ESTIMATING THE SIZE OF SHADOW ECONOMY IN NEPAL: A MIMIC APPROACH

A Thesis

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LETTER OF RECOMMENDATON

This thesis entitled *The Estimation of Shadow Economy in Nepal using the MIMIC model* has been prepared by **Mr. Deependra Paudel** under my supervision. I hereby recommend this thesis for examination by the thesis committee as a partial fulfillment of the requirements for the **Degree of Masters** of **Arts in Economics.**

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Nirmal Kumar Raut, PhD

(Thesis Supervisor)

Date:

APPROVAL LETTER

This thesis entitled **The *Estimation of Shadow Economy in Nepal using the MIMIC model*** submitted by **Mr. Deependra Paudel** to the Central Department of Economics, Faculty of Humanities and Social Sciences, Tribhuwan University, in partial fulfillment of the requirements for the degree of **Master of Arts** in **Economics** have been found satisfactory in scope and quality. Therefore, we accept this thesis as a part of the Degree.

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This thesis would not have been possible without the contribution 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 to accomplish this project.

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I take sole responsibility for any errors and discrepancies that might have been occurred in this study.

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Deependra Paudel

December, 2020

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ABBREVIATIONS

ADF – Augmented Dickey Fuller Test

CBS – Central Bureau of Statistics

FY – Fiscal Year

GDP – Gross Domestic Product

GNP – Gross National Product

IM – Illegal Money

LM – Legal Money

M1 – Narrow Money

M2 – Broad Money

MoF – Ministry of Finance

NRB – Nepal Rastra Bank

OLS – Ordinary Least Square

PCI – Per Capita Income

WB – World Bank

CHAPTER – ONE

INTRODUCTION

1.1 Background of the study:

Shadow economy is a broad concept with various names in the economic literature; underground, black, hidden, unofficial, informal, unreported, or unrecorded economy. The size of underground economy is increasing rapidly in today's world. It relates to the economic activities that are not included in the formal measurement of GDP. Many developed and developing countries have shown serious concern over the underground economy and its consequences. A recent study by Buhn (2010) for 162 developed and developing countries between 1999 and 2007, found that the shadow economy has reached remarkable proportions, with an average value of 34.5% of official GDP of those countries. Furthermore, Buhn showed tax and social security burdens, tax morale, the quality of state institutions, labor market regulation, the level of transfer payments and the quality of public services are the major determinants of shadow economy.

The underground economy is ubiquitous in every country throughout the world. It has existed and continue to exist in one form or other in all societies. It has significant effect on economic and social development, national account and public finance. It also creates a distortion in market due to which there is unequal production among the producers in formal economy and underground economy. As a result, there is distortion in economic indicators. Many economists believed that there is strong relationship between the size of underground economy and the tax system. The underground economy is depleting the size of government revenue through tax evasion which further decreases the quantity and quality of the public goods and services distributed by the government. In order to increase the government revenue, the government may raise the tax rates. This may further increase the size of underground economy. Furthermore, the underground economy may be linked with the miscalculation of true growth in economy, national income and employment and over evaluate the unemployment.

The presence of underground economy may influence the decision of policy makers because they will make their decisions based on inaccurate information which

reduces the efficiency and effectiveness 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 underground economy.

According to the Schneider (2019), the shadow economy also includes all market-based legal production of goods and services that are deliberately concealed from public authorities, chiefly to avoid paying income, value added or other taxes, to avoid making social security contributions, to avoid having to meet legal labour market standards such as minimum wages, maximum working hours and safety standards, and to avoid complying with administrative procedures such as statistical questionnaires or other administrative forms.

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 3 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		Non – monetary 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 service and goods	Employee discounts fringe benefits.	Barter of legal services and goods.	All do-it-yourself work and neighbor help.

Source: Lippert and Walker (1997) and Schneider (2002)

The purpose of this study is to estimate the size of shadow economy in the context of Nepal, 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 Statement of the problem:

Shadow economy brings many difficulties to the decision makers while formulating social and economic policies because those policies will depend on inaccurate economic indicators. Therefore, it is very essential to measure the size of the shadow economy in order to reduce the distortion in those policies. With the growing interest in estimating the size of shadow economic activities in many countries, only few attempts have been made to estimate the shadow economy of Nepal.

Nepal has improved its ranking in the global corruption perceptions index but it continues to have significant corruption. Nepal ranked 31st in Transparency International Corruption Perception Index 2019. According to Nepal National Governance Survey (2019), 21 percent of total population believe the government does not want to control corruption while 17 percent believe the government cannot control corruption.

Despite the considerable size of the shadow economy, it seems that motivation of governments to deal with this phenomenon is quite low. Solving this problem would probably bring significant additional resources and make policy decisions much more effective. But when countries try to reduce the share of shadow activities, it is usually through shortsighted measures such as punishment or prosecution instead of complex reforms of the tax and regulation systems. Therefore, this study raises the following questions:

a) What is the size of shadow economy in Nepal?
b) What are the determinants of shadow economy in Nepal?

1.3 Objective of the study:

The general objective of the study is to conduct a situational analysis of shadow economy in Nepal.

The specific objectives of the study are as follows:

- To estimate the size of shadow economy in Nepal.
- To analyze the determinants of shadow economy in Nepal.

1.4 Significance of the study:

The phenomenon of globalization has led to a major transformation of the world economy since the beginning of the 1980s. The elimination of borders between countries has accelerated global trade. With the increase occurring in world trade volume, the size of the shadow economy has increased as well.

Although the shadow economy is defined in various ways by many scientists, taken in its broadest definition, it involves both legal activities which is unrecorded and illegal activities besides it involves issues such as marginal sectors, tax informality and shadow employment. The findings of this study will be beneficial to the society and nation considering what determine shadow economy in Nepal and the variables affecting the size of shadow economy. For the researchers, the study will help them uncover critical areas in the economy that many researchers were not able to explore.

There would be several contributions from my thesis which motivate study of the shadow economy in Nepal. There are no previous economic studies that have estimated the shadow economy for the Nepalese economy. Although Schneider (2005) and Schneider et al (2010) estimate the shadow economy in Nepal 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 in Nepal for the period 2001-2018.

Still Nepalese are not to engage in the banking transactions. Only 61 percent of Nepalese adults are formally banked while 21 percent use informal channels and 18 percent remain financially excluded. 40 percent of adult population is banked. Taking into the cooperatives and other formal non-bank financial institutions, about 61 percent of adult population is formally served. Since still 39 percent of adult population are not formally banked, it increases the size of informal economy which increases the size of the shadow economy.

Tax morale defined as the intrinsic motivation to pay taxes. It measures an individual's willingness to pay taxes, in other words, the moral obligation to pay taxes or the belief that paying taxes contributes to society. According to Benno Togler and Friedich Schneider, high tax morale and high institutional quality leads to a smaller shadow

economy and vice-versa. They suggested improving social institutions, (through such channels as enhancing tax morale, voice and accountability, the rule of law, government effectiveness and its regulatory quality, and by reducing corruption) helps lessen a possible incentive to ''go underground.

The government of Nepal has been under pressure to manage financial resources with the slow growth in revenue collection. The economic survey of 2018-19 showed that the government has unable to generate enough revenue to cover the government expenditure. It is due to the government has not been able to ensure tax compliance from taxpayers. The revenue collection is largely based on imports, so a decline in imports is a one cause for the decline in revenue. But due to having open border with India, people are importing goods and products using bypass roads. So due to informal economy there is decline in revenue collection.

From other side, it is known that the administrative officials in many countries emphasize less on regulatory control and there is a large loophole in regulating the irregular activities which might eventually destroy the tax bases and social security burden. This is another reason that emphasizes the importance of this research.

This research can serve as a cautionary reminder to the government to seriously consider and take into account the consequences of the underground economy that may hamper or stimulate the economic growth and social welfare. We also hope that we have encouraged enough in further research in the area of fuzzy estimation of the economy, especially the underground economy.

1.5 Limitation of the study:

This study is concentrated in general on the present status of shadow economy, its determinants and examine the casual relationship between different types of taxes and shadow economy in Nepal. The conclusion of this study may not fully apply though something can be drawn to other country.

Estimating the size of the shadow economy is difficult. After all, people engaged in underground activities do their best to avoid detection. In this context, the research

problem of this thesis is to estimate the size of shadow economy in Nepal with a view to prepare recommendation on how to minimize the size of shadow economy.

In spite of several significance as mentioned above, there are also presence of some limitation in this study. Due to resource and time constraints, primary data of the variables could not be collected. So, this study is based on the secondary data only. The secondary data of 18 years beginning from FY 2001 to 2018 has been used and no attempts had been made to examine the reliability of the secondary data.

1.6 Organization of the study:

This study is organized into five chapters. Firs chapter is the introduction which includes background of the study, statement of the problem, objective of the study, significance of the study, limitation of the study and organization of the study. Similarly, second chapter is related to review of literature. Likewise, third chapter is about research methodology and data. Fourth chapter is about result presentation and finally fifth chapter consists of major findings and conclusion.

CHAPTER – TWO

REVIEW OF LITERATURE

2.1 Review of Literature:

This chapter summarizes some existing works on shadow economy in literature. There are lots of study about shadow economy in literature in order to reveal the relationship between shadow economy and other economic, social, fiscal, political indicators such as corruption, social development, tax burden, unemployment, public expenditures, population growth and so on.

Lippert and Walker (1997) collected and edited 18 studies 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.

Cebula (1997) established a model in order to analyse the effect of federal income tax rates, Internal Revenue Service (IRS) tax penalties on unpaid tax liabilities by taxpayers and tax audit rates of the IRS on the size of the shadow economy in the USA. In the study, period between 1973 -1994 were examined for USA economy by employing ordinary least square (OLS) method. The author concluded that the maximum marginal personal income tax rate increases the size of shadow economy. Moreover, the author confirmed that as the probability of being audited and expected tax penalty imposed by the IRS from underreporting income increases, the size of shadow economy decreases for USA economy.

Dreher and Schneider (2006) investigated the impact of shadow economy on corruption and vice versa. They hypothesized that shadow economy and corruption are substitutes in high income countries whereas they are complements in low income countries. The hypotheses were tested for a cross-section of 120 countries and a panel of

70 countries for the period 1994 and 2002. The result confirmed their hypothesis and revealed that shadow economy reduces corruption in high income countries, however, it increases corruption in low income countries. They also find that stricter regulations increase both corruption and the shadow economy.

Torgler and et.al (2008) analyzed the relationship between local autonomy and tax morale or the size of the shadow economy in Switzerland. Multiple regression analysis was employed and the data of 1990, 1995 and 2000 was collected for the study. Centralization, Direct Democracy, GDP, transfers, population size, tax burden, labor force, unemployment rate, education expenditures data were used as an independent variable. The findings suggest that there is a positive relationship between local autonomy and tax morale, negative relationship between local autonomy and the size of shadow economy.

Dreher and et.al (2008) examined the relationship between institutional quality, the shadow economy and corruption. These predictions were tested using data from 78-135 countries between 2000 and 2002. OLS, 3SLS and 2SLS regression models were used in the study. Shadow economy, corruption, GDP per Capita, Fiscal burden, age of democracy, school enrolment is employed as variables in the analysis. Model shows that an improvement in institutional quality reduces both shadow economy and corruption.

Polonskyi (2009) examined the relationship between corruption and shadow economy in Ukraine and Russia. 2SLS, GMM and 3SLS estimation methods were applied. In previous study Dreher and Schneider (2007) concluded that there was a complementary relationship between corruption and shadow economy for Ukraine and Russia. However, Polonskyi (2009), contrary to Dreher and Schneider (2007), finds no clear evidence of complementary relationship between corruption and shadow economy for low-income countries such as Ukraine and Russia in his study. Therefore, he pointed out that further analysis should be conducted with more data by using panel data and expanding the sample.

Dobre and Alexandru (2010) used time-series data for the USA hidden economy and unemployment rate in order to explore the linkage between unemployment rate and the size of shadow economy in USA from 1980's to 2007. Granger causality tests carried out and it was found that both series are co-integrated and there is strong evidence of Granger

causality from unemployment rate to shadow economy. Moreover, there is no "reverse causation" from shadow economy to unemployment rate.

Schneider and et.al (2010) revealed the main causes, indicators, size and development of the shadow economy for 162 countries between 1999 and 2007. The authors find a clear negative trend in the size of shadow economy from 1999 to 2007 for observed countries. Authors used the MIMIC (Multiple Indıcators Multiple Causes) estimation method in order to measure the size of shadow economy. They conclude that the driving forces of the shadow economy are an increased tax burden, combined with labor market regulations and the quality of public goods and services, as well as state of the official economy.

Yendi (2011), firstly revealed the different measurement methods of shadow economy in her study. Then, she discussed the causes of the shadow economy. She obtains panel data analysis and uses three models for 56 countries between 1999 and 2007 in order to investigate economic, financial and institutional reasons of shadow economy. Contrary to expectations, she finds that the size of shadow economy increases as GDP growth rate per capita increases, however, the size of shadow economy decreases as unemployment increases in the observed country economy. Her results show impact of inflation, economic freedom and government spending on shadow economy are ambiguous. She also found as marginal corporate tax rate increases; the size of shadow economy increases.

Rakici (2011) evaluated the new structure of tax audit and the role of tax auditing in preventing shadow economy for Turkey. He stated that there is negative relationship between tax audit and shadow economy. He emphasized that the size of shadow economy will decrease by increasing the tax audit rate. The author advocates that increases the number of inspectors will make positive contribution to prevent shadow economy, however, he highlighted that increasing only the quantitative capacity will not enough to become more functional in terms of tax audits beside this qualitative capacity of tax inspectors should be increased.

Schneider (2013) examine shadow economy, tax evasion and corruption in Portugal and in other OECD countries. In his study, in addition to the above, he revealed the dimension of shadow economy for 31 European countries over 2003 – 2012. His analysis

showed shrinking in the size of shadow economy for most OECD countries and increasing the extent of corruption and the damage from it.

Kara (2014) analyzed the effect of tax amnesties on tax revenue and shadow economy after 1985 in Turkey. Cross-examination of amnesty effects was carried out with Ordinary Least Squares regression (OLS) and Error Correction Model (ECM). Empirical results suggest that tax amnesties are proved to be ineffective both in terms of revenue and size of the shadow economy in Turkey. Only 1989 amnesty yields statistically significant results in increasing total tax revenues. As for shadow economy, all of the amnesties being insignificant except 2002 and 2008 amnesties. Post effects of 2008 amnesty indicate that shadow economy size increase.

Katrechka and Dahlberg (2014) analyzed the effect of the shadow economy on social development. In their research, life expectancy, HIV prevalence, school enrolment, mortality under age 5 were selected as determinants of social development. Investigation of the relationship between the shadow economy and social development were carried out within a sample of advanced and least-developed 58 countries, during period of 39 years (1970-2008 period). The result of the empirical analysis revealed that there is a negative relationship between the shadow economy and social development.

Schneider et al. (2015) measured the size of shadow economy of 31 European Countries in 2014 and 28 European Union countries over 2003 – 2014 (in per cent of official GDP). MIMIC method is used in this study. According to this study, the average size of the shadow economy in 28 EU countries was 22.6 per cent in 2003 and this ratio decreased to 18.6 per cent in 2003 – 2014 period. They also determine the largest driving forces of the shadow economy in terms of countries included in the analysis. These are respectively unemployment and self-employment with 14.6 per cent, tax morale with 14.5 per cent and GDP growth with 14.3 per cent. In addition to this result, the proportional effect of tax evasion on the size of shadow economy for countries included in the analysis is found as 4.2 per cent of GDP.

Vlachaki (2015) empirically analyzed the impact of the shadow economy on indirect tax revenues of 125 countries for the 1990 – 2011 period. Under the absolute tax compliance assumption, this study depends on a government would prefer to depend on

less indirect taxation, considering indirect taxation's distorting nature. The author tries to find answer to the following question.

Due to the size of black economy, if a government fail to raise direct tax revenues, do the government change its decision and tend towards indirect taxation more. The author concludes that the size of shadow economy increases the proportion of indirect tax revenues to GDP as long as the size of shadow economy does not exceed a cut-off value, however, any further increase above the threshold value affects indirect taxation negatively.

Dobre and Alexandru (2015) estimates the size of the Romanian shadow economy by using the currency demand approach. Then, using Granger causality tests and ECMs, they examine the impact of unemployment rate on the Romanian shadow economy involving the quarterly period between 2000 and 2010. The empirical result revealed the existence of a negative relationship in the short-run and a positive relationship in the long-run between both the unemployment rate and the size of 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.

2.2 Research Gap

To estimate the size of the shadow economy and its determinants is one of the important issues in the world. It is necessary to know the size of shadow economy for attaining the higher and sustainable economic growth and development. Several studies

have been carried out on the shadow economy in international level. By analyzing these studies, it becomes clear that the shadow economy has great effect in the economy. Therefore, it is necessary for developing countries like Nepal to study and estimate the size of shadow economy that's help to achieve higher economic growth. However only one study has been conducted that specifically focuses Nepal.

Raut, Chalise and Thapa (2014) conducted a study on underground economy in Nepal using currency demand approach. According to this study, the average size of the shadow economy in Nepal was 40.57 percent of GNP in 2000 and this this ratio increased to 68.44 percent in 2000 – 2012 period. They also determined the factors which are driving the shadow economy in Nepal. These are protection by political parties and leaders which foster the violation of law and order in the country. They concluded until and unless economic agendas are not given proper priority, the size of underground economy will increase.

Estimating the size and trend of the shadow economy is a challenging and difficult task. Different methods like currency demand approach, electricity approach etc. consider only one indicator that summarize the all effect of the shadow economy. But only one indicator may not show up the effect of shadow economy in the economy. So, MIMIC is the better method to estimate the size of shadow economy.

To the best of knowledge, there is no attempt to carry out study on estimating the size of shadow economy using MIMIC model. So, the present study tries to carry out the research using MIMIC model. This study is focused on estimating the size of shadow economy and its determinants using Multiple Indicator Multiple Cause (MIMIC) model by including new control variables and recent data.

CHAPTER – THREE

RESEARCH METHODOLOGY

This chapter discusses about the research methodology that has been used in this research. The major heading of this chapter is study design, data, hypotheses and model specification.

3.1 Study Design

The study analyzed the size of shadow economy by using table and graphs. Different econometric tools and methods have been used. The Augmented Dickey Fuller (ADF) test has employed to test the stationary of the variable. Root Mean Square Error of Approximation, Bentler-Bonett Index or Normal Fit Index, Tucker Lewis Index or Non-normed Fit Index, Goodness of fit Index and Adjusted goodness of fit index have been used.

3.2 Nature and Sources of Data

Annual time series data of the Nepalese economy for the period 2001-2018 were used to estimate the shadow economy in Nepal for that period by the MIMIC approach. The time period of the study is selected based on the availability of consistent national accounts data from Nepal and on the most recent available data. The data were collected from different sources, mainly the World Bank Database, the Central Bank of Nepal, the Ministry of Finance, and Central Bureau of Statistics.

3.3 Sample Period Covered

The study covers the annual datasets of eighteen years from FY 2001/02 AD to 2017/18 AD. This time period is chosen due to the unavailability of data of all variables before this time.

3.4 Tools and Methods of Data Collection

The required data and information were collected by the researcher himself by visiting concerned institutions and collected various published documents of these institutions like Quarterly Economic Bullet from Nepal Rastra Bank (NRB), Economic

Survey Reports from Ministry of Finance (MoF), National Accounts of Nepal and Statistical Year Book of Nepal from CBS.

3.5 Specification of Tools and Method of Data Analysis

This study used different statistical tools to analyze the statistics of the variables. The tables and graphs were used to analyze the trend of the shadow economy. The Augmented Dickey-Fuller (ADF), Root Mean Square Error of Approximation, Bentler-Bonett Index or Normal Fit Index, Tucker Lewis Index or Non-normed Fit Index, Goodness of fit Index and Adjusted goodness of fit index were used to test the variables. The study uses the R software for data analysis and examine the size of shadow economy in Nepal.

3.5.1 Model Specification

This paper uses multiple indicator multi cause (MIMIC) approach of indirect method of estimating the size of shadow economy. This method explicitly considers several causes, as well as the multiple effects, of the informal economy. The methodology makes use of the associations between the observable causes and the effects of an unobserved variable, in this case the informal economy, to estimate the variable itself (Loayza, 1997).

The model exploits the associations between observable causes and effects of the unobserved informal economy to estimate the size of the informal economy itself. The model can be described as:

$$y = \lambda IE + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.1)$$

$$IE = \gamma' x + \upsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.2)$$

where IE is the unobservable latent variable, $y' = (y_1, \ldots, y_p)$ is a vector of indicators for IE, $x = (x_1, \ldots, x_q)1$ is a vector of causes of IE, λ and γ are the (px1) and (qx1) vectors of the parameters, and ε and υ are the (px1) and scalar errors. Equation (1) relates the informal economy to its indicators, while equation (2) associates the informal economy with a set of observable causes. Assuming that the errors are normally distributed and mutually uncorrelated with $var(\upsilon) = \sigma_v^2$ and $cov(\varepsilon) = \emptyset_\varepsilon$, the model can be solved for the reduced form as a function of observable variables by combining equations (1) and (2):

$$y = \pi x + \mu \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.3)$$

where $\pi = \lambda\gamma', \mu = \lambda\upsilon \text{ and } cov(\mu) = \lambda\lambda'\sigma_v^2 + \emptyset_\varepsilon$

As y and x are data vectors, equation (3) can be estimated by maximum likelihood using the restrictions implied in both the coefficient matrix π and the covariance matrix of the errors μ. Since the reduced form parameters of equation (3) remain unaltered when λ is multiplied by a scalar and γ and σ_v^2 are divided by the same scalar, the estimation of equations (1) and (2) requires a normalization of the parameters in equation (1), and a convenient way to achieve this is to constrain one element of λ to some pre-assigned value.

Since the estimation of λ and γ is obtained by constraining one element of λ to an arbitrary value, it is useful to standardize the regression coefficient $\hat{\lambda} \; and \; \hat{\gamma}$ as $\widehat{\lambda^s} = \hat{\lambda}\left(\frac{\widehat{\sigma_{IE}}}{\widehat{\sigma_y}}\right)$ and $\widehat{\gamma^s} = \hat{\gamma}\left(\frac{\widehat{\sigma_x}}{\widehat{\sigma_{IE}}}\right)$.

The standardized coefficient measures the expected change (in standard deviation units) of the dependent variable due to one standard deviation change of a given explanatory variable, when all other explanatory variables are held constant. Using the estimates of the γ^s vector and setting the error term υ to its mean value to zero, the predicted values for the informal economy measured in percent of GDP, the ordinal within sample predictions for the informal economy can be converted into percentages of GDP.

Graphically, the structural relation of the model in the following path diagrams where arrows, which represent the causal relationship, go from the causes of the shadow economy to the latent variable and then from the shadow economy to its indicators.

Figure 3.1: Schematic figure showing the MIMIC model
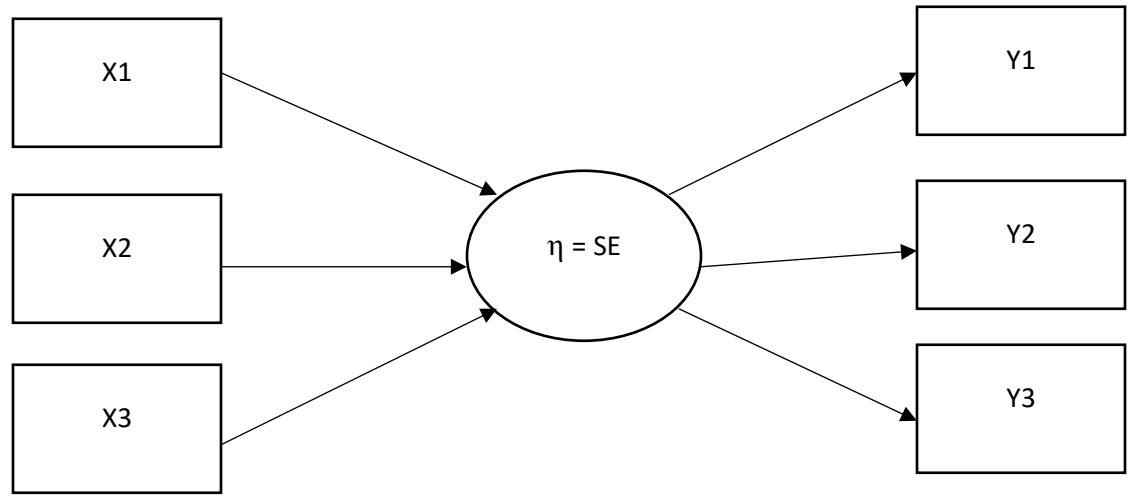
The MIMIC model, as a special case of SEM models, concentrates on analyzing the covariance structure. In the MIMIC model there are (p+q) (p+q+1)/2 equations to be estimated, which include all coefficients, variances of the observed variables, and co-variances between observed variables. Due to the large 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 ($\sum (\theta)$).

$$(\textstyle\sum) = (\textstyle\sum(\theta)) + (\psi) \dots \dots \dots \dots \dots \dots \dots \dots (3.4)$$

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

The MIMIC estimation process requires estimating more than one specification of the model to achieve the best fitting model. Alexandru et. al. (2010) starts 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 Nepal.

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:

$$y_{1t} = \gamma' x_t + v_{1t} \dots \dots \dots \dots \dots \dots \dots \dots (3.5)$$

$$y_{2t} = \lambda_2 \gamma' x_t + v_{2t} \dots \dots \dots \dots \dots \dots \dots (3.6)$$

$$y_{3t} = \lambda_3 \gamma' x_t + v_{3t} \dots \dots \dots \dots \dots \dots \dots (3.7)$$

From equation (3.2) and (3.5) we can see that estimating the shadow economy (latent variable) is identical to the estimated value of the normalized indicator variable y1, and equations (3.6) and (3.7) show that the estimated value of the second and the third indicator variables y2 and y3 are rescaled (by λ_2 and λ_3 respectively) of the first indicator y1.

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. They argued that the causal variables in MIMIC models are in fact determinants of hidden economic output and that it is reasonable to interpret their combined effect as a measure of the underground economy.

3.5.1.1 Hypotheses of the model:

1. We will include the trade openness index as a causal variable in the MIMIC model and examine the effect of this variable on shadow economy in Nepal.

   - Null Hypothesis (H0): Trade Openness has no effect on the shadow economy in Nepal.

   - Alternative Hypothesis (H1): Trade Openness has an effect on the shadow economy in Nepal.

2. We will include the GDP per capita as a causal variable in the MIMIC model and

examine the effect of this variable on shadow economy in Nepal

- Null Hypothesis (H0): GDP per capita has no effect on the shadow economy in Nepal.

- Alternative Hypothesis (H1): GDP per capita has an effect on the shadow economy in Nepal.

3. 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 Nepal.

- Null Hypothesis (H0): Unemployment rate have no effect on the shadow economy in Nepal.

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

4. We will include fiscal freedom as a causal variable in the MIMIC model and examine the effect of this variable on shadow economy in Nepal.

- Null Hypothesis (H0): The fiscal freedom has no effect on the shadow economy in Nepal.

- Alternative Hypothesis (H1): The fiscal freedom has an effect on the shadow economy in Nepal.

5. We will include government stability as a causal variable in the MIMIC model and examine the effect of this variable on shadow economy in Nepal.

- Null Hypothesis (H0): The government stability has no effect on the shadow economy in Nepal.

- Alternative Hypothesis (H1): The government stability has an effect on the shadow economy in Nepal.

6. We will include the government stability as casual variable in the MIMIC model and examine the effect of this variable on shadow economy in Nepal.

- Null Hypothesis (H0): The government expenditure has no effect on the shadow economy in Nepal.

- Alternative Hypothesis (H1): The government expenditure has an effect on the shadow economy in Nepal.

There is more than one test that is usually used to choose the best fitting model. 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).

3.5.2 Unit Root Test

This empirical analysis is based on time series data, assumes that the underlying time series should be stationary. Time series data is said to be stationary if it's mean, variance and covariance do not vary over time. But it is now a well-known fact that most of the macroeconomic time series are non-stationary (Dickey-Fuller, 1979, and Gujrati, 1995). If we apply the regression model in non-stationary data, it gives a spurious relationship which makes hypothetical test results unreliable. Hence, to avoid a spurious relationship, detecting the stationary or non-stationary of time series is crucial. There are several methods to tests stationary such as graphical analysis, the correlogram test and unit root test. However, this study only discusses the unit root test using the Augmented Dickey-Fuller test.

Augmented Dickey Fuller Test (ADF)

This test was developed by Dickey and Fuller in 1970 and named after them as Dickey-Fuller test. The Augmented Dickey-Fuller test as follows:

The equation for no intercept and no trend is:

$$\Delta y_t = \gamma_i Y_{t-1} + \sum_{i=1}^{k} c_i \Delta Y_{t-1} + e_t \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (i)$$

The equation for only intercept but no trend is:

$$\Delta y_t = a_1 + \gamma_i Y_{t-1} + \sum_{i=1}^{k} c_i \Delta Y_{t-1} + e_t \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (ii)$$

The equation for both intercept and trend is:

$$\Delta y_t = a_1 + \gamma_i Y_{t-1} + at + \sum_{i=1}^{k} c_i \Delta Y_{t-1} + e_t \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (iii)$$

where Δy_t = first difference

The null hypothesis of ADF is $\gamma_i = 0$ against the alternative hypothesis of $\gamma_i < 0$. If we do not reject the null, the series is non-stationary whereas rejection means the series is stationary. If the series is stationary without any differencing, it is said to be I(0) or integrated with order 0. Similarly, if the series stationary after a first difference is said to be I(1) or integrated of order 1.

3.5.3 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.

3.5.4 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:

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

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 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.

3.5.5 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:

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

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.

3.5.6 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 = FML/Fo, where Fo 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.

3.5.7 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.

3.6 Definition of Variables

The MIMIC approach requires the use of structural equation and the measurement equations. 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:

3.6.1 The causes of the shadow economy

Trade openness in the economy

It corresponds to trade (% of GDP). Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product. As economies become more interconnected and trade more with their neighbors and other countries it would be harder to hide shadow activities from authorities.

We will take trade openness in the economy as an indicator of the degree of regulation in the economy. Trade openness has negative effect on the shadow economy.

Unemployment Rate

Unemployment refers to the share of the labor force that is without work but available for and seeking employment. As lack of opportunities in the formal sector would force individuals to engage in informal economic activities. 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.

GDP per capita

It is the average income earned by a person. Countries with higher productivity (GDP per capita) typically have a better allocation of resources within the economy and so smaller informal sectors (*Porta and Shleifer 2008*). Productivity could also act as a proxy for a country's level of development, which is generally correlated with taxation capacity and demand for public goods and services. As with the income level, the relationship between productivity and the size of shadow economy

is endogenous, with causation going both ways. GDP per capita has negative effect on the shadow economy.

Fiscal Freedom

The fiscal freedom component is a composite measure of the burden of taxes that reflects both marginal tax rates and the overall level of taxation, including direct and indirect taxes imposed by all levels of government, as a percentage of gross domestic product (GDP). Tax burden and tax administration are also crucial factors that explain the size of the shadow economy. The higher overall tax burden and/or lower monitoring and enforcement, the stronger incentive for tax evasion and underreporting of wages (*Schneider and Williams 2013, Hassan and Schneider 2016*). It has negative effect on the shadow economy.

Government Stability

It captures perceptions of the stability of political party in the government for an election period. One of the major reasons for the increase of informal economy and shadow economy is political and governmental stability. Weak institutional quality is found to be a key determinant for the shadow economy across the literature. Excessive regulatory burden, inefficiency of government institutions, weak rule of law, widespread corruption can prevent formal firms from hiring workers and encourage informal activities. Government stability has positive effect on the shadow economy.

Government Expenditure

This refers to the expenditure made by the government. This shows the consumption of the government. As the size of government expenditure increases, it shows that the government is investing in development activities which helps to provide better services to the people. As the quality of service provided by government increases, the activities of shadow economy decrease. A positive sign is expected.

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.

3.6.2 The indicators of the shadow economy

Growth rate of GDP

It corresponds to the percentage change in the GDP per capita between two consecutive years. There is no consensus among economists about the correct relationship between the official GDP and the shadow economy. Tedds (2005), Schneider and Bajada (2003), and Giles (1999) find that there is a positive relationship between official GDP and the shadow economy. According to those economists, an increase in the official 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.

Currency in circulation

It corresponds to the currency outside the banks as a proportion of M1. As people engaged in the informal economy usually conduct their activities in cash. The 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.

Labor Force Participation

It defined as the proportion of the population that is economically active. As a decline in official labor force participation could signal some giving up searching for work in the formal sector. 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.

Figure 3.2: The Structural Equation Model Builder Diagram of the DYMIMIC:
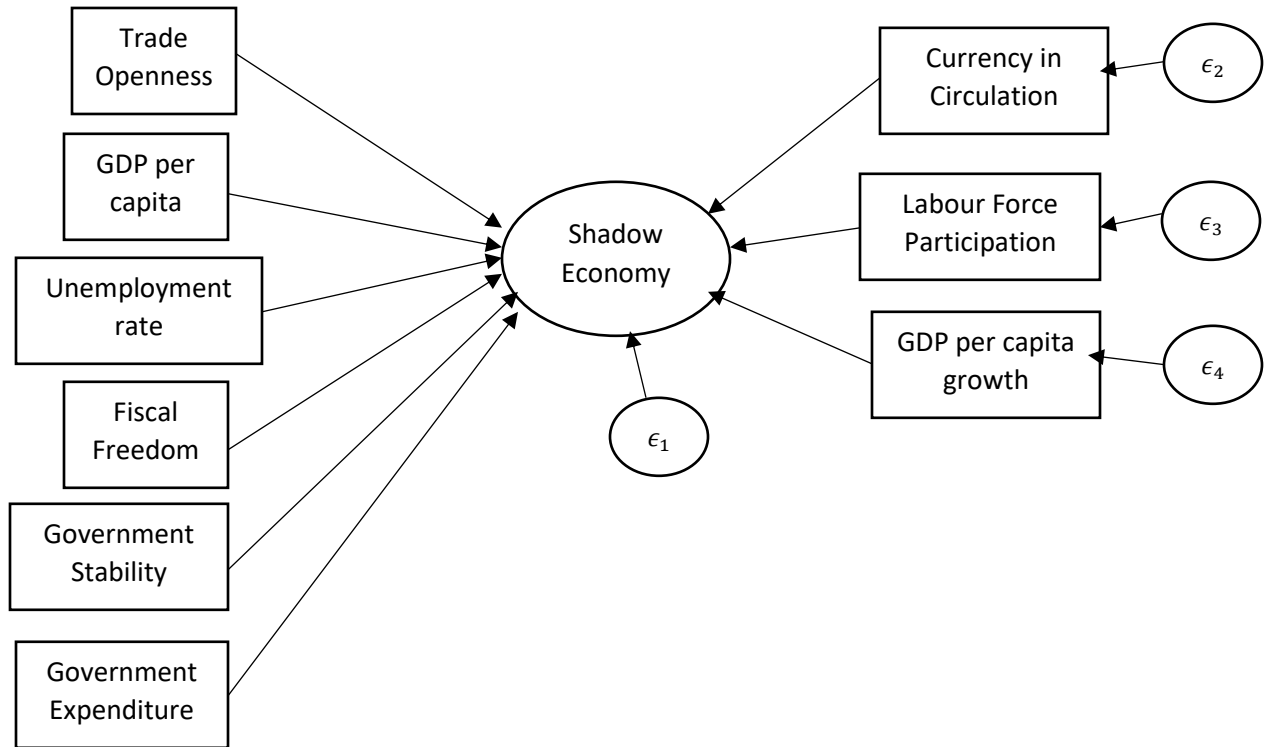
CHAPTER FOUR

ESTIMATING THE SHADOW ECONOMY BY THE MIMIC APPROACH

The purpose of this chapter is to estimate the annual size of the shadow economy in Nepal during the period 2001 – 2018 by using the MIMIC approach. In order to apply MIMIC approach, it is important test stationarity of the variable used in the model i.e. whether there exist unit root. 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).

4.1 Result of unit root test

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. GS, DT and NDT are stationary at level. while GRGDP is stationary at 5%. As for TO, GDPPC, UR, and FF, 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 TO and UR became stationary at 1% whereas GDPPC became stationary at 5%. Table (4-2) shows the results of the Dickey-Fuller unit root test for the variables of the MIMIC approach.

Table 4.1: Result of Augmented Dickey Fuller Unit Root Test

Variables	At Level				At first difference			
	1%	5%	10%	t-stat	1%	5%	10%	t-stat
TO	-2.7550	-1.9710	-1.6037	**0.9710**	-2.7406	-1.9684	-1.6043	**-3.2572**
GDPPC	-2.7550	-1.9710	-1.6037	**0.9387**	-2.7406	-1.9684	-1.6043	**-3.2149**
UR	-2.7550	-1.9710	-1.6037	**-1.6931**	-2.7406	-1.9684	-1.6043	**-3.0387**
FF	-2.7550	-1.9710	-1.6037	**-1.7255**	-2.7406	-1.9684	-1.6043	**-7.6506**
GS	-2.7550	-1.9710	-1.6037	**-4.3792**				
GOVEXP	-2.7550	-1.9710	-1.6037	**-3.7349**				

4.2 Results of 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 other method. 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 percent of official GDP.

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 Nepal, we start with a (8-1-3) (eight causes, one latent variable, and three indicators). The variables which are not significant are gradually omitted until the best fit 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:

- Trade Openness (TO).

- GDP per capita (GDPPC).

- Unemployment rate (UR).

- Fiscal Freedom (FF)

- Government Stability (GS)

- Government Expenditure (GOVEXP).

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

- Currency in Circulation (CIC).

- Labor Force Participation (LFP).

- GDP per capita growth (CG).

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:

$$SE_t = Y_1 X_{1t} + Y_2 X_{2t} + Y_3 X_{3t} + Y_4 X_{4t} + Y_5 X_{5t} + Y_6 X_{6t} + \zeta \dots \dots \dots \dots \dots (4-1)$$

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 currency in circulation with the shadow economy SE, is given by:

$$CIC_t = \lambda_1 SE_t + \epsilon \ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(4-2)$$

The second measurement equation, which links the labor force participation with the shadow economy, is given by:

$$LFP_t = \lambda_2 SE_t + \epsilon \ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(4-3)$$

The third measurement equation, which links the GDP per capita growth with the shadow economy, is given by:

$$CG_t = \lambda_3 SE_t + \epsilon \ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(4-4)$$

Many specifications were estimated to get the best fitting model by the maximum likelihood estimator (MLE) via the program R and package lavaan. In each specification we gradually omitted the statistically insignificant variables. It is worth noting that when the two variables (rule of law, and control in corruption) are used as separate causes in the model, the model either does not converge or the variables are not significant. Therefore, we omit the insignificant variables. After conducting many specifications, the end result is the (6-1-3) specification, which is considered the best fitting model. Table (4-1) shows the model's results, which converged after eighty-eight iterations.

There are many tests that examine the model's overall goodness of fit (appendix). 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 and adjusted 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.

Table 4. 2: The MIMIC model results for the Nepalese economy

Casual Variables	Estimated Coefficients
Trade Openness	1** (6.838)
GDPPC	-0.133** (7.317)
Unemployment Rate	0.338** (5.855)
Fiscal Freedom	-0.083** (0.816)
Government Stability	-3.18** (3.219)
Indicator Variables	
Currency in Circulation	3.031* (1.732)
Labor Force Participation	9.177** (4.954)
GPPC Growth	16.06** (6.706)
Test Statistics	NFI = 0.93 NNFI = 0.91 RMSEA= 0.065 GFI = 0.97 AGFI = 0.77

*, ** indicates that t-statistics is significant at 90% or 95% confidence level, respectively.

In the same direction, the trade openness variable 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 Nepal. The GDPPC, fiscal freedom and government stability, however, have a negative sign and is significant at the 5 percent confidence level. This indicates that the effect of these three variables reduces the shadow economy in Nepal.

Table 4.2 above shows the accepted MIMIC model with three indicators namely, CIC, LFP and CF and six casual variables namely, TO, GDPPC, UR, FF, GS and GE.

The indicators LFP and CG from the measurement model are highly significant i.e., at 5 percent level of significance and CIC is significant in 10 percent level of significance. All three indicators have positive coefficients indicating a direct relationship with the SE.

The structural equation model, which links the causal variables to the SE, indicates that TO, UR and GE are positively related to the SE activities, implying that an increase in any of those causal variables will results in an increase in the SE activities.

The GDPPC, FF and GS were highly significant in explaining some movements in the SE activities. When these indicators decrease, the SE activities increases shows an indirect relationship.

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

Measurement equations:

$$CIC_t = 3.031 * SE_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots . (4-5)$$

$$LFP_t = 9.177 * SE_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots . (4-6)$$

$$CG_t = 16.06 * SE_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots . . (4-7)$$

Structural Equation:

$$SE_t = 1 * dTO - 0.133 * dGDPPC + 0.338 * dUR - 0.083 * dFF - 3.18 * GS + 0.989 * GOVEXP \ldots (4-8)$$

From equation (4-8), annual indices (ordinal values) for the shadow economy in Nepal are calculated for the period 2001-2018. The MIMIC approach estimates show that the average shadow economy in Nepal for the period 2001-2018 was 21.49 percent of GDP. Despite the absolute value of the shadow economy during that period witnessed continuous increases, from 2001 to 2006, its percentage to GDP has decreased from 19.52 percent in 2001 to 11.24 percent in 2006. 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 Nepal; namely the trade openness, GDP per capita, unemployment rate, fiscal freedom, government stability and government expenditure.

Figure (4-1) shows that the general trend of the shadow economy in Nepal according to the MIMIC approach went downward during the period 2001-2018 despite the upward trend in some years during that period. The shadow economy witnessed a notable increase in the recent times and reached 35.48 percent of GDP in 2018. That increase may be mainly due to the extension of the government intervention in the Nepalese economy when the government has increased the tax bracket and tax rate due to which people tends to carry out activities in cash as well showing minimum income and wealth. The shadow economy witnessed a downward trend to reach 11.24 percent of GDP in 2006. This decrease may be affected by the remarkable change of the political structure of the country. After that, the shadow economy increased and reached its peak of 35.48 percent of GDP in 2018.

Figure 4. 1: Trend of the shadow economy in Nepal (% of GDP)
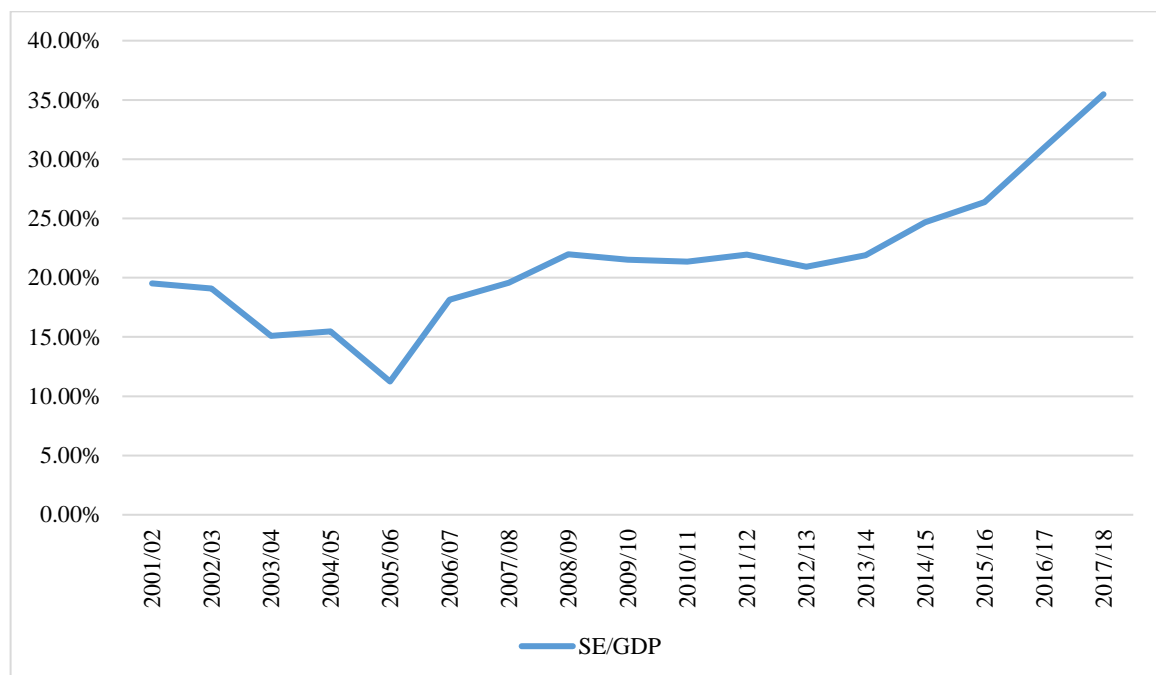
This study uses the scientific "indirect" method, the MIMIC model to estimate the size of SE in Nepal. The model estimates the SE using economic indicators at macro-level and is viewed to be superior when compared to direct methods such as surveys and tax auditing. (Giles & Tedds, 2002; Hassan & Schneider, 2016).

The MIMIC model was evaluated using the commonly used statistics, RMSEA and fit index. The value of RMSEA is 0.065. Accepted models are considered to have a RMSEA

of less than 0.10. The NFI and NNFI vary from 0 to 1, where 1 is the complete fit model. The values of NFI and NNFI are 0.93 and 0.91 respectively, which indicate a good model fit.

The GFI and 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. The result shows that GFI and AGFI are high at 0.97 and 0.77 respectively, which indicate a good model fit.

4.3 Discussion

The sharp economic crises in Nepal in the late eighties boosted unemployment to unrecorded rates in the first half of the nineties. This, in turn, may cause 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.

In 2000, the shadow economy increased by one percentage point to 20.4 percent of GDP. That increase may be the outcome of the increase in the effective tax rate from 15.3 percent in 1999 to 16 percent in 2000, after raising VAT 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. The cause of decrease in the size of shadow economy might be the comprehensive peace agreement between the Maoist party and other political parties of Nepal, provocation work of CIAA and increase in the awareness of the people.

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. During this time, there held election to form the constitutional assembly. As election is the costly thing to do, during that time most the politicians used hidden money to fund for the election. Due to which hidden or black money were brought in the market which increases the size of shadow economy in Nepal.

After 2010, the size of the shadow economy was increased continuously. It reached about 35 % percent of the GDP in 2018. The average size of the shadow economy between 2010 to 2018 was 25.50 percent of the GDP. The main reason for the increase in the size of the

shadow economy during that time was mainly due to the government and political parties are unable to formulate the constitution in time. As a result, there was increment of impudence, corruption, non-transparent works, no rule of law etc.

The MIMIC model result support the trade openness, GDP per capita, fiscal freedom, government stability and government expenditure are considered as the causes of the shadow economy in Nepal. The unemployment rate is found to be positive factor for the shadow economy in Nepal. This indicates that the income effect of unemployment, which reduces the shadow economy, is less than the substitution effect, which increases the shadow economy.

The coefficient of trade openness is 1 thus trade openness has a positive effect towards the shadow economy. The effect is significant at 5 percent level. Chaudary (2010) found out that despite indicating good performance in trade openness there is no harmony to open all sectors. Due to which people may search for illegal channels to import the goods and services.

GDP per capita has negative coefficient i.e., -0.133, which shows that it has negative impact on the shadow economy. The shadow economy depresses the growth of GDP. The shrinking shadow economy will increase tax revenues, stimulating a rise in public spending and leading to a rise in the overall economic growth. The lower the GDP, the people will look for opportunities in the SE (Buen & Farzanegan, 2013; Schneider and Enste, 2013; Dell' Anno *et. al.,* 2007)

The coefficient of unemployment rate is 0.388. It means unemployment has positive relation with the shadow economy. As the unemployment rise, the shadow economy rises and vice-versa. According to Schneider (2012), the overall burden of the state, situation of labour force market and unemployment rate are crucial for an understanding of the dynamics of the shadow economy and especially the shadow labour force. Medina & Schneider (2018) use unemployment as an important factor of the shadow economy.

The fiscal freedom has negative impact on the shadow economy. As the tax burden imposed by the government increases, people hesitate to pay the increase tax. So, they search for the illegal ways to reduce the amount of tax which ultimately increases the size of shadow economy.

The government stability has the value of coefficient -3.18. Mazhar and Jafri (2017) established negative correlation between political stability and the shadow economy and it ceases to exist at higher levels of the size of the informal sector. Less stable government use inflation tax because of their tendency to use inefficient economic policies. It enhances the presence of the shadow economy. Dell'Anno (2007) states that an increased public sector means that government officials have more power over decisions and will result in more corruption.

Government expenditure coefficient shows positive relation with the shadow economy. When the share of useful government expenditure is high, then increase in wages in the formal sector leads to increase in the size of the shadow economy and taxation.

Medina & Schneider (2018) have assessed the size of shadow economy in a cross-country framework. Their estimated the average size of shadow economy of Nepal for the period of 1991 to 2017 was 36.4 percent. Raut *et. al.* (2012) estimates the size of shadow economy for the period of 1991 to 2012 in the range of 20 percent to 68 percent of the GNP.

Arun Kumar (2006) argues that the shadow economy in India is worth almost half the size of India's official economy. Given Nepal's open border with India, this has an influence on Nepal's shadow economy.

According to World Bank Policy Paper (2010), transition countries tend to have higher levels of regulations, leading to a significantly higher incidence of bribery. In Nepal, there is chronically low wages, high taxes and the lack of control exercised by authorities. The prevalence of cash payments allows for the low risk of detection of illegal exchanges.

CHAPTER FIVE

FINDINGS, CONCLUSION and RECOMMENDATION

5.1 Findings

The main objective of this study was to estimate size of the shadow economy in Nepal using MIMIC model. To achieve this objective, this study used dataset of 18 years from 2001 to 2018. The ADF test was applied to test the stationary of the time series data. The model was estimated by the structural equation modelling. The major finding of the study are as follows:

1. The estimated size of the shadow economy of Nepal in 2018 was 35.48 percent of the GDP.
2. The average size of the shadow economy of Nepal from 2001 to 2018 was 27.72 percent of the GDP.

5.2 Conclusion

Many studies have suggested that the optimal method is the MIMIC mode. It assumes that the size of the shadow economy is a latent variable, on the one hand, with certain number of observable indicators which reflects changes in shadow practice and, on the other hand, with set of observable causal variables that are taken as the most important determinants of hidden economy relations.

The determinants of the shadow economy have a multidirectional influence, positive and negative. Of the identified factors of the shadow economy trade openness, unemployment rate and government expenditure have positive impact while GDP per capita, fiscal freedom and government stability have negative impact on the shadow economy.

Our model suggests that increase in trade openness does serve as a motivation to stop engaging in the SE activities. Government expenditure could result in either a positive or a negative relationship with the shadow economy. In our case, the model suggests that growth in government expenditure will result in more activities in the shadow economy. GDPPC could also have a positive or negative relationship with the shadow economy. The

model result confirms Schneider (2005)'s assertion that the relationship is negative for developing countries. Similar results were obtained for unemployment rate and fiscal freedom.

Nepal has been undertaking considerable tax reforms for more than two decades but has been less effective in widening the tax base, simplifying and strengthening tax administration, initiating good governance, improving compliance and modernising the economy that could help the tax coverage and reduce the size of the shadow economy.

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

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Appendix 1. Variable Definitions and Data Sources

TRADE OPENNESS: It corresponds to trade (% of GDP). Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.

Source: United Nations Statistical Database.

GDP PER CAPITA: It is the average income earned by a person. It is a measure of a country's economic output that accounts for its number of people.

Source: Economic Surveys.

UNEMPLOYMENT RATE: Unemployment, total (% of total labor force). Unemployment refers to the share of the labor force that is without work but available for and seeking employment. Definitions of labor force and unemployment differ by country. Source: International Labor Organization, Key Indicators of the Labor Market database.

FISCAL FREEDOM: Subcomponent of the Economic Freedom Index. It measures the fiscal burden in an economy, i.e., top tax rates on individual and corporate income. It ranges from 0 to 100, where 0 = least fiscal freedom, and 100 = maximum degree of fiscal freedom. Source: Heritage Foundation.

GOVERNMENT STABILITY: It captures perceptions of the stability of political party in the government for an election period. The scores of this index lie between -2.5 and 2.5, with higher scores corresponding to better outcomes.

Source: Worldwide Governance Indicators: 1996-2019, World Bank.

Available on line at: web.worldbank.org.

GOVERNMENT EXPENDITURE: General government final consumption expenditure (% of GDP). General government final consumption expenditure (formerly general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees).

Source: United Nations Statistical Database.

Available on line at http://unstats.un.org/unsd/snaama/dnllist.asp.

CURRENCY IN CIRCULATION: It corresponds to the currency outside the banks (M0) as a proportion of M1.

Source: International Monetary Fund, Economic Survey and Nepal Rastra Bank.

LABOR FORCE PARTICIPATION RATE: It corresponds to the labor force participation rate, total (% of total population). Labor force participation rate is the proportion of the population that is economically active: all people who supply labor for the production of goods and services during a specified period.

Source: International Labor Organization, Estimates and Projections of the Economically Active Population database.

RATE OF GDP PER CAPITA: It corresponds to the percentage change in the GDP per capita between two consecutive years.

Source: World Bank Database, Economic Survey and Nepal Rastra Bank