

UNDERGROUND ECONOMY OF NEPAL: AN ESTIMATION USING THE CURRENCY DEMAND APPROACH AND THE MIMIC MODEL

CHAPTER 1: INTRODUCTION

Underground economy is a highly debated and non sequitur phenomenon which exists everywhere around the world. National accounts of a country do not comprehend every transaction that occurs in the country, at times things are not transparent or accountable to be a contributor of subject matter in the economic figures. Likewise, is the underground economy. In simple terms, participants of the underground economy may be an illegal trader of drugs or people misrepresenting their income to avoid taxes. These activities exist physically in the economy but do not hold grounds in national figures. Underground economy or underground economic activities are referred to those production of goods and services that could otherwise be provided through registered market channels, but are subject to economic transactions not registered in national income and product accounts.

There is no correct tool to measure the outreach of underground activities in an economy, but broadly these three methods are identified to estimate the measurement:

1. **Direct approaches:** The techniques under this approach are survey and questionnaire based. Tax audits, statements, and national accounts. Direct approach techniques are doubted to have biases because people or evaders are less likely to admit that they are not paying taxes or are involved in illegal activities, etc.
2. **Indirect approaches:** The techniques of estimation under this approach are based on using indicators of underground economy as a proxy. These macroeconomic approaches are based on various discrepancies between indicator variables. The commonly used indirect approaches are Discrepancy between the National Expenditure and Income Statistics, Discrepancy between Official and Actual Labor Force, Transactions Approach, Currency Demand Approach, and Electricity Consumption approach.
3. **Structural or modelling approach:** This approach uses structural equation modeling (SEM) technique, which is widely used in psychometrics and social science research. Multiple indicators, Multiple causes (MIMIC) is one of the common estimation models used in this approach, where a set of exogenous causal variables impact on the latent variable is observed.

Among these various methods, the currency demand approach, which is one of the indirect approaches, and MIMIC under the structural modelling approach are commonly used for measuring the estimates of underground economy. This study is based on Nepal. Nepal is also a developing and a lower-middle income country with HDI value of 0.602 as of 2019. In many countries, including Nepalese cases, in the initial phase of urbanization, informal economic activities are very high. The Central Bureau of Statistic's analytical report on informal sector according to the National Economic Census defines informal sector which has the characters of: ease of entry, reliance on indigenous resources, family ownership of enterprises, small scale of operation, labor-intensive and adapted technology, skills acquired outside the formal school systems and unregulated and competitive markets. Whereas the same report also reveals that there are 49.9 percent of unregistered establishments in Nepal, whereas 25.8 percent of people are

engaged in those unregistered establishments. The Nepal Labor Force Survey (NLFS) - 2017/18 has estimated around 62 percent of people to be currently employed in the informal sector.

The Central Bureau of Statistics is responsible for collecting the relevant data of the underground economy. A report by International Labor Organization (ILO) shows that the share of informal employment covers about 94.3 per cent in Nepal (*Women and men in the informal economy*, 2019). This paper includes measurement of Nepal's underground economy from 1991 to 2019 and the factors contributing to it.

CHAPTER 2: METHODOLOGY

In this study, causal research aims to explain the cause-and-effect relationship between various indicators and causal variables of underground calculated from CDA and MIMIC approaches. This causal research also aims to explain the associations of rising Nepalese Swiss Bank deposits with the underground economy.

For the CDA approach, the currency demand equation will be estimated. Several independent variables will be assessed and used in this study. In case of CDA approach, the independent variables will be Tax revenue per GNP, Households' final consumption expenditure (% of GDP), Rate of interest given on time deposits, Per capita income, and Inflation (general price levels). While in the MIMIC approach, Tax burden, Recurrent government expenditure, self-employment rate, and unemployment rate will be the exogenous causal variables; Real GDP growth, real currency growth, and labor force participation will be the indicator variables; and Underground economy will be used as the latent variable. Lastly, Nepalese deposits in Swiss banks will be used as the independent variable in the latter phase. The data for this research will be taken from 1991 to 2019 as the data before this period is not conveniently available. The data for estimating the size of underground economy have been collected from various reports and economic bulletins published by Nepal Rastra Bank, Ministry of Finance, and World Bank Database.

CDA model Specification:

$$CC = a_0 + a_1 \ln T + a_2 \ln (WS/NI) + a_3 \ln R + a_4 \ln Y + e$$

In the equation, the dependent variable is the ratio of currency holdings (C) to money (specified as M2). Real per capita income (Y), the rate of interest paid on time deposits (R), the wage-salary ratio in national income (WS/NI), and an income tax variable are the independent variables (T). Demand for money is calculated as:

$$\ln \left(\frac{C}{M2} \right)_t = \beta_0 + \beta_1 \ln \text{consumption}_t + \beta_2 \ln \text{interest}_t + \beta_3 \ln \text{tax}_t + \beta_4 \ln \text{percapita}_t + \beta_5 \ln \text{inflation}_t + u_t - (1)$$

with $\beta_1 > 0$, $\beta_2 < 0$, $\beta_3 > 0$, $\beta_4 > 0$

In the following equation, \ln stands for natural logarithm, $C/M2$ is the ratio of cash holdings to current and deposit accounts, \ln_tax is the government's total tax revenue per Gross National Product representing changes in the size of the shadow economy, and $\ln_consumption$ is the proportion of private consumption expenditure in national income to capture changing payment and money holding patterns, $\ln_interest$ is the rate of interest given on savings accounts to capture

the opportunity cost of holding cash, $\ln_percapita$ is per capita income and $\ln_inflation$ is the inflation rate representing general price level.

The new equation with tax becomes the following from equation 1:

$$CC_t = \beta_0 + \beta_1 \ln consumption_t + \beta_2 \ln interest_t + \beta_3 \ln tax_t + \beta_4 \ln percapita_t + \beta_5 \ln inflation_t + u_t - (2)$$

The new equation without tax becomes the following:

$$\beta_0 + \beta_1 \ln consumption_t + \beta_2 \ln interest_t + \beta_3 \ln percapita_t + \beta_5 \ln inflation_t + u_t - (3)$$

Thus, excess currency demand (ECD) is calculated as follows:

$$ECD_t = CC_t - CC_{t \neq 0} - (4)$$

Where, CC_t represents Currency Calculations with tax and $CC_{t \neq 0}$ is Currency Calculations without tax.

Illegal money (IM) is calculated by multiplying equation 4 by the M_2 variable:

$$IM = ECD_t * M_2$$

Legal money (LM) is calculated using as:

$$LM = \text{Narrow Money Supply (M1)} - IM$$

Velocity (V) for the formal economy is calculated as:

$$V = \text{National Income (GNP)} / LM$$

Lastly, Underground Economy is calculated as:

$$UE = IM * V$$

The calculated IM is then presented as a percentage of GDP in the following sections of model estimations and analysis.

Equation (2) is re-specified to use the ARDL model, whereby the variables Per Capita Income ($\frac{Y}{N}$)_t and Interest rate (I_t) is removed from the equation. For the specifications of ARDL model and the Bound test, the study defines a vector of variables, G_t , where, $G_t = (c_t, b_t')'$. Here, c_t is the dependent variable and b_t' is a vector of regressors. The data generating process of G_t is a p-order vector autoregression. For cointegration analysis ΔCC_t must be modeled with the error correction form (ECM) in the model i.e.,

$$\Delta CC_t = \beta_0 + \pi_{cc} c_{t-1} + \pi_{cb.b} b_{t-1} + \sum_{i=1}^p \partial_i \Delta c_{t-i} + \sum_{j=1}^q \delta_j \Delta b_{t-j} + \emptyset w_t + u_t - (5)$$

where, π_{cc} and π_{cb} are long run multipliers, β_0 is the drift term and w_t is a vector of exogenous components. The bounds testing procedure tests for the absence of any level relationship between c_t and b_t through exclusion of the lagged levels variables c_{t-1} and b_{t-1} in the equation.

MIMIC Model Specification:

Part 1: Latent variable is linearly determined by a set of exogenous causal variables

$$\eta = \gamma' \chi + \zeta \quad (6)$$

Where, χ is a vector of causal variables, γ is a vector of scalars, η is the latent variable (shadow economy) and ζ is a structural disturbance term.

Part 2: Links the shadow economy with the set of selected indicators

$$y = \lambda \eta + \varepsilon \quad (7)$$

Where, y is a vector of indicator variables, λ is a vector of loading factors to represent the magnitude of the expected change for a unit change in the latent variable η and ε is the measurement error term.

After the SEM's results of part 1 and 2 are obtained on the γ vector, the values are projected to fit the latent variable, which tracks the estimates of Underground economy in Nepal. For the benchmarking procedure, 1991/92 is taken as the base year.

$$C = \frac{V}{\eta} \text{ and}$$

$$UE = C * \eta \quad (8)$$

Where, V is the benchmark value at time index, η is the estimates obtained by MIMIC, UE is the benchmarked estimates. The methodologies for benchmarking differ in each, but they always boil down to two options. The benchmark value is obtained by multiplying or adding the corresponding element in the time series produced by MIMIC. In this investigation, the multiplication process is applied.

Swiss Deposits Model:

$$UE_t = \beta_0 + \beta_1 \text{Swis}_t + u_t \quad (9)$$

Where, Swis represents the Nepalese deposits in Swiss bank accounts and u_t is the error term in the equation. A simple OLS regression and correlation analysis will be conducted for this model.

CHAPTER 3: ANALYSIS

The results of Augmented Dickey-fuller (ADF) tests show that all the variables are stationary at the first difference except for log_interest. ARDL model cannot be used until there exist mixed results of stationarity, which can be seen from the ADF test. Thus, as this paper aims to check both long and short run effects, the Interest rate variable (log_interest) is also dropped. The benefits to using the bounds testing approach to cointegration after the ARDL model, as it works regardless of whether the underlying regressors are strictly I (0), strictly I (1), or mutually cointegrated, additionally, it solves the potential endogeneity concern. Bound test is also one of the best ways to test the stability of an economic model, thus CUSUM test or LM test are not included to check for structural stability.

For the calculation of Illegal Money, the values are re-estimated using two different equations with and without tax separately. The variables log_percapita and log_interest is excluded while calculating equation 2 and 3 due to issues of multicollinearity (see annexure 2 and 3) and

Variables	Estimates with Tax			Estimates without Tax		
	Coefficients	t-stat	p-value	Coefficients	t-stat	p-value
Constant	-2.19	-5.94	0.0000	-1.47	-6.07	0.0000
log_consumption	-0.79	-4.54	0.0001	0.72	2.25	0.034
log_inflation	0.07	2.70	0.022	0.021	0.19	0.853
log_tax	0.32	2.81	0.018			
R squared = 0.88				R squared = 0.17		
Adjusted R squared = 0.74				Adjusted R squared = 0.10		
Prob>F = 0.0000				Prob>F = 0.009		
Bounds Test (F stat) = 10.109						

the ADF test. The summarized empirical results are as follows in the tables

With the estimates including tax, the sign of coefficients is as expected. Inflation and Tax positively affects the dependent variable C/M2, whereas consumption seems to have negative impact in C/M2. All the variables are significant at 5% level of significance. The adjusted R squared of 0.74 represent that 74% variations in dependent variable C/M2 is explained by the three independent variables. In the equation estimated without tax, only 10% variations in C/M2 are explained by consumption and inflation. But the variations can be seen in the long run through the estimates of ARDL model. According to the results of ARDL model, in long run the variables log_consumption, log_inflation and log_tax is significant at 5% level of significance. This shows that the variables are co-integrated in the long run. Although, the coefficients of log_tax and log_inflation deviates, in long run they ultimately combine together. The dependent variable C/M2 although deviates in short run, in long run the averages converge. The results of ARDL error correction model also shows that in long run, inflation and tax negatively affects the currency demand, while the consumption positively affects the currency demand by coefficient of 1.44. Despite the assumption of CDA approach that tax increases UE, in context of Nepal, in the long run, tax reduces the UE. The results of short run indicate that, the first difference of inflation is not significant one lag prior year shows significance and has positive impact of currency demand.

After re-estimating the values calculated for each t by putting the corresponding observed through the results using tax and without tax, the difference of these two multiplied by broad money gives the Illegal money. Except for some fiscal years, the LM is always higher than the IM (See Figure). The results of this study incline to that of Raut et al., (2016), whereby it can be seen that UE is on a steady rise in Nepal (see figure) irrespective of formulating multiple reform measures, rules, and regulations enacted.

Figure: Comparison of Legal and Illegal Money over time

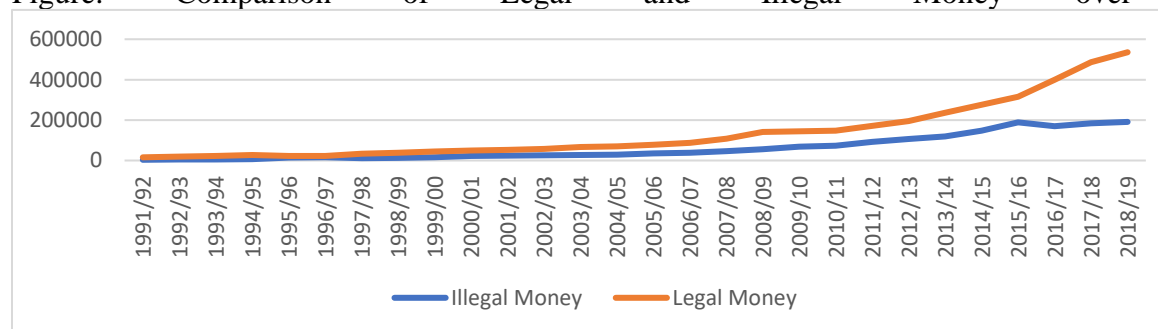
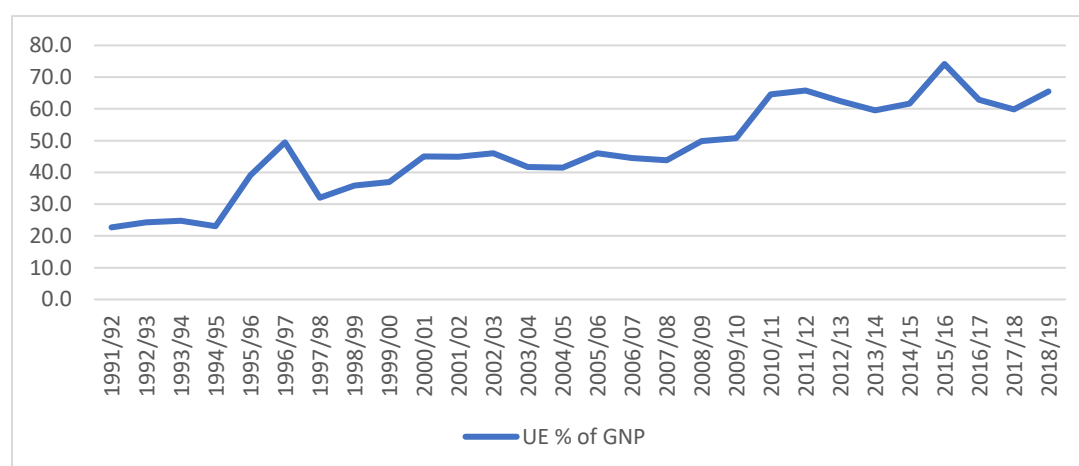


Figure: Underground Economy as percentage of GNP



The UE was stagnant in the early 90s and had a sharp inclination till around 50% in the mid-90s, which can be tagged to the beginning era of Armed conflict in Nepal, and again fell to between 30 to 40 percent. Then the UE has been in a slow rising trend reaching around sixty percent in 2014/15. But there can be seen a slight growth to above 70% in the year 2015/16, which can be attributed to the fact of a massive earthquake. This can be explained with the fact that the economy was shattered, followed by the Indian Blockade, whereby many people lost their jobs, and illegal trade could have increased.

Structural Equation Modelling is used in this study to associate the causes of underground economy and satisfy its presence through indicator variables. The variables used in this model to see the causes of underground economy were Tax, Self-employment, Unemployment, and Recurrent government expenditure, whereas the indicator variables were Labor force participation rate, real GDP growth rate, and Real currency growth rate. The detailed SEM estimates including the error term, modelling paths and diagram show the clear representations after 200 iterations

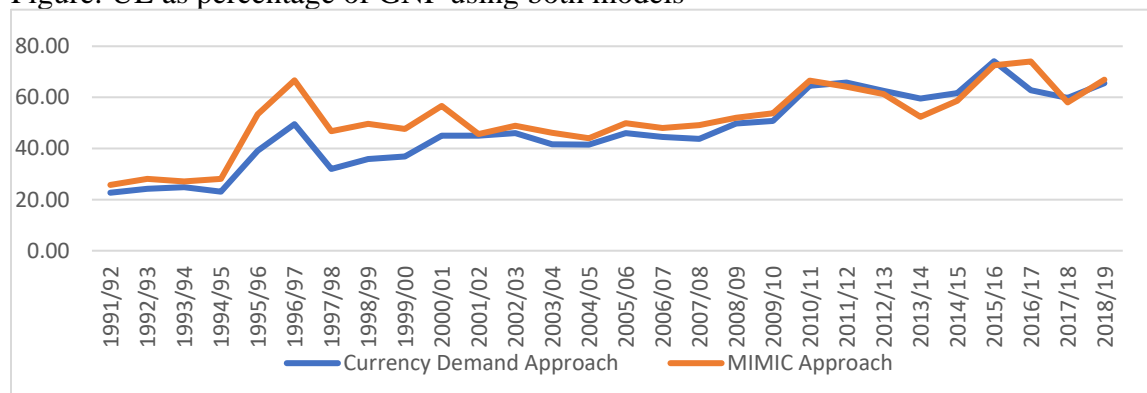
selected to make the model concave and applied Wald test. The summarized estimates are shown in the table below.

Table 1: Estimates from MIMIC

Variables	MIMIC estimates from SEM		
	Coefficients	z-stat	p-value
Tax	0.88	1.99	0.047
ln_SelfEmployment	8.27	2.84	0.005
ln_Unemployment	2.34	0.52	0.002
ln_gov	-4.97	-2.75	0.006
Prob>chi2 = 0.0000			
Wald test for UE= 0.0134			

As the table summarizes, all the variables except recurrent government expenditure positively affects the UE whereas the indicator variables also seem to be significant. Government Expenditure on the other hand does not represent the spending for unemployed or for filling the gap of currency demanded in an economy. The Wald test is significant at 5% level of significance which sought to justify that the explanatory variables in the model are significant as well. Later the prediction of the observed latent variables gives the estimates of UE in the model. The results of SEM are as expected. For the calculations of underground economy, the estimates of CDA approach are taken where estimates of year 1991/92 is taken as base year for predicting the UE through this model. The estimates of both the models are shown in the graph below.

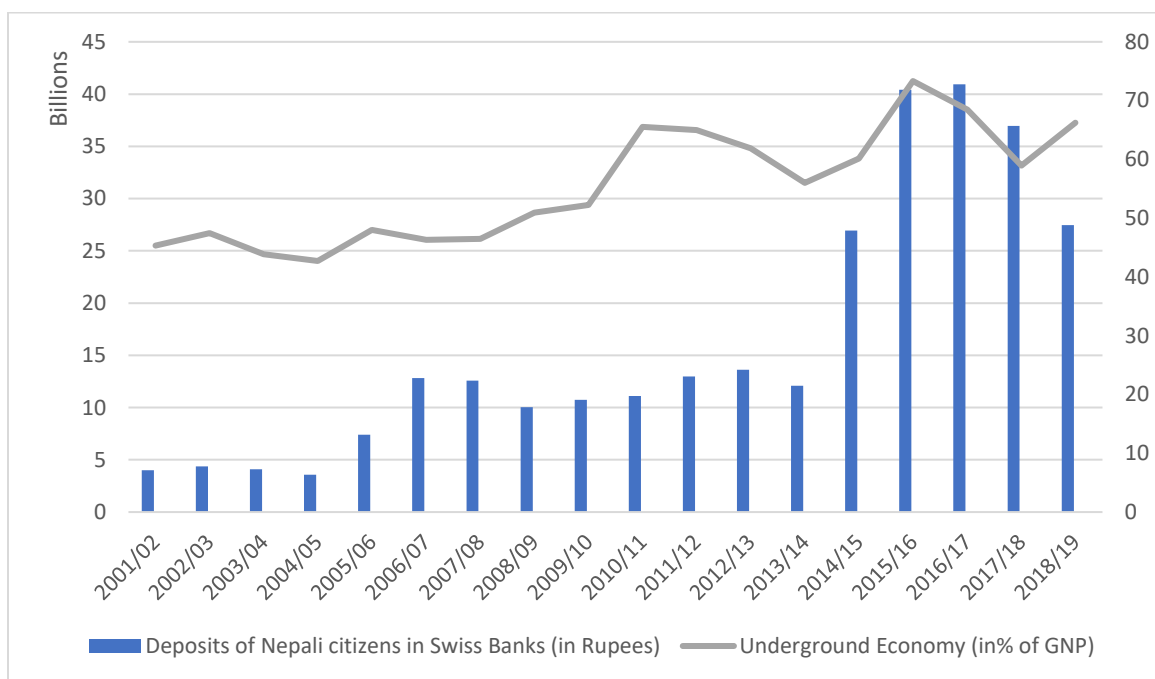
Figure: UE as percentage of GNP using both models



The summarized results of the data show that the average Nepalese deposits in Swiss bank accounts is Rs.16.22 billion whereas the average underground economy is 55.49 percent of GNP from the year 2001/02 to 2018/19.

The Adjusted R-squared implied that 59% of the variations caused in the UE is the responsibility of the Nepalese parking illicit money in Swiss bank accounts. The model is also significant at the 5% level of confidence. The results show that Rising deposits of Nepalese in Swiss accounts have a positive impact on the dependent variable, i.e., UE. As the UE tends to pace upwards, the deposits also seem to hike at a rapid rate. This clearly shows that underground economic activities create illegal money which is parked into foreign banks for tax evasion or illicit income to places where banks offer great privacy in doing so (See Figure).

Figure: Deposit of Nepali Citizens in Swiss Bank and the UE of Nepal



CHAPTER 4: SUMMARY, DISCUSSION AND IMPLICATIONS

Although MIMIC estimates show more share of UE in GDP, both models' estimates suggest that UE is in a rising trend from 1991/92 to 2018/19 as expected. This also indicates that the official statistics related to the country's labor force, employment rate, private consumption and national income are untrustworthy due to a thriving shadow economy. Policies and the steps from the Nepalese government that are based on incorrect statistics may be ineffective and counterproductive. The choices made on the political and economic level depict false indicators and unproductive macroeconomic strategies and planning.

With occurrence of instances like the moist insurgency in late 90s, housing bubble in 2008, earthquake and economic blockade in 2015 and the Corona virus pandemic in 2020, the UE in Nepal seems to take an inclination. Similarly, rising UE is also responsible for triggering Nepalese

deposits in Swiss accounts as shown by the estimates in the analysis section above. Political instability, lack of security, and degraded facilities from the side of the government can be a quick cause for people refraining from the official economy and violating the principles of boarding the Nepalese currency outside the country. Money laundering has been a heating issue in developing nations, although regulatory bodies and enforcement agencies have been authorized with power to work on it, the results do not seem to show a positive sign. Politicians and economic culprits are focused on illegal money and corruption. The game of illegal money is played from the top. Reducing the bounds of UE activities does not imply closing down street vendors and activities associated with poor. The UE activities need to be included with the formal system, the authorities need to conduct behavior elevating recognition campaigns to elevate the attention of the unofficial network approximately the need of adherence to legal guidelines and policies for the general public interest. Because on the contrary, UE activities are providing contributions to the advent of markets, boom monetary resources, decorate entrepreneurship, and remodel the legal, social, and monetary establishments vital for accumulation. The voluntary self-choice among the formal and informal sector can additionally offer a better capacity for monetary growth, resulting in a tremendous correlation between a boom of the informal sector and economic growth. The authorities need to additionally rethink the tax coverage because it negatively affects the social and financial conditions. and Commercial banks need to rethink funding to create an investment environment that would boost the saving deposits.