the economy even more and having serious distributional consequences.

On the other hand, the government may be forced to borrow money from domestic or external sources to cover the shortage in the tax revenues due to tax evasion. The increase in the public debt outstanding will be associated with an increase in public debt service (interest and principal) payments in the public budget, which can dramatically worsen the public budget deficit and also contribute to distortions in the economy.

8.1.2. The monetary side

The key assumption in estimating the size of the shadow economy is that people who engage in shadow economic activities use cash in their transactions in order to evade paying income and sales taxes on those activities. An increase in the size of the shadow economy therefore leads to a proportional increase in the demand for money in circulation. Since the expansion in the money supply is specified by the central bank based on the expected growth of the official output (GDP), the supply of money in circulation will be less than the demand which should put upward pressure on interest rates and on the general prices level.

Furthermore, the expansion in government demand for borrowing to cover the loss of tax revenues due to the tax evasion will rival the private sector for banking deposits which will also cause a rise in interest rates and, consequently, an increase in the cost of investment.

8.1.3. Firm's size

Working in the shadow economy requires firms to hide their activities from the official authorities. Since it is very difficult for large firms to do that, firms that work in the shadow economy will tend to seek to stay small in order to remain undetected. This prevents those firms from achieving benefits of the economies of scale. Shadow economy firms also compete with official firms. Therefore, the official firms' plans of expansion will tend to be negatively affected by the existence of the shadow economy. As a result, most firms in the economy will tend to remain small whatever or not it is efficient to do so.

8.1.4. Accuracy of the national accounts statistics

The existence of the shadow economy makes the official national accounts statistics inaccurate in representing the true performance of the economy. In particular, unreported shadow economic activities underestimate the officially published GDP by the size of the shadow economy. Consequently, all popular economic indicators that are expressed as a percent of GDP will be overestimated. For instance, the budget deficit, the current account deficit, and the public debt as percentage of GDP will be higher than the true values if the shadow economy is reported. On the other hand, the unreported shadow economy underestimates the per capita GDP in the country which is often used as an indicator of the standard of living in the country and as a measure of comparison among various countries.

High tax rates induce labor to shift from the formal economy to the shadow economy. Most laborers who work in the shadow economy are not included in the official labor census due to the secret nature of shadow economic activities. As a result, the officially published employment statistics do not reflect the true employment in the labor market which leads to overestimate unemployment rates. Consequently, the other economic policies and indicators that

are related to the unemployment, such as poverty indicators and social welfare allocations and government subsidies, will be distorted.

On the inflation side, it is known that the consumer price index measures the general price level of goods and services in the official market and it does not include the price level in the shadow economy. Usually, the prices of goods and services produced in the shadow economy are lower than their prices in the formal economy due to the lower cost and the tax evasion in the shadow economy. Therefore, official inflation rates overestimate the price level in the economy which causes a distortion in related economic indicators such as the real economic growth, the real interest rates, and real effective exchange rate.

8.1.5. Poverty

Literature on the shadow economy shows that the net effect of the shadow economy on poverty is ambiguous. On one side, the shortfall in the government revenues due to the shadow economy and the consequent tax evasion has a negative effect on poverty. It leads to reducing government social programs and allocations that aimed at alleviating poverty. This, in turn, increases the size of poverty. On the other side, income earned in the shadow economy has a positive effect in reducing the poverty level. The net effect depends on which is bigger the negative effect or the positive effect of the shadow economy on poverty.

8.2. Policy implications of the shadow economy

With all of these negative consequences of the shadow economy, governments should pay more attention to this phenomenon and expend more effort to reduce the size of the shadow economy and minimize its negative consequences. Reducing the size of the shadow economy is not an easy task; it needs time and requires implementing some economic, legal, and administrative measures. However, we believe that some negative consequences of the shadow

economy, particularly those related to the accuracy of the national account statistics, could be reduced with some effort by the government. In this section, we analyze the policy implications of the shadow economy.

When policy makers design economic policies they use official statistics. The efficiency of policy depends upon the level of accuracy in those statistics. Since the official statistics do not represent the true indicators of the economy, as mentioned above, the outcome of the economic policy will tend to be inefficient. The government will need to try to reduce the discrepancy between the official indicators and the true indicators. This can be achieved if policy makers take into consideration the existence of the shadow economy when considering their policies. The government could conduct periodic estimates of the size of the shadow economy and include the results of the estimation in the official statistics. To do so, a specialized unit should be established in the department of economics and staffed with qualified experts to conduct this mission.

As taxes are found to be the main driving force of the shadow economy, reforming the tax system by imposing reasonable tax rates and simplifying the tax procedures should contribute to reducing the size of the shadow economy. Specifying optimal tax rates is an important issue which needs separate research. High taxes are not necessarily associated with high tax revenues due to the tax evasion. Therefore, governments should concentrate on extending the tax base to collect sufficient tax revenues rather than raising individual tax rates. Furthermore, legal reforms should be associated with tax reforms to adopt a high level of transparency and accountability in the tax system. The reforms should concentrate on the strict enforcement of laws against working in the shadow economy and evading taxes, including implementing strict penalties and financial sanctions.

Implementing tax incentive policy, particularly for individual firms and micro-enterprises, will reduce the incentives for the owners of those firms to engage in activities in the shadow economy. The tax incentives may include adopting tax exemption or tax holiday for specific periods for individual firms in the sectors of large shadow economic activities. This will encourage those firms to report their economic activities to the official authorities. In addition, applying simple and cost effective techniques by imposing lump-sum tax on small and micro-enterprises will help the government to capture shadow economic activities. In this regard, there is a need to conduct research and analysis to identify the impact of tax incentives and incidence of existing tax rates on the shadow economy.

Excessive government intervention in the economy is another reason that induces people to engage in activities in the shadow economy. Regulations can cause rigidities and hurt market competition which distorts incentives for resources allocation in the economy. If government intervention in the economy is extensive, people may prefer to exit from the formal economy to work in the shadow economy. Although some degree of regulation is necessary, over-regulation creates barriers to entering the formal market and increases the costs of working in the formal economy. To reduce incentives to work in the shadow economy, the government should minimize the rigidity and the complexity of regulations and reduce unnecessary intervention in the economy. Creating an attractive business environment in the formal economy can be achieved by enhancing economic freedom, removing market barriers, and simplifying the bureaucratic procedures that are required for working in the formal economy. In addition, governments should emphasize the rule of law by enforcing regulations in a transparent way.

Table 8. 1: Tax evasion (TE) in Jordan according to the currency approach

	Total SE (US$ Mill)	TI (%)	Income TE (US$ Mill)	TS (%)	Sales TE (US$ Mill)	Total TE (US$ Mill)	Total TE (% of Gov Domestic Revenues)
1976	104.9	1.6	1.7	1.5	1.6	3.3	3.1
1977	149.7	1.9	2.9	1.4	2.1	5	3.5
1978	173.4	2.3	4	0.9	1.5	5.6	3.5
1979	207	2.3	4.7	1.1	2.2	6.9	3.7
1980	246.2	2.4	5.9	1.1	2.8	8.7	3.8
1981	328.2	2.8	9.1	1.2	3.8	12.9	4.2
1982	339.9	2.6	9	1.5	5	14	3.9
1983	336	2.6	8.7	2	6.6	15.3	3.8
1984	341.9	2.6	8.7	1.9	6.7	15.4	3.7
1985	477.5	2.8	13.2	2.3	11.1	24.3	5.5
1986	438.4	2.1	9.4	2.3	10.1	19.5	3.8
1987	504	2	10	2.5	12.8	22.8	4.3
1988	315.4	1.8	5.8	2.6	8.2	14	2.6
1989	361.8	2.1	7.7	3.2	11.6	19.2	3.4
1990	669.1	4.1	27.6	3.3	21.9	49.5	6.7
1991	620.9	3.1	19.5	3.2	20.2	39.6	4.8
1992	637.1	3	19.3	3.8	24.4	43.7	3.6
1993	707.7	3.1	21.6	4.5	31.7	53.4	4.4
1994	927	3.1	29.1	5.1	47.3	76.3	5.9
1995	1165	3.2	37.7	5.6	65.1	102.8	7.3
1996	1638.6	3.5	57.8	6.3	103.4	161.2	11.3
1997	1568.4	2.9	45.7	6.1	96.3	142	10.3
1998	1616.2	2.5	40.2	6.2	100.9	141.1	9.6
1999	1619.6	2.6	42.8	6.4	104.4	147.2	9.8
2000	1851.7	2.7	49.7	7.7	143.4	193.1	12.1
2001	2174.6	3.1	66.8	7.9	171.8	238.6	14.4
2002	2168.1	2.9	62.6	7.5	163	225.6	13.7
2003	2022.8	2.6	53.4	8.3	168.8	222.3	13.3
2004	2434.5	2.7	65.6	10.4	254.2	319.7	14.9
2005	2418.9	3.2	76.9	11.5	277.4	354.2	13.8
2006	3035.5	3.7	112.6	11	333.6	446.2	14.1
2007	3947.4	3.9	155.1	11.6	459	614.1	16.9
2008	5175.9	3.7	193.9	10.4	537.1	731	16.7
2009	5826.9	4.3	250.1	9.4	550.3	800.4	19.1
2010	6086	3.2	194.7	10.2	619.4	814	19.1

Table 8. 2: Tax evasion (TE) in Jordan according to the MIMIC approach

	Total SE (US$ Mill)	TI (%)	Income TE (US$ Mill)	TS (%)	Sales TE (US$ Mill)	Total TE (US$ Mill)	Total TE (% of Gov Domestic Revenues)
1976	536.4	1.6	8.6	**1.5**	8	16.6	15.5
1977	699.8	1.9	13.3	1.4	9.8	23.1	16.2
1978	911.6	2.3	21	0.9	8.2	29.2	18.4
1979	1216.2	2.3	28	1.1	13.4	41.4	22
1980	1422.1	2.4	34.1	1.1	15.6	49.8	22
1981	1550.5	2.8	43.4	1.2	18.6	62	20.1
1982	1669.6	2.6	43.4	1.5	25	68.5	18.9
1983	1666.7	2.6	43.3	2	33.3	76.7	19.1
1984	1642.2	2.6	42.7	1.9	31.2	73.9	17.8
1985	1637.3	2.8	45.8	2.3	37.7	83.5	18.9
1986	2104.1	2.1	44.2	2.3	48.4	92.6	18
1987	2306.8	2	46.1	2.5	57.7	103.8	19.5
1988	2331.8	1.8	42	2.6	60.6	102.6	18.8
1989	1377	2.1	28.9	3.2	44.1	73	12.9
1990	1271.2	4.1	52.1	3.3	41.9	94.1	12.6
1991	1197.1	3.1	37.1	3.2	38.3	75.4	9.1
1992	1497.5	3	44.9	3.8	56.9	101.8	8.3
1993	1357.6	3.1	42.1	4.5	61.1	103.2	8.5
1994	1475.9	3.1	45.8	5.1	75.3	121	9.3
1995	1520.3	3.2	48.6	5.6	85.1	133.8	9.5
1996	1599	3.5	56	6.3	100.7	156.7	10.9
1997	1559.6	2.9	45.2	6.1	95.1	140.4	10.2
1998	1578.9	2.5	39.5	6.2	97.9	137.4	9.3
1999	1585.1	2.6	41.2	6.4	101.4	142.7	9.5
2000	1732.2	2.7	46.8	7.7	133.4	180.1	11.3
2001	1817.4	3.1	56.3	7.9	143.6	199.9	12.1
2002	1894	2.9	54.9	7.5	142.1	197	12
2003	2015.5	2.6	52.4	8.3	167.3	219.7	13.1
2004	2231.7	2.7	60.3	10.4	232.1	292.4	13.6
2005	2499.7	3.2	80	11.5	287.5	367.5	14.3
2006	3163.9	3.7	117.1	11	348	465.1	14.7
2007	3706.9	3.9	144.6	11.6	430	574.6	15.8
2008	4608	3.7	170.5	10.4	479.2	649.7	14.8
2009	5160.4	4.3	221.9	9.4	485.1	707	16.9
2010	5533.5	3.2	177.1	10.2	564.4	741.5	17.4

9. CHAPTER NINE: SUMMARY AND CONCLUSION

9.1. Summary

The shadow economy represents economic activities with monetary transactions that are subject to tax but are not reported to the tax authorities or to statistical institutions in order to avoid regulations and evade paying tax on the sales and income resulting from these activities. This dissertation estimates the annual size of the shadow economy in Jordan for period 1976-2010 using two methodologies: the currency approach and the multiple indicators multiple causes (MIMIC) approach. It also analyzes the economic consequences and the policy implications of the shadow economy, concentrating on estimating the amount of tax evasion in Jordan during the aforementioned time period.

In chapter six, the currency approach is used to estimate the annual size of the shadow economy in Jordan during the period of study. This approach depends on estimating the demand for money in circulation in Jordan using OLS, and then determines the excess demand for currency that results from imposing taxes to estimate the shadow economy in Jordan. The per capita real currency in circulation is used as the dependent variable to represent the demand for money in circulation in Jordan. This is the first study that uses the number of Islamic banks (per one thousand people) as one of the determinants of that demand. The other determinants are: the effective tax rate on sales (general sales tax revenues/GDP), the effective income tax rate (income tax revenues/GDP), the effective tax rate on imports (customs duties revenues/imports),

the weighted average of interest rates on savings, and a dummy variable for the depreciation of the Jordanian dinar in 1988. The currency approach results show that the average size of the shadow economy in Jordan for the period 1976-2010 was 14.7 percent of GDP. It increased from around US $104.9 million, or 6.1 percent of GDP, in 1976 to around US $6086 million, or 22.1 percent of GDP, in 2010.

In chapter seven, the MIMIC approach, a special case of structural equation models (SEM), is used to estimate the annual size of the shadow economy in Jordan during the period of study. This approach uses multiple observed variables as causes and indicators of the shadow economy, which is considered itself a latent variable. According to the MIMIC approach, the causal variables for the shadow economy in Jordan are found to be: the total effective tax rate (tax revenues/GDP), the unemployment rate, the extent of government regulation (government intervention in the economy), and a dummy variable for the depreciation of the Jordanian dinar in 1988. The growth rate of real GDP and the growth rate of real private consumption are found to be indicators of the shadow economy in Jordan. According to the MIMIC approach estimates, the shadow economy in Jordan shrank during the period 1976-2010 despite an upward trend in some years during that period. The average size of the shadow economy in Jordan for that period was 27.7 percent of GDP. However, absolute value of the shadow economy during that period showed a continuous increases; from US $536.4 million in 1976 to US $5534 million in 2010. However, as a percent of GDP, it decreased from 31.3 in 1976 to 20.1 in 2010.

In chapter eight, the main consequences and the policy implications of the shadow economy are analyzed. In particular, the annual amount of income and sales tax evasion in Jordan during the period 1976-2010 is estimated based on the currency and the MIMIC approaches. The estimates show that the aggregate tax evasion for both types of tax increased

according to the currency approach from US $3.3 million, or 3.1 percent of the government domestic revenues, in 1976 to US $814 million, or 19.1 percent of the government domestic revenues, in 2010. The annual average of tax evasion for that period was US $174.1 million, or 8.4 percent of the government domestic revenues. According to the MIMIC approach, the aggregate tax evasion from the income tax and the sales tax increased from US $16.6 million, or about 15.5 percent of the government domestic revenues, in 1976 to US $741.5 million, or 17.4 percent of the government domestic revenues, in 2010. The annual average of tax evasion for that period was US $191.4 million, or about 14.6 percent of the government domestic revenues.

It is hypothesized that raising tax rates to compensate for a shortage in the tax revenues due to tax evasion is likely to induce people to increase their engagement in the shadow economy in order to evade paying even more in taxes. The result will be an increase in the size of the shadow economy and in the amount of tax evasion. On the other hand, if the government borrows money from domestic or external sources to cover the shortage in tax revenues, the increase in the public debt will be associated with an increase in the cost of public debt servicing in the public budget, which can dramatically worsen the public budget deficit and consequently distort the economy.

The monetary consequences of the shadow economy are also discussed. An increase in the size of the shadow economy should lead to a proportional increase in the demand for money in circulation. Since the expansion in the money supply is specified by the central bank based on the expected growth of official output (GDP), the supply of money in circulation will be less than the demand, which likely creates upward pressure on interest rates and on the general price level. There will be additional upward pressure on interest rates if the government increases its demand for borrowing to cover the loss of tax revenues due to tax evasion. On the other hand,

the shadow economy is behaved to induce firms to stay small in the market because working in the shadow requires them to hide in order to avoid being detected by the official authorities. Furthermore, because shadow economy firms compete with official firms by sharing the market, official firms' plans of expansion will tend to be negatively affected by the existence of the shadow economy.

In this dissertation, it has been shown that the shadow economy 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 shadow economy. Consequently, all indicators that are expressed as a percent of GDP (for instance, the budget deficit, the current account deficit, and the public debt) will be overestimated. Furthermore, since most laborers who work in the shadow economy are not included in the official labor census, the published unemployment rates will be overestimated as well. In addition, since the prices of goods and services produced in the shadow economy are lower than prices in the formal economy, the official inflation rates will overstate the price level in the economy because they do not include prices in the shadow economy.

Chapter eight also discusses the policy implications of the shadow economy and presents some policy recommendations for reducing the negative consequences of the shadow economy. Some negative consequences of the shadow economy can be reduced if policy makers adopt the second best by taking into consideration the existence of the shadow economy when formulating their policies. Establishment of a specialized unit in the department of statistics is recommended. The unit should be provided with qualified experts to conduct periodic estimates of the size of the shadow economy making sure to include the results of the estimation in the official statistics. Furthermore, the government should reform the tax system, imposing reasonable tax rates, and

simplifying the tax procedures, as well as adopting the highest level of transparency and accountability in the tax system in order to reduce incentives for people to work in the shadow economy. The government should concentrate on extending the tax base to collect sufficient tax revenues rather than raising tax rates. In addition, the government should implement a tax incentive policy, particularly for individual firms and micro-enterprises, to reduce incentives for them to engage in the shadow economy. The government should also minimize the rigidity and the complexity of existing regulations and reduce unnecessary intervention in the economy in order to develop an attractive business environment in the formal economy and reduce incentives to work in the shadow economy.

9.2. Conclusion

This dissertation has illustrated the significance shadow economy in the Jordanian economy; its absolute value has increased overtime and it represents a significant percent of official GDP based on the results of the two methodologies that we used to estimate it (based on the currency approach and the MIMIC approach). In 2010, the estimated shadow economy in Jordan according to these approaches was 22.1 percent and 20.1 percent of official GDP, respectively.

It is very difficult to say which approach is superior to the other in representing the shadow economy in Jordan. Each one has its own econometric techniques and its results are strongly related to its assumptions. In general, the MIMIC approach is more comprehensive because it takes into consideration the various causes and indicators of the shadow economy, while the currency approach takes into consideration only taxes as the sole cause of the shadow economy. We believe that deciding which measure should be considered by the policy maker depends on the purpose of the policy. If the policy aims at reforming the tax system and

enhancing the tax revenues, the currency approach results may be more relevant. If the policy aims at improving the efficiency of economic policy and the quality of official statistics, then the MIMIC approach maybe more appropriate.

This dissertation is the first study that differentiates the effect of taxes on imports (custom duties) on the shadow economy from the effect of other taxes (on income and sales). It hypothesizes, unlike other studies, that taxes on imports negatively affect the size of the shadow economy. As taxes on imports fall down, protection of the domestic production decreases, which induces the domestic producer to leave official markets to work in the shadow economy. The currency approach results support this hypothesis.

This study is also the first one to take into consideration religious factors as one of the determinants of the demand for money in circulation, which is used in estimating the shadow economy in Jordan by the currency approach. It is hypothesizes that the number of Islamic banks in Jordan negatively affects the demand for money in circulation. The coefficient of this variable has a negative sign, which supports that hypothesis; however, this variable is insignificant at the 10 percent level (Prob=0.287).

The currency approach results support the idea that income taxes and sales taxes are considered causes of the shadow economy in Jordan during the period of study. The MIMIC approach results support the total taxes, regulation (government intervention in the economy), and the depreciation of the Jordanian dinar in 1988 are the causes of the shadow economy in Jordan. The unemployment rate is found to be a negative factor for the shadow economy in Jordan. This indicates that the income effect of unemployment, which reduces the shadow economy, is greater than the substitution effect, which increases the shadow economy.

When the estimated US dollar values of the shadow economy in Jordan that resulted from the two methodologies are compared, the trends in those values go in the same direction during most of the years of the study. The most interesting result is that, since 1996, the two values are very close (Figure 9-1). On the other hand, when the ratios of the shadow economy to the GDP are compared, there is a clear discrepancy between the results of the two methodologies for the years 1976-1995. This divergence between the two trends is most reasonably explained by the extensive intervention of the Jordanian government in the economy and the low rate of unemployment in Jordan during that period. These two variables increased the size of the shadow economy according to the MIMIC approach during those years, whereas they are not included in the determinants of the shadow economy according to the currency demand approach. Over time, the discrepancy between the two trends of the shadow economy according to both approaches gets smaller. This was due to the continuous increase in the unemployment rate since early 1980s in addition to the substantial reduction in the government intervention in the economy after implementing a privatization program under the supervision of the IMF and the World Bank since mid-1990s. These two variables led to a fall down in the trend of the shadow economy according to the MIMIC approach. The discrepancy almost disappears in 1996 as the two approaches now seem to be trading the effects of taxation. After that, the MIMIC approach trend remains stable at around 20 percent of GDP, while the currency approach trend fluctuates between 20 percent and 24 percent of GDP.
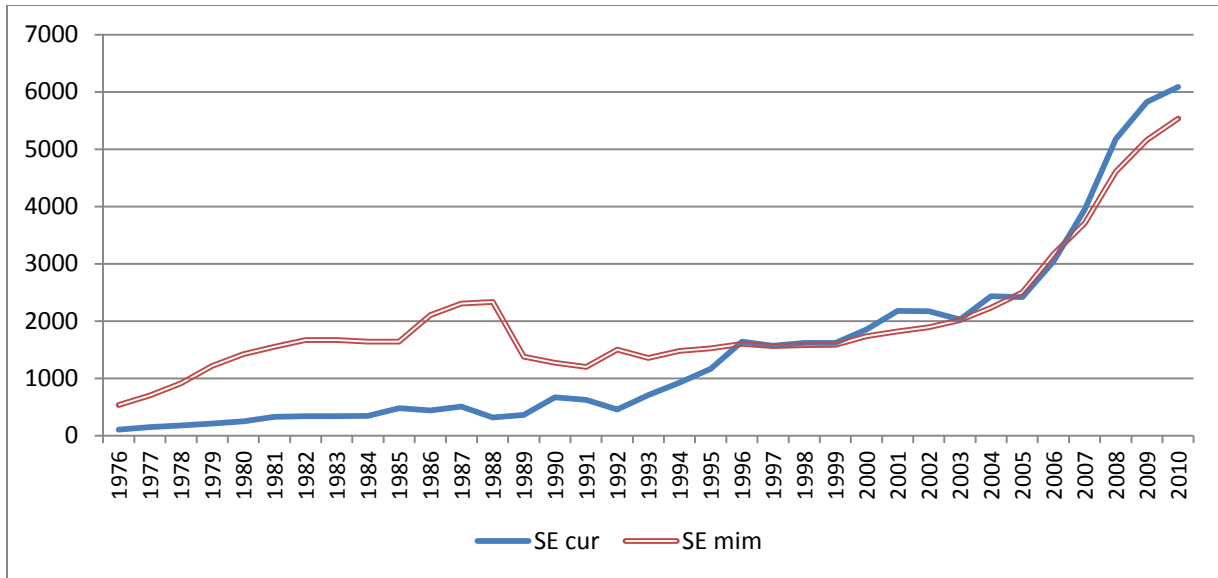
Figure 9. 1: Trends of the shadow economy in Jordan according to the currency approach and the MIMIC approach (US$ million).
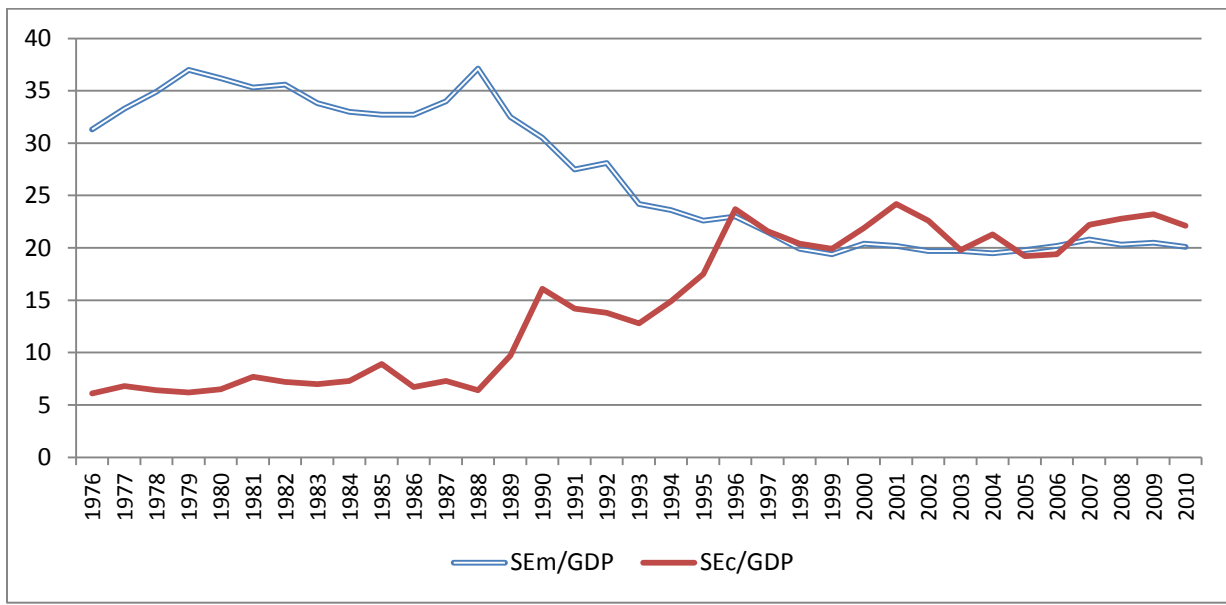

Figure 9. 2: Trends of the shadow economy in Jordan according to the currency approach and the MIMIC approach (% of GDP)

The currency approach results show that the relative importance of various types of taxes as a cause of the shadow economy in Jordan varied during the period of study. The custom duties' contribution to the shadow economy increased from 22.2 percent of the shadow economy in 1976 to 41.3 percent in 2010. The general sales tax (domestic production fees) contribution increased from 23.2 percent of the shadow economy in 1976 to 34.8 percent in 2010. On the other hand, the contribution of the income tax to the shadow economy in Jordan saw a significant decrease from 54.7 percent of the shadow economy in 1976 to 23.8 percent in 2010. We believe that the significant change in the structure of the tax system in Jordan, which was implemented under the IMF economic adjustment program which took effect in the mid-nineties (mainly adopting the GST, reducing the custom tariffs, and reducing income tax rates and tranches), led to the observed variation in the contribution of the tax types to the shadow economy.

When the estimates of the shadow economy in Jordan are compared to the estimates of the other two studies that include Jordan (Schneider et. Al. (2010) and Schneider (2007)) for the mutual years, all estimates are found to be very close for most years as seen in Table (9-1) and Figure (9-3).

Table 9. 1: Comparison of the estimated shadow economy in Jordan among various studies (% of GDP)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average
This study (Currency)	19.9	21.9	24.2	22.6	19.8	21.3	19.2	19.4	22.2	**21.2**
This study (MIMIC)	19.4	20.4	20.2	19.7	19.7	19.5	19.8	20.2	20.8	**20.0**
Schneider et. al. (2010)	19.4	19.4	19.6	19.9	20.1	20.6	20.9	21.4	21.7	**20.3**
Schneider (2007)	19.4	19.4	20.5	21.6	21.2	20.4	-	-	-	**20.4**
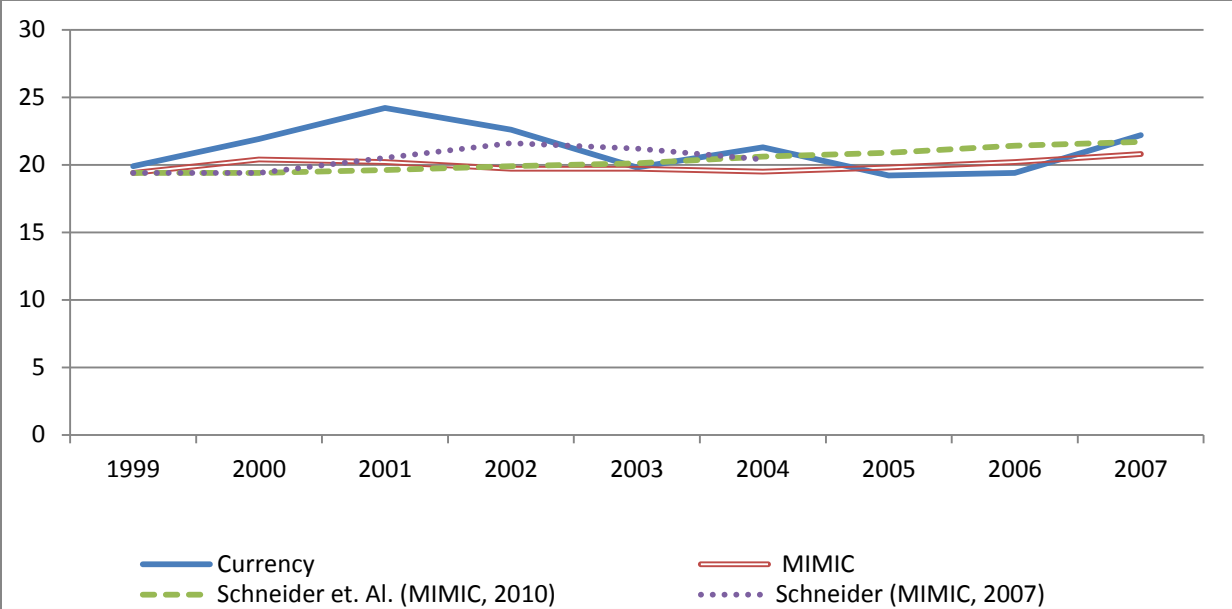
Figure 9. 3: Comparison of various studies estimates of the shadow economy in Jordan (% of GDP)

Therefore, this dissertation provides researchers with recent and time period estimates of the annual size of the shadow economy in Jordan. These estimates could be used in future research into the relationship between the shadow economy and various economic policy issues in Jordan. There is a need for further research into the impact of the shadow economy in Jordan on some macroeconomic indicators, for instance; poverty, unemployment, monetary and fiscal policies, and corruption.

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APPENDIX A.

Table A. 1: Population, output, and private consumption in Jordan

	Population	Nominal GDP	Real GDP	Nominal GNP	Private Consumption
	(Million)	(JD million)	(JD million)	(JD million)	(JD million)
1976	1.890	567.3	1689.4	589.3	452.6
1977	1.970	690.4	1829.6	712.3	569.0
1978	2.060	795.4	2098.1	818.5	666.7
1979	2.133	982.5	2534.6	1009.7	846.5
1980	2.233	1164.8	2818.1	1198.2	914.8
1981	2.319	1448.7	3302.2	1506.2	1120.8
1982	2.409	1649.9	3534.2	1714.3	1406.7
1983	2.502	1786.6	3455.8	1835.8	1537.0
1984	2.599	1909.7	3604.1	1923.3	1576.7
1985	2.700	1970.5	3506.5	1965.8	1745.2
1986	2.805	2240.5	3699.5	2223.2	1795.0
1987	2.914	2286.7	3785.5	2236.5	1747.7
1988	3.027	2349.5	3840.8	2261.0	1711.7
1989	3.144	2425.4	3428.7	2234.0	1688.0
1990	3.468	2760.9	3419.3	2521.4	2069.0
1991	3.701	2958.0	3474.3	2736.9	2142.5
1992	3.844	3611.6	3967.3	3424.3	2765.9
1993	3.993	3885.2	4151.1	3735.2	2793.0
1994	4.139	4359.2	4358.1	4206.9	2934.9
1995	4.264	4714.7	4627.7	4597.8	3045.9
1996	4.383	4912.2	4724.3	4799.9	3450.6
1997	4.506	5137.5	4880.5	5090.1	3647.3
1998	4.623	5609.8	5026.7	5604.0	4111.9
1999	4.738	5778.1	5198.0	5769.4	4177.7
2000	4.857	5998.5	5418.7	6069.7	4835.8
2001	4.978	6363.7	5704.2	6478.3	5157.4
2002	5.098	6794.0	6034.2	6848.6	5191.3
2003	5.230	7228.7	6285.2	7320.8	5561.6
2004	5.350	8090.7	6823.7	8285.1	6598.9
2005	5.473	8925.4	7379.6	9163.9	7838.3
2006	5.600	11092.6	7964.7	11413.8	9268.2
2007	5.723	12595.7	8640.7	13080.0	10583.8
2008	5.850	16108.0	9298.2	16601.6	12726.4
2009	5.980	17815.6	9514.4	18243.9	13718.0
2010	6.113	19527.9	9808.6	19887.5	15134.1

Source: Central Bank of Jordan and the Jordanian Department of Statistics.

Table A. 2: Tax revenues in Jordan (JD million).

	Total tax revenues	Income tax revenues	Custom duties revenues	GST revenues
1976	65.8	9.3	32.5	8.6
1977	96.3	13.2	64.0	9.9
1978	96.6	18.6	61.4	7.0
1979	118.4	22.4	72.1	10.6
1980	136.2	27.9	78.0	13.2
1981	171.3	40.0	94.1	16.9
1982	200.3	43.7	109.7	24.1
1983	225.8	46.0	120.6	35.3
1984	232.2	48.7	118.0	37.2
1985	246.6	54.4	117.9	45.8
1986	238.0	47.9	112.0	51.6
1987	242.4	45.3	108.5	58.3
1988	254.6	43.3	117.4	61.2
1989	273.9	51.4	103.9	77.5
1990	383.0	114.0	116.7	90.4
1991	398.7	92.8	122.5	96.1
1992	639.3	109.5	329.8	138.4
1993	643.4	118.8	281.1	174.3
1994	694.4	136.6	268.8	222.4
1995	757.9	152.4	264.0	263.5
1996	841.1	173.2	279.8	310.0
1997	798.5	149.7	258.5	315.4
1998	858.6	139.6	294.3	350.3
1999	884.2	152.7	279.3	372.5
2000	961.9	161.0	264.5	464.5
2001	996.4	195.4	228.5	502.7
2002	1000.3	196.2	219.8	510.7
2003	1083.2	191.0	209.4	603.4
2004	1428.8	217.9	266.9	844.7
2005	1765.8	283.7	304.9	1023.4
2006	2133.5	411.4	315.6	1219.1
2007	2472.1	494.9	312.1	1464.5
2008	2758.0	603.4	284.4	1671.6
2009	2879.9	764.7	270.3	1682.5
2010	2985.1	624.6	275.3	1987.3

Source: Central Bank of Jordan and the Jordanian Ministry of Finance.

Table A. 3: Some monetary indicators in Jordan

	Currency in circulation	Exchange rate	Islamic banks	Interest rate on savings
	(JD million)	US$/1 JD	Number	%
1976	161.4	3.021	0	5.0
1977	188.0	3.175	0	5.0
1978	219.5	3.413	1	5.0
1979	275.4	3.390	1	5.0
1980	351.6	3.242	2	5.0
1981	412.3	2.950	5	5.0
1982	470.0	2.845	7	5.0
1983	516.0	2.692	8	6.5
1984	530.5	2.469	9	7.0
1985	531.8	2.719	12	7.0
1986	583.9	2.906	12	6.0
1987	655.8	3.040	13	6.0
1988	811.2	2.096	14	5.5
1989	871.1	1.543	18	5.0
1990	1006.1	1.504	18	5.2
1991	992.4	1.481	22	5.0
1992	1003.9	1.447	24	5.0
1993	1047.9	1.420	26	5.1
1994	1072.6	1.427	29	5.0
1995	1050.9	1.410	32	5.0
1996	952.2	1.410	33	5.2
1997	987.6	1.410	41	4.8
1998	952.8	1.410	50	4.6
1999	1106.6	1.410	56	4.2
2000	1239.9	1.410	61	3.8
2001	1202.4	1.410	64	2.9
2002	1252.8	1.410	65	1.8
2003	1443.7	1.410	63	0.9
2004	1414.4	1.410	63	0.7
2005	1657.2	1.410	65	0.8
2006	2027.4	1.410	65	1.0
2007	2172.4	1.410	72	1.1
2008	2664.8	1.410	74	1.0
2009	2679.5	1.410	80	0.8
2010	2843.6	1.410	85	0.8

Source: Central Bank of Jordan.

APPENDIX B.

Measures of fit for the MIMIC model [1]

- **Root Mean Square Error of Approximation (RMSEA)**

This absolute measure of fit is based on the non-centrality parameter. Its computational formula is:

$$\frac{\sqrt{(\chi^2 - df)}}{\sqrt{[df(N - 1)]}}$$

where N the sample size and *df* the degrees of freedom of the model. If χ^2 is less than df, then the RMSEA is set to zero. Its penalty for complexity is the chi square to df ratio. The RMSEA is currently the most popular measure of model fit and it now reported in virtually all papers that use CFA or SEM. Economists suggest 0.10 as the cutoff for poor fitting models.

- **Bentler-Bonett Index or Normed Fit Index (NFI)**

This is an incremental measure of fit. The best model is defined as model with a χ^2 of zero and the worst model by the χ^2 of the null model. Its formula is:

$$\frac{\chi^2(\text{Null Model}) - \chi^2(\text{Proposed Model})}{\chi^2(\text{Null Model})}$$

A value above .90 is an indicator for a good fitting model, and below .90 is considered to be a poor model. A major disadvantage of this measure is that it cannot be smaller if more

1 : This section based mainly on a document for David Kenny (2011) available at: http://www.davidakenny.net/cm/fit.htm.
And on a document available at: http://www.docstoc.com/docs/56500948/Measuring-Model-Fit

parameters are added to the model. Its "penalty" for complexity is zero. Thus, the more parameters added to the model, the larger the index. It is for this reason that this measure is not recommended, but rather one of the next two is used.

- **Tucker Lewis Index or Non-normed Fit Index (NNFI)**

A problem with the Bentler-Bonett index is that there is no penalty for adding parameters. The Tucker-Lewis index, another incremental fit index, does have such a penalty. Let χ^2/df be the ratio of chi square to its degrees of freedom, and the TLI is computed as follows:

$$\frac{\chi^2/df(\text{Null Model}) - \chi^2/df(\text{Proposed Model})}{\chi^2/df(\text{Null Model}) - 1}$$

If the index is greater than one, it is set at one. It is interpreted as the Bentler-Bonett index. Its penalty for complexity is χ^2/df.

- **Goodness-of-fit index (GFI)**

GFI is the percent of observed covariances explained by the covariances implied by the model. It varies from 0 to 1, but theoretically can yield meaningless negative values. A large sample size pushes GFI up. By convention, GFI should by equal to or greater than .90 to accept the model. GFI = F_{ML}/F_o, where F_o is the fit function when all model parameters are zero. Also, when degrees of freedom are large relative to sample size, GFI is biased downward except when the number of parameters (p) is very large.

- **Adjusted goodness-of-fit index, AGFI**.

AGFI is a variant of GFI which uses mean squares instead of total sums of squares in the numerator and denominator of 1 - GFI. It, too, varies from 0 to 1, but theoretically can yield meaningless negative values. AGFI > 1.0 is associated with just-identified models and models with almost perfect fit. AGFI < 0 is associated with models with extremely poor fit, or based on small sample size. Like GFI, AGFI is also biased downward when degrees of freedom are large relative to sample size, except when the number of parameters is very large. Like GFI, AGFI tends to be larger as sample size increases; correspondingly, AGFI may underestimate fit for small sample size.