UNEMPLOYMENT, OFFICIAL ECONOMY AND THE DIMENSION OF THE SHADOW ECONOMY: AN EMPIRICAL ANALYSIS FOR SRI LANKA USING *SEM* APPROACH

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Abstract

This study attempts to estimate the share of Sri Lankan shadow economic activities as a percentage of official estimates, while revolving the wheel of non-clarified zones and market functions through overstepping the traditional official estimates. The methodology involves the estimation of structural models to analyse a set of causes of the shadow economy and its influence upon a series of indicators. The study introduces three Multiple Indicator Multiple Cause (MIMIC) models namely MIMIC 5-1-2a, MIMIC 4-1-2b and MIMIC 3-1-3a. The benchmark calculations for each model derives a series of average values for the Sri Lankan shadow economy (SE) in the period from 1990 to2012. Estimated data in model MIMIC 5-1-2a suggests to evidence that the average size of shadow economy in the country is ranging between 91% and 32% in the period from 1990 to 2012 with a decreasing trend. By contrast, calculations for MIMIC 4-1-2b and MIMIC 3-1-3a demonstrate a size of 14% and 52% with an increasing trend respectively. In-depth analysis further reveals the facts that effect the share of tax on goods and services to the government revenue and the level of public employments tend to undermine the increasing pattern of shadow economy. Since the unemployment rate and private employment is playing a charismatic role in the economy, shadow economy tends to increase. Eradicating the workplace enforcement crisis and underemployment issues may hinder the increasing pattern. The results from re-examination of Okun's law supports for the idea that, less interdependence of the growth of shadow economy and official economy and a parallel growth with shifting stages in market functions.

Keywords: *Shadow Economy; Unemployment Rate; MIMIC Models; Benchmark Calculations; Okun's Law; Official Economy*

JEL Classification: E26, E27, C36

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INTRODUCTION

Existence of a considerable share of shadow economic activities is one of the major obstacles faced by the emerging nations, like Sri Lanka. It may hinder the growth of a strong public sector as well as creation of a *functioning market economy*[1]. Existence of Shadow Economy (SE) imposes the pessimistic costs such as tax evasion, market distortion, unfair competition and inefficient resource allocation in the economy. On the other hand, it provides an important safety net for individuals who fall short to compete within the rigid occupational structure in Sri Lanka. For examples, a school teacher who owes a tuition class at his home may not pay any share of income from tuitions to the government as the form of income tax. Similarly, a university student who doing a part time job hiring an unlicensed three-wheeler at night and a drug dealer negotiates a sale with his eventual customer on a street corner are further examples for activities in SE. Therefore, giving definition to and understanding the exact shape of SE is not an easy task to sort out.

In general, there are two major approaches to define SE. They are the 'Definitional Approach' and the 'Behavioural Approach'. According to Definitional approach, Shadow Economic activities are simply in the unrecorded economic activities while the behavioural approach is focusing to its behavioural characteristics. Usually, SE is recognized

[1] Well-functioning markets are embedded in a larger environment that creates the necessary conditions for their effective operation. Markets do not function as well without a certain degree of macroeconomic stability, trust and confidence.

as a part of economic activities involving goods and services which are paid by cash, but not declared for tax. In addition to that, modern thinking reveals that the formal and informal sectors in the economy are depending on each other. Therefore, SE and formal economy could be inter-dependent on each other.

A study conducted by Schneider and Enste (2000) in Sri Lanka, using *physical input-electricity consumption method* [2] demonstrates that in average 40% of Shadow economy was in 1989-90 periods. Another study by Schneider (2004) has fund that an increasing trend of the size of SE in between 1999-2003 periods and it has averaged at 45.9%. However, recent study by Schneider et al. (2010) demonstrate a 43.9 % of average size of SE with decreasing trend for the periods from 1999 to 2007. In general, by 40% of economic activities are running avoiding taxes and social security contributions; those will be greater pessimistic barriers against the economic growth in a country.

The relationship between SE and the unemployment rate has long been discussed by the researchers. According to Alanon and Antonio (2005), higher unemployment rates encourage individuals to find a job in the SE. In a study by Dell'Anno and Solomon (2008), have found a positive relationship between unemployment rate and the SE. Analysing the empirical literature, Davidescu and Dobre (2012) found

[2] This method assumes that a part of the electricity supply is used for shadow economy activities and that it is possible to calculate value added figures for the shadow economy through concerning electricity consumption patterns. It compares the dynamics of electricity consumption and the GDP. (See Nastav and Bojnec, 2005)

a strong evidence of *uni-directional causality*[3]. The findings of studies which focus SE and level of unemployment may help the policy makers to get rid of extensive barriers of growth and development structures in Sri Lanka. Therefore, this study attempts to investigate the appropriate models to estimate the SE as a percentage of GDP, using unemployment rate and GDP index as proxies. Size of the SE in Sri Lanka is not observed yet *after 2007*[4] and it is hard to find any study which accomplishes to reveal the nature and relationship between growth of SE and official estimates (GDP) in the economy.

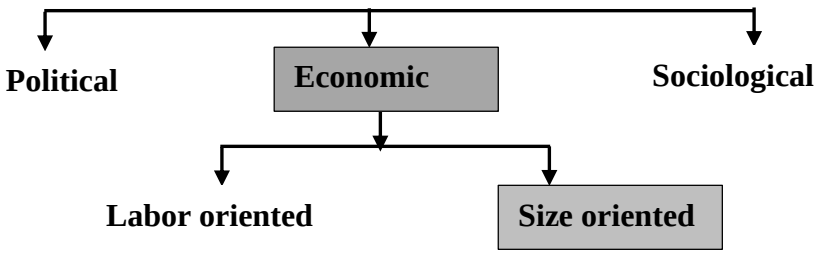
LITERATURE REVIEW

Monitoring the characteristics and functions of SE is very important in policy making point of view which directed towards improving social and economic conditions of a country. Number of definitions to a shadow economy can be available in literature at all the aspect of political, sociological and economic. Considering the economic definitions, Dell'Anno and Solomon (2008) classify shadow economy into two categories as labour-oriented definitions and size-oriented definitions.

[3] Uni-directional causality is indicated if unemployment rate cause SE, then SE does not cause unemployment rate.

[4] The newest estimation for the Sri Lankan SE is observed through the study conduct by Schneider et al. (2010). They found that Sri Lankan SE is 42.2 % share of GDP in 2007.

Figure 1: Classification of Shadow Economy



Source: Dell'Anno and Solomon, 2008

The Labour-oriented definitions focus on the impact of shadow economy on the labour market while the Size-oriented definitions consider the relationship between the state regulations and the operation of business. This study uses the size-oriented classifications of the SE in line with Dell'Anno and Solomon (2008). Shadow Economic activities generate unofficial income[5] in a country, and it will create a problem for all the economic units in general and to the government in particular in terms of policy planning and strategic perspectives. Generally, the creation and improvements of a Shadow Economy can possibility to be any forms of formal, informal and illegal economic activities. The formal sector of the economy deals

[5] Income generated through economic activities, which are not reported to the governments and taxes are not paid.

officially with the government paying taxes. The sector includes large enterprises, the government, hospitals, universities, foreign investors and etc. Increasing of Shadow Economic activities are badly affecting in the base of formal economy. Rigidness of the rules and regulations and the behavioural impacts of the government can induce the widening of Shadow Economy.

The informal sector consists of small scale activities and they are too small to be monitored. Workers and firms in this sector do not pay taxes and hardly to be captured to the same laws as in the formal sector. The informal sector in most of developing countries provides services, manufactures, materials and etc. According to the Department of Census and Statistics data base (2012), informal sector in Sri Lanka accounts for about 57% to 62% of total employment. According to the Consumer Finance and Socio-economic Survey (2012) the relative share of informal economy was70%.

When we compare informal economy with SE, the shadow economic activities do not pay the taxes to government. Yet, it includes illegal economic activities other than the informal economy. However, informal economy has a great link with shadow economy with slight differences. According to the Organization of Economic Cooperation and Development (2002), 'Illegal Economic Activities' are productive activities that generate goods and services forbidden by law. Furthermore, it can be unlawful services carried out by unauthorized producers. When we compare particular illegal economy with shadow economic activities, obviously illegal economic activities are one of

the important aspects in the Shadow Economy. It means that improvements in illegal economic activities in a country will essentially increase the size of the Shadow Economy.

Table 1: Types of Shadow Economy (Lippert and Walker, 1997 and Remarks by Schneider)

Type of activities	**Monetary transactions**		**Non-monetary transactions**	
Illegal activities	Trade in stolen goods, drug dealing and manufacturing, prostitution, gambling, smuggling, fraud, etc.		Barter of drugs, stolen goods, smuggling, etc.: (Production or growing of 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 lawful goods and services	Employee discounts, fringe benefits	Barter of lawful goods and services	All do-it yourself work and neighbourly help

Source: Schneider, 2001

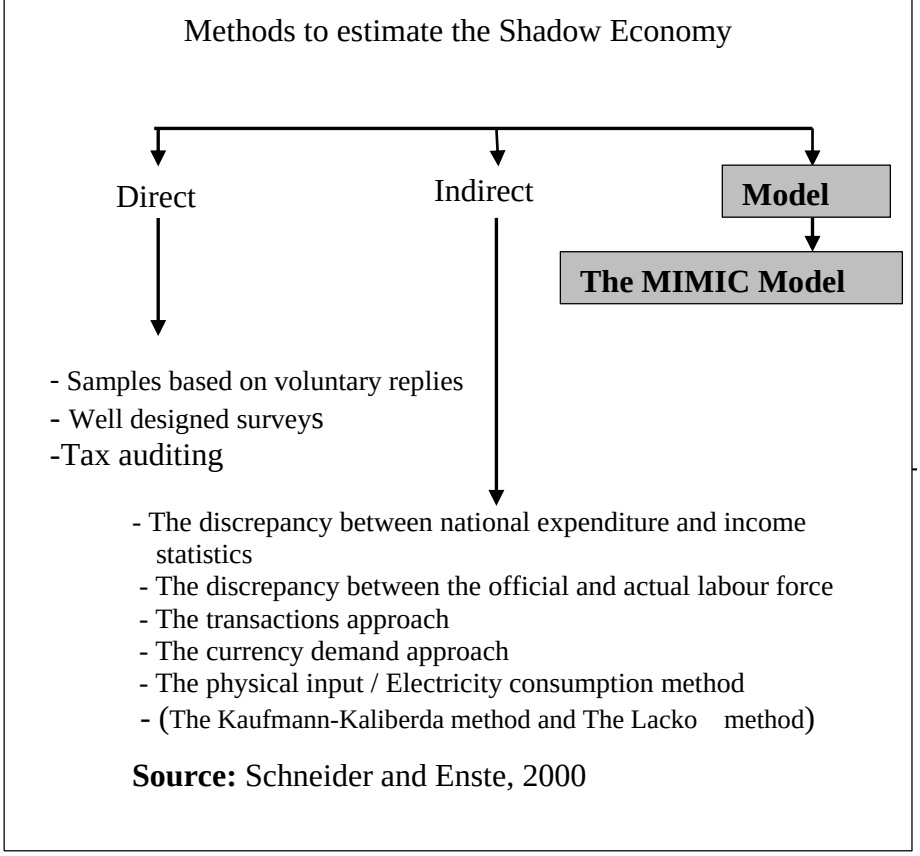
The current study does not include all the above categories in table 1 in modelling and analysing. It includes only the market based legal productions of goods and services, similar to the definition given by Schneider et al. (2010) that are purposely buried away from public authorities due to any of the following reasons.

- To avoid paying taxes
- To avoid paying for social security contributions
- To avoid certain legal labour market standards
  (Minimum wages, maximum working hours, etc.)
- To avoid fulfilling certain administrative procedures. (Questionnaires, forms)

Alternative methods that can be applied to estimate the size of Shadow Economy can available from literature. Schneider and Enste (2000) classified those methods under three categories as direct, indirect and modelling approaches. Majority of recent scholars use Multiple Indicator Multiple Cause Model (MIMC) under Structural Equation Modelling (SEM) approach to measure the size of the shadow economy.

Schneider (2001) use currency demand approach and SEM to estimate the size of the 18 Asian and 21 OECD countries. Then he investigate that the shadow economy in terms of value added was 25.8% of official GDP in the 18 Asian countries and 16.7% of official GDP in the 21 OECD countries.

Figure 2: Methods to Estimate Shadow Economy



Source: Schneider and Enste, 2000

Alanon and Antonio (2005) use SEM with latent variables to estimate the size of the Shadow Economy in Spain for the 1976-2002 period. They found in their study that a higher share of GDP (18%) in shadow economy and it has been significantly influenced by three separate factors: tax burden, the degree of regulation and unit labour costs. They further found that a positive correlation between GDP, money demand and the level of the Shadow Economy. In order to justify the results from previous studies Dell'Anno et al. (2007) had measured the size of

the shadow economy in three Mediterranean countries: France, Spain and Greece using the SEM approach. Unlike Alanon and Antonio (2005), their results confirm that unemployment, the fiscal burden and self-employment are the main causes of the shadow economy in these countries. Moreover, they have identified that an inverse relationship exists between the official GDP growth rate and the unofficial economy.

In Asian experiences in measuring the size of the Shadow Economy Chaudhri, Schneider and Chattopadhyay (2006) investigate the size of the shadow economy in Indian states over the period 1974/75 to 1995/96 using the SEM approach. According to their analysis the average growth rate of the SE has tended to decrease in the period after the liberalization of the Indian economy in 1991/92. They show that the growth in the size of the SE was approximately 4% in scheduled election years relative to the normal years. Schneider (2004) estimates the size of the SE for 145 countries all over the world using the SEM approach over the period 1999 to 2003. In Sri Lanka, size of the SE increased from 44.6% to 47.2% as a percentage of official GDP. In context of Asia, it was 30.8% in 2002/03. In addition to that, another empirical estimation of SE for 145 countries by Schneider (2004) from 1999 to 2003, verifies the increasing trend of SE in Sri Lanka. However, Schneider et al. (2010) demonstrate a decreasing trend in SE from 1999 to 2007 and it differs from the previous results regarding the estimated sizes of SE in Sri Lanka.

In addition to the measuring the size of SE, scholars have attempted to analyse the impact of SE on overall economy and the structural relationship of factors affecting in growing SE sector in an economy widening the dimensions of research area. In Dell'Anno and Solomon (2008) estimate the size of US shadow economy using SEM to find structural relationship exists between the SE and the unemployment rate in the US. Furthermore, they extend the Okun's law to estimate the structural relationship between growth rate of official GDP, SE and unemployment rate. They found a significant positive relationship between SE and unemployment rate (UR).

Similarly, a strong positive relationship between SE and UR find by Davidescu and Dobre (2012). They analysed the causal relationship between UR and US Shadow Economy using SEM under Toda-Yamamoto approach. On the base of empirical results they have pointed out that a strong evidence of uni-directional causality running from unemployment rate to shadow economy (at 1% level of significance).

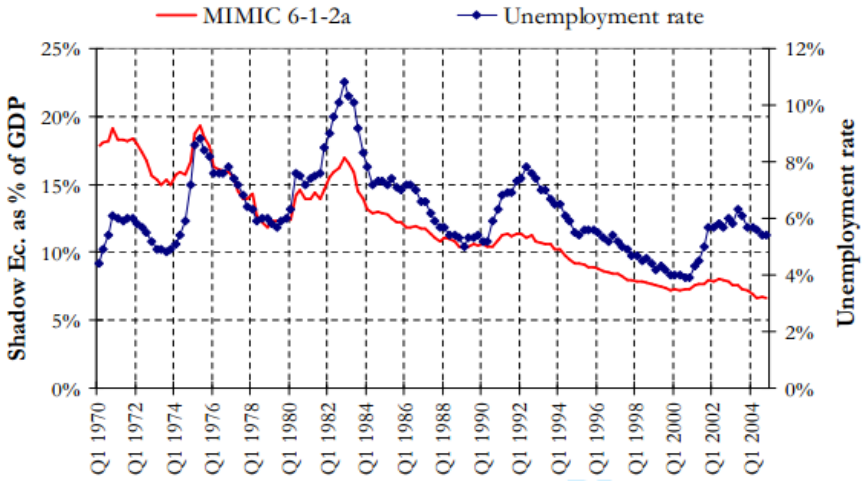
Schneider (2009) uses MIMIC approach to analyse the relationship between corruption and the Shadow Economy and fund a positive relationship between the SE and corruption. In analysing the interdependent, The SE influences corruption more than corruptions to SE. Biswas, Farzanegan and Thum (2012) observe how the SE affects pollution and how that effect depends on corruption levels in public administration. Their estimates verified that the size of SE and the level of pollution depend on the level of corruptions. Dreher, Kotsogiannis

and McCorriston (2005) capture the relationship between institutional quality, the SE and corruption. Their results show that an improvement in institutional quality reduces the SE directly and corruption by both directions: direct and indirect.

Illustrating the impact of unemployment rate to the dimensions of Shadow Economy is a major interest field in recent studies in different country context. According to Dell'Anno and Solomon (2008), the empirical evidence suggests two important factors in discussing the growth of SE. They are 'reduction in official working hours' and 'the influence of unemployment rate'. Therefore, most of researches to estimate size of the SE use unemployment rate as a main causal variable. Alanon and Antonio (2005), Dell'Anno et al. (2007), Dell'Anno and Solomon (2008), Schneider (2009), Davidescu and Dobre (2012) found unemployment as a highly significant causal variable under the SEM approach. In more detail, the graphical comparison made by Dell'Anno and Solomon (2008) can be used to identify the way of significance of the unemployment rate.

Therefore, unemployment rate highly affects to the dimensions of SE in USA. This result was pretty much same in the other European countries too. In context of Sri Lanka, the estimations from Schneider et al. (2010) and the behaviour of unemployment rates in certain periods demonstrate a positive trend over the time period.

Figure 3: Unemployment vs. SE in United States



Source: Dell'Anno and Solomon, 2008

According to the literature, researchers has used different types of SEM approaches to estimate the size of SE. Alanon and Antonio (2005) has used Multiple Indicator Multiple Cause model (MIMIC) including the variables such as tax burden, unit labour costs, waged employment rate, unemployment rate, disposable income and public consumption as their principle causes. They have used GDP, demand for money (money in the hands of individuals) and energy consumption as indicators to measure the SE. Their results are shown that disposable income and public consumption are not statistically significant to use as causal variables of the SE.

In Dell'Anno and Solomon (2008), have used nine causal variables to estimate the size of the SE. They are aggregate index of tax burden, personal current tax/GDP, taxes on production and import/GDP, taxes

on corporate income/GDP, contribution for government social insurance/GDP, government unemployment insurance/GDP, unemployment rate, self-employment/labour force and index of bureaucracy. Indicators were the ratio of narrow money supply to broad money monetary aggregate (M_1/M_2), Index of real GDP and labour force participation rate. Also, Davidescu and Dobre (2012) use the same causal and indicator variables in their research.

SEM approach with benchmark equation has been estimated by Andreas and Schneider (2009) to examine the relationship between corruption and the SE. He has used two unobserved indexes, SE and corruption and causal and indicator variables. Business regulations, unemployment rate, transfers and subsidies and government consumption have been used as the causes of the SE and GDP growth, Labour force participation and ratio of M_0 to M_1 for indicators. Subsequently, he has used government effectiveness, fiscal freedom, bureaucracy costs and rule of law as the causes of corruption and Real GDP per capita, bribes and judicial independence as for indicators.

It is hardly to be found a specific study from Sri Lankan literature, with the criteria of three model selections, calculation and growth relationship analysis altogether. However, it is important to investigate suitable models to estimate the Sri Lankan SE and to identify whether which types of trend shown by the estimated values as a percentage of official GDP. Three steps have to be followed. Initial portion of the study is therefore intends to choose and develop suitable, fitted MIMIC model or models, while using the structural relationship between the

unemployment rate and SE to estimate the size of the Shadow Economy in Sri Lanka. Then the following portion is to estimate SE for each fitted model through benchmark calculations. Finally, to examine if estimated models and their calculations are accepted by re-examination of Okun's law and to contrast estimated results in growth terms to the growth of official estimates (GDP) of the economy.

METHODOLOGY

The size of the Shadow Economy cannot be directly observed and therefore, it demand a proper statistical approach to measure the size of the economy. To fill the gap this study attempts to estimate the size of the Shadow Economy by developing a Multiple Indicator Multiple Cause (MIMIC) model under Structural Equation Modelling (SEM) approach. Researchers use Structural Equation Models in order to measure the relationships among unobserved and observed variables. All variables have been tested for the unit root at levels of differences. This method considers SE as an unobserved variable link with a set of observed causal variables and also with a set of observed indicators to reflect the changes in the size of the SE. These sorts of models include two types of equations systems: the 'structural equation' and the 'measurement equation'. An equation which explains the relationship between unobserved variable (η) and the causes (X_n) is called the 'Structural Equation'. If we assume the SE is linearly determines by a set of observable exogenous causes (X_1,X_2, $X_3 \ldots X_n$) and the error term ε_i it can be expressed as;

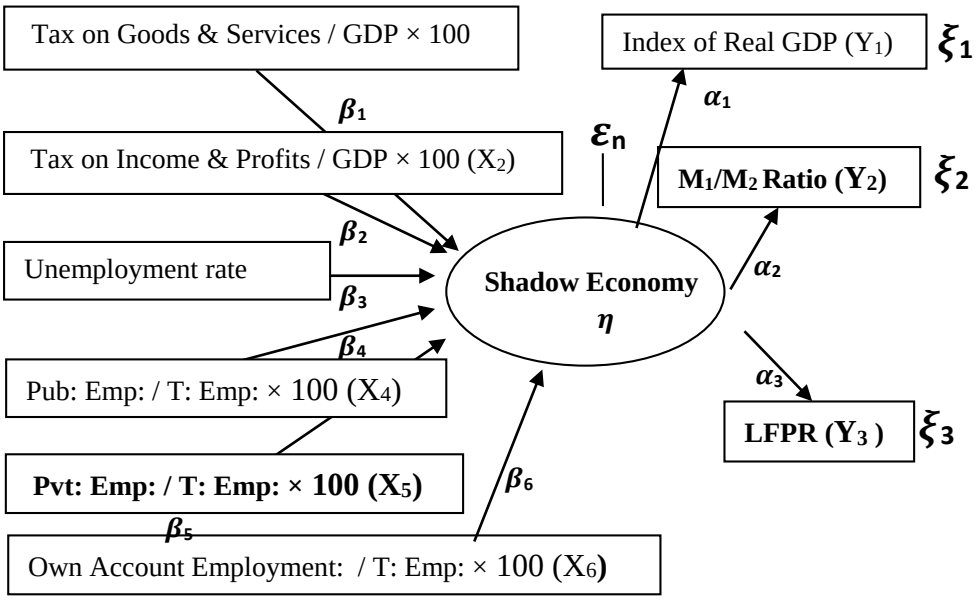
$$\boldsymbol{\eta} = \beta_1(X_1) + \beta_2(X_2) + \beta_3(X_3) + \ldots\ldots\ldots\ldots\ldots \beta_n(X_n) + \varepsilon_n \qquad (1)$$

On the other hand, the equations that link indicators (Y_n) with the unobserved variable (η) is called the measurement model. Under thw assumption of the Shadow Economy linearly determines subject to set of observable exogenous indicators (Y_1,Y_2, Y_3….Y_n) and to error terms (ξ_1,ξ_2, ξ_3….ξ_n), it can be expressed as,

$$\boldsymbol{Y_1} = \alpha_1\eta + \xi_i,\ \boldsymbol{Y_2} = \alpha_2\eta + \xi_i,\ \boldsymbol{Y_3} = \alpha_3\eta + \xi_i\ldots\ldots,\ \boldsymbol{Y_i} = \alpha_i\eta + \xi_i \quad (2)$$

Here the structural error term (ε_n) and measurement errors (ξ_1,ξ_2, ξ_3 …. ξ_n) are normally distributed, mutually independent and all variables are taken to have zero expectation in line with OLS properties. This study depends only on secondary data and information sources. As determinants of the existence of the shadow economy, the following variables are included in this research. Six causal variables and three indicators are going to be used to visualize the size of the Shadow Economy in Sri Lanka using STATA-12 statistical software.

Figure 4: The MIMIC Model Path Diagram with Variables and Coefficients



Source: Authors Preparation

Each and every possibilities at least with three causal variables are run in the software and identify the most fitted and suitable MIMIC models according to following criterion.

1. The unemployment rate uses as a proxy to identify the fitted models. Therefore, the causal variable unemployment rate (X_3) should be significant with either positive or negative coefficient.

2. Model should be fitted under either 95% or 99% confidence level. (χ^2 and RMSEA)

3. Lowest values of AIC and BIC are the final choice, if there are number of fitted models in line with above three conditions.

After the structural analysis, we can identify the fitted model with significant coefficients and their signs; which can be used to obtain the size of SE. This study use a benchmark equation to estimate the size of SE as a percentage of the GDP in Sri Lanka. It can be expressed as in the form of equation 3:

$$[\tilde{\eta}_t / GDP_{base}] \times [\eta^*_{base} / GDP_{base}] \times [GDP_{base} / \tilde{\eta}_{base}] \times [GDP_{base} / GDP_t] = [\hat{\eta}_t / GDP_t] \quad (3)$$

The equation 3 can be simplify as in equation 4,

$$[\tilde{\eta}_t \times [\eta^*_{base} / \tilde{\eta}_{base}] = \hat{\eta}_t \quad (4)$$

Where $\tilde{\eta}_t$ for the value of structural calculation as a percentage of GDP from the selected MIMIC model for year t, η^*_{base} for the average size of the previous estimations of Shadow Economy in the base year, $\tilde{\eta}_{base}$ for value of the structural calculation from the selected MIMIC model for the base year and $\hat{\eta}_t$ for size of the SE as a percentage of the Gross Domestic Production in Sri Lanka. Therefore, this study requests a base year to estimate the size of SE in Sri Lanka. Then chose year 2002[6] as the base year and use the average size of previous estimates for Sri Lankan Shadow Economy.

In order to verify the estimated results for the SE in Sri Lanka and to collaborate the relationship between the growth of official economy and the growth of the SE, set of OLS (Ordinary Least Squares)

[6] This year reports two previous estimations for the average size of Sri Lankan SE and also a popular for number of national estimates as the base year.

regressions are used to re-examine the well-known Okun's law for each estimated MIMIC models.

Table 2: Estimates of the size of Sri Lankan Shadow Economy in 2002

Author/Authors	Source/method	Size of Shadow Economy
Schneider (2004)	MIMIC Model	47.2%*
Schneider *et al.* (2010)	MIMIC Model	44.1%
Average size		**45.65%**

Note: *(Mean of 2002/3)

Then the benchmark equation can be written as below,

$$[\tilde{\eta}_t \times [\eta^*_{2002} / \tilde{\eta}_{2002}] = \hat{\boldsymbol{\eta}}_{\boldsymbol{t}} \quad (5)$$

According to the Okun's law, there is an inverse relationship exists between unemployment rate and output growth in an economy. Therefore the current study will use equation 6 as an initial equation for Okun's law to investigate the structural relationship.

$$\boldsymbol{g}_{\boldsymbol{t}}^{\boldsymbol{y}} = \propto_1 \Delta u_t + g_t^{ni} + \varepsilon_t \quad (6)$$

Where Δu_t for the change in unemployment rate, g_t^{ni} for the annual growth rate of the estimated SE of i^{th} model and g_t^y for the annual growth rate of the official economy.

The study collected the Sri Lankan annual time series data for the period from 1990 – 2012 to analyse and investigate the nature of relationships exists between causes or indicators and the shadow

economic activities. However this is not a typical time series analysis, and uses special methodology named Structural Equation Modelling to measure the impact of 'latent' or unobserved variables.

RESULTS AND DISCUSSION

Test for the Unit-root

The variables used in the estimation are defined in table 2 and all of them have been tested for unit root in levels or differences. Augmented Dickey-Fuller (ADF) test have been used for making data stationary at I (0) or I (1) levels. The summary of the unit root test is demonstrated in the table 3.

Table 3: Summary for ADF test results

Variable	**Level**	**1st Difference**
Tax on Goods and Services	-0.457	-3.852**
Tax on net income and profits	-2.592*	-5.352***
Unemployment rate	-1.546	-4.429***
Public employment	-2.671*	-3.753**
Private employment	-4.413***	-
Own account workers	-1.579	-9.719***
Real GDP Index	-1.054	-5.344***
M_1/M_2 Ratio	-1.381	-3.333**
LFPR	-3,255**	-

Note: t statistics are given in table and *10%, **5% and ***1% significance levels.

Source: Authors Preparation

As it is clear from the Table 3, the level of private employment and Labour Force Participation Ratio (LFPR) are the significant variables (at I(0)). Other variables have only the significant at I(1) level. Then the set of estimated MIMIC models are shown in table 4.

Table 4: Estimated Coefficients of the MIMIC models and Descriptive Statistics

Models	Taxes on Good and Services	Taxes on income and profits	Unemp. Rate	Public emp.	Private emp.	Own account workers	GDPI	M1/M2	LFPR	χ^2 (p-value)	RMSEA (p-value)	AIC	BIC	Df
	X_1	X_2	X_3	X_4	X_5	X_6	Y_1	Y_2	Y_3					
MIMIC 3-1-3a	-	- 0.006 (- .01)	- 0.718** (- 2.76)	-	0.48*** (23.76)	-	- 0.41	- 0.12 (- 0.24)	- 0.22*** (- 6.14)	22.91^{++}	0.285^{++}	193.38	214.95	08
MIMIC 3-1-3b	-	-	0.24* (1.74)	-	0.9*** (3.95)	- 0.41*** (- 4.67)	- 0.447	- 0.036 (- 0.56)	- 0.23	1513.6^{++}	2.437^{++}	1754.3	1772.5	11
MIMIC 4-1-3a	-	- 0.42* (- .79)	0.75*** (5.22)	0.367 (1.33)	- 0.23*** (- 4.36)	-	- 0.187 (- 0.69)	0.265 (1.2)	0.63*** (8.8)	30.07^{++}	0.275^{++}	272.3	299.6	11
MIMIC 4-1-3b	0.99*** (5.03)	-	0.29** (2.69)	0.31 (0.84)	-	0.34 (0.99)	- 0.34* (- 1.65)	- 0.05 (- 0.22)	0.526*** (4.16)	14.09	0.133	254.5	282.8	10
MIMIC 4-1-3c	-	- 0.47* (- .74)	0.75*** (3.82)	-	- 0.24 (- 0.68)	0.06 (0.22)	- 0.21 (- 0.68)	0.22 (0.91)	0.62 (6.61)	26.44^{++}	0.267^{++}	279.6	307.9	10
MIMIC 4-1-3d	0.71** (2.45)	-	0.61* (1.68)	-	- 0.12*** (- 3.6)	0.1 (0.42)	- 0.24 (- 0.66)	.003 (0.01)	0.67*** (4.32)	18.58^{+}	0.193	304.7	333.1	10

Models	Taxes on Good and Services	Taxes on income and profits	Unemp. Rate	Public emp.	Private emp.	Own account workers	GDPI	M1/M2	LFPR	χ^2 (p-value)	RMSEA (p-value)	AIC	BIC	Df
MIMIC 5-1-3a	0.72** (2.19)	- 0.39* (- .79)	0.62*** (3.83)	0.27 (1.16)	- 0.12 (- 0.3)	-	- 0.308 (- 1.01)	0.13 (0.44)	0.71*** (9.41)	31.16^{++}	0.263^{++}	309.7	346.1	12
MIMIC 5-1-3b	0.82*** (4.11)	-	0.56*** (3.6)	0.29 (1.1)	- 0.11*** (- 3.87)	0.19 (0.77)	- 0.235 (- 0.91)	- .009 (- 0.04)	0.67*** (7.73)	18.64	0.137	371.78	406.98	13
MIMIC 6-1-2a	0.92 *** (4.44)	- 0.3 (- .16)	0.29** (2.09)	0.38 (1.33)	- 0.1*** (- 3.14)	0.133 (0.44)	- 0.123 (- 0.23)	-	0.65*** (5.62)	14.25	0.184	513.3	554.2	08
MIMIC 5-1-2a	- 0.42*** (- 4.34)	-	- 0.36*** (- 4.52)	- 0.37** (- .09)	0.11** (2.42)	0.18 (1.00)	0.047*** (5.76)	1	-	56.85^{++}	0.515^{++}	341.26	371.92	08
	X_1	X_2	X_3	X_4	X_5	X_6	Y_1	Y_2	Y_3					
MIMIC 4-1-2a	1.04*** (6.13)	- 0.3 (-0.96)	0.258*** (2.63)	0.295 (0.85)	-	-	- 0.359* (- 1.75)	-	0.51*** (3.93)	9.68	0.2	308.96	333.94	05
MIMIC 4-1-2b	-	-	0.691** (2.61)	0.299 (0.87)	- 0.467** (- 2.41)	0.11 (0.4)	0.056** (2.47)	0.64*** (4.1)	-	21.7^{++}	0.381^{++}	268.68	293.66	05

Models	Taxes on Good and Services	Taxes on income and profits	Unemp. Rate	Public emp.	Private emp.	Own account workers	GDPI	M1/M2	LFPR	$\mathcal{X}^2$ (p-value)	RMSEA (p-value)	AIC	BIC	Df
MIMIC 3-1-2a	-	-	- 0.71** (- 2.14)	- 0.24 (- 0.55)	0.45*** (3.43)	-	- 0.4*** (- 3.92)	-	- 0.115** (- 2.32)	7.12	0.184	373.2	391.3	04
MIMIC 3-1-2b	1.07*** (10.41)	-	0.32*** (3.04)	0.197 (0.55)	-	-	- 0.335** (- 2.27)	-	0.49*** (4.94)	8.34^{+}	0.278^{+}	295.67	314.97	03

Notes: z – statistics are given in parentheses for each coefficient. Coefficients are significant if | z - statistic | > 1.96 for 95% confidence.
*** Means significance of coefficients under 99% of confidence level. ** For 95% and * for 90 % respectively.
$^{++}$ Means good fitting (p-value > 0.01) where 99% confidence and $^{+}$ Means good fitting (p-value > 0.05) where 95% confidence.
RMSEA – Root mean squared error of approximation. P-value for test of close fit (RMSEA > 0.05)
AIC – Akaike's information criterion, BIC- Bayesian information criterion
Df- Degrees of freedom. (Values obtain from the each estimated models)

Model selection Criteria:
Unemployment rate (X_3) should be significant – Coefficient can be either positive or negative. (Assumption -Theoretical)
Model should be fitted under either 95% or 99% confidence level. ($\mathcal{X}^2$ and RMSEA)
Lowest values of AIC and BIC are the final choice if there are number of fitted models in line with above three conditions.

Source: Authors Preparation

Estimated MIMIC Models

MIMIC 5-1-2a, MIMIC 4-1-2b and **MIMIC 3-1-3a** are three estimated models which have been selected according to the model selection criterion. Then these three models can be used to extract the structural equations using estimated coefficients. The Structural Equation (7) is extracted by the coefficients from **MIMIC 5-1-2a.**

$$\tilde{\eta}_t / GDP_{2002} = \underset{(-4.34)}{-0.42\, X_{1t}} \underset{(-4.52)}{-0.36\, X_{3t}} \underset{(-2.09)}{-0.37\, X_{4t}} + \underset{(2.42)}{0.11\, X_{5t}} \qquad (7)$$

According to **MIMIC 5-1-2a,** the shadow economy of Sri Lanka as a percentage of GDP will depend on tax on domestic goods and service, unemployment rate, public employment and private employment. Here, three coefficients except public employment negatively affected to the size of the Shadow Economy in Sri Lanka. The Structural Equation (8) is extracted by the coefficients from **MIMIC 4-1-2b**.

$$\tilde{\eta}_t / GDP_{2002} = \underset{(2.61)}{0.69\, X_{3t}} \underset{(-2.41)}{-0.467\, X_{5t}} \qquad (8)$$

According to **MIMIC 4-1-2b,** Shadow Economy, as a percentage of GDP, will depend only on the unemployment rate and private employment. Here, unemployment rate positively affect to the size of the Shadow economy in Sri Lanka while the private employment demonstrate an inverse relationship. The Equation (9) is extracted by the coefficients from **MIMIC 3-1-3a**.

$$\tilde{\eta}_t / GDP_{2002} = \underset{(-2.76)}{-0.718\ X_{3t}} + \underset{(23.76)}{0.48\ X_{5t}} \quad (9)$$

According to **MIMIC 3-1-3a,** shadow economy, as a percentage of GDP will depend on only unemployment rate and privet employment. Here, the unemployment rate negatively affects to the size of the SE while the private employment demonstrate a positive relationship. Then these three structural equations are used to perform the benchmark calculations.

Benchmark Calculations

Estimate coefficients from each estimated model and average base year value for the Shadow economy will be used to measure the average size of shadow economy for Sri Lanka. Benchmark calculations are performed separately for each model[7].

Table 5: New Estimate for Sri Lankan Shadow Economy (1990-1997)

Estimates of SE (% 0f GDP)	Year							
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
MIMIC 5-1-2a	91	86.3	78.8	70	64.86	63.5	57.29	55.7
MIMIC 4-1-2b	14.79	25.77	26.7	32.47	36.15	37.86	42.18	41.72
MIMIC 3-1-3a	14.45	25.51	26.45	32.27	35.98	37.73	42.1	41.65

[7] All benchmark calculations for relative sizes of SE are shown in appendix

Table 6: New Estimate for Sri Lankan Shadow Economy (1998-2004)

Estimates of SE (% 0f GDP)	Year						
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
MIMIC 5-1-2a	51.1	49.53	45.64	46.1	45.65	42.88	42.18
MIMIC 4-1-2b	40	43.4	45.9	47.86	45.65	46.36	49.47
MIMIC 3-1-3a	39.97	43.4	45.93	47.9	45.65	46.37	49.5

Table 7: New Estimate for Sri Lankan Shadow Economy (2005-2012)

Estimates of SE (% 0f GDP)	Year							
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
MIMIC 5-1-2a	42.08	41.09	38.23	38.39	36.07	33.45	32.26	33.62
MIMIC 4-1-2b	50.32	47.1	49	48.15	48.38	49.22	49.7	51.3
MIMIC 3-1-3a	50.37	47.16	49.13	48.25	48.47	49.34	49.84	51.45

Source: Authors Calculations

According to **MIMIC 5-1-2a,** Sri Lankan SE varies between 91% and 32% of GDP and demonstrates a decreasing trend over the period under study. On the other hand, according to **MIMIC 4-1-2b** and **MIMIC 3-1-3a,** the size of the SE varies between 14% and 52% of GDP and demonstrates an increasing trend. Moreover, the estimated values from **MIMIC 4-1-2b** and **MIMIC 3-1-3a** are showing a similar observation for all respective years. Therefore, it is worthy to discuss the results from each model separately with concerning the effects from causal

variables including in each model. The OLS regression analysis for Okun's law and augmented equations will help to recognize the relevance of three MIMIC models and the fundamental theoretical basis of Okun's law.

Okun's Law and Augmented Equations

To examine the negative relationship between the change in unemployment and the growth rate of official output (GDP) in Sri Lanka within the respective study period (1990-2012), this study persuades a simple OLS regression analysis between the annual growth of GDP and the change in unemployment rate.

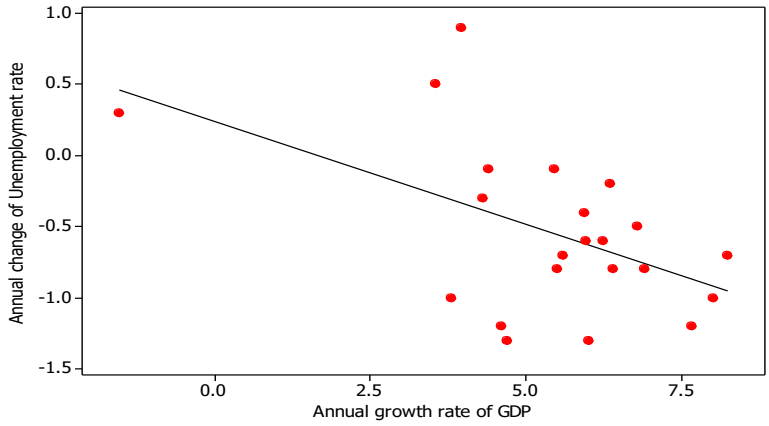
$$g_t^y = \propto_1 \Delta u_t + \varepsilon_t \quad (10)$$

g_t^y = Annual growth of official GDP

Δu_t = Change in unemployment rate

Results satisfy the expected negative relationship and help for the re-examination of Okun's law with augmented versions of equations for each MIMIC model.

Figure 5: Relationship between GDP Growth Rate and Change of Unemployment (1990-2012)



Source: Authors preparation using MINITAB 13 statistical software

Then three separate OLS regressions were run on each MIMIC model to recognize the nature and relationship between growth in official GDP and change in the unemployment rate.

$$g_t^y = \propto_1 \Delta u_t + g_t^{\eta 1} + \varepsilon_t \quad (11)$$

$$g_t^y = \propto_1 \Delta u_t + g_t^{\eta 2} + \varepsilon_t \quad (12)$$

$$g_t^y = \propto_1 \Delta u_t + g_t^{\eta 3} + \varepsilon_t \quad (13)$$

Where g_t^y for annual growth of official GDP, Δu_t for change in unemployment rate and $g_t^{\eta 1}$, $g_t^{\eta 2}$, $g_t^{\eta 3}$ for annual growth rate of SE for **MIMIC 5-1-2a, MIMIC 4-1-2b and MIMIC 3-1-3a.** Summary of estimated results were shown in table 8.

Table 8: Summery Statistics for the OLS Regressions

Test	Model	GDP growth and Δ Unem: Rate	GDP growth and growth of S:E:	F-prob:	R^2
Okun's law	-	-1.77** **(-2.63)**	-	0.016**	0.2194
Augmented Eq: 1	MIMIC 5-1-2a	-1 94** **(-2.65)**	0.104 **(0.65)**	0.048**	0.2726
Augmented Eq: 2	MIMIC 4-1-2b	-1.996*** **(-2.95)**	- 0.187 **(- 1.42)**	0.023**	0.3280
Augmented Eq: 3	MIMIC 3-1-3a	-2*** **(-2.95)**	-0.186 **(- 1.42)**	0.023**	0.3281

Note: t statistics are given in the parenthesis.
Coefficients are significant if | t-statistic | > 1.96 for 95% confidence.

The results in table 8 very clearly shows that initial equation for Okun's law and all three models (Augmented equations) are statistically significant at 95% confidence level. Though, all equations show lower R^2 values. This may because of purposive chosen of some variables and fitted into the regression models. Re-examination of Okun's law for **MIMIC 5-1-2a, MIMIC 4-1-2b and MIMIC 3-1-3a** demonstrate the expected negative relationship between GDP growth rate and change of unemployment rate. However, most importantly any of three models do not illustrate a significant relationship between growth of estimated SE and growth of official GDP.

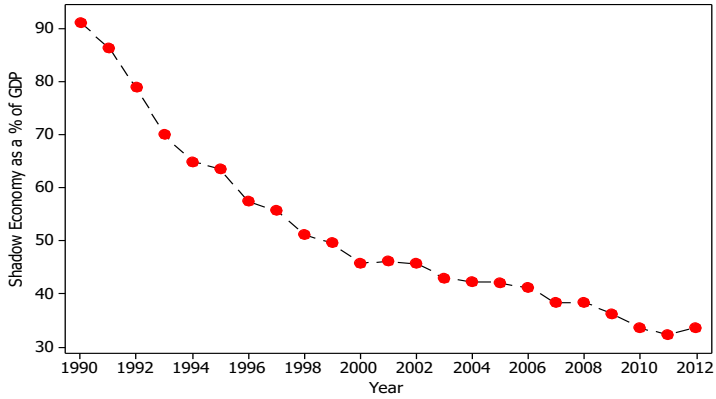
OVERALL DISCUSSION OF RESULTS

This section will broadly discuss the whole set of results coming under each chosen MIMIC model and their empirical validity; theoretical support by previous studies and the ground realities in the Sri Lankan economy.

MIMIC 5-1-2a

Benchmark calculations for MIMIC 5-1-2a demonstrate a decreasing trend of estimated SE as a percentage of Sri Lankan GDP over 1990-2012.

Figure 6: Estimated SE from 1990-2012 According to MIMIC 5-1-2a



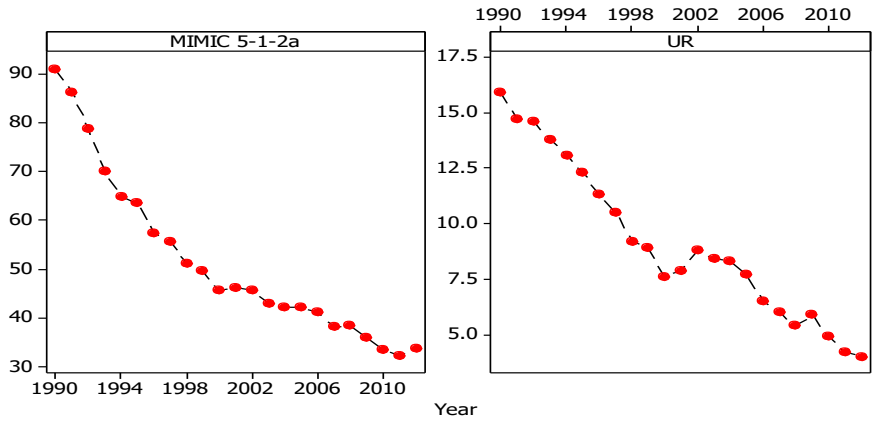
Source: Authors preparation using MINITAB 13 statistical software

Four causal variables have been used to estimate the percentage demonstrated on the vertical axis in figure 6. Tax on domestic goods and services demonstrates an inverse relationship to the size of the SE. Calculated coefficient between two variables was at 0.42. It is evident to suggest that higher government tax revenue on domestic goods and

services will contract the size of the SE. Therefore, this is not only about the increase of tax per unit of commodity or service, but also about the number of economic activities which counts under the government tax scheme. According to the literature, Schneider et al. (2010) also estimated Sri Lankan SE with a decreasing trend from 1999-2007. Share of direct taxation and total tax burden are two variables they use in their MIMIC model specifications. Therefore, the negative effect from government tax revenue on domestic goods and services will provide a hint, where Sri Lankan tax collection procedures getting smoother and it covers lots of goods and services over the time. On the other hand, tax on net income and profits is insignificant and not much important as a causal variable to explain the SE within the results; because more than 70% of government tax revenue comes from indirect taxes (through goods and services).

Unemployment rate, public employment and private employment are the other significant causal variables in this model. The unemployment rate also shows an inverse relationship with 0.36 coefficient. It means that higher the unemployment rate will lower the size of SE in Sri Lanka. This is confirming the empirical evidence (e g. Sri Lankan unemployment rate shows a decreasing trend over time).

Figure 7: Estimated SE for MIMIC 5-1-2a and Unemployment Rate in Sri Lanka



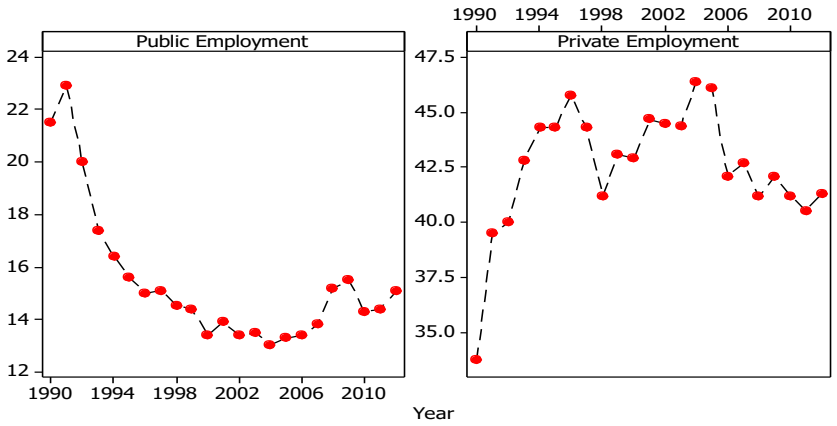
Source: Authors preparation using MINITAB 13 statistical software

Figure 7 illustrates a positive behavioural pattern between average size of SE and the unemployment rate of the economy. The under-employment issue will be a major reason for this kind of dilemma between estimated results and the ground reality. The mismatch between wages and qualifications will generate under-employment issue and the results can stimulate public sector employers to spend less time for their job and spend more with Shadow Economic activities.

Public employment demonstrates similar inverse relationship to the size of the SE with 0.37 coefficient. Accordingly it can be conclude that the higher the public employment in Sri Lankan economy will lead to reduce the size of SE. This can persuade due to the higher degree of job security and sticky wage rates within the public sector occupations. On the other hand, private employment demonstrates positive

relationship to the size of the SE with 0.11 of coefficient, means that when higher the private employment in Sri Lankan economy will tend to higher the size of the SE. Uncertainty and dynamic wage patterns with easy access for employer to make their own decisions can be some reasons for this kind of result.

Figure 8: Public Employment (PE) and Privet Employment (PVTE)



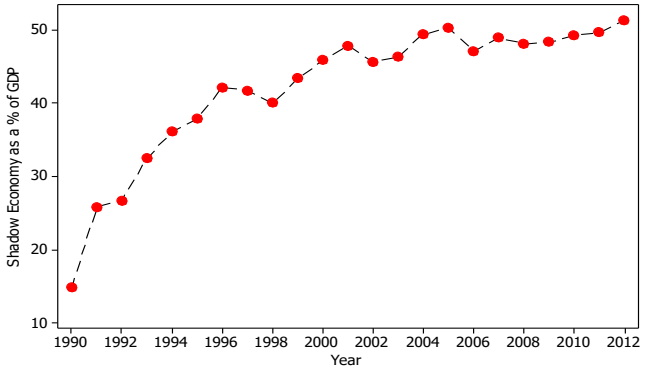
Source: Authors preparation using MINITAB 13 statistical software

The augmented Okun's law analysis for this model demonstrates a significant inverse relationship between growth of GDP and change in unemployment rate with 1.94 of coefficient. Moreover, there is no significant relationship between growth of GDP and SE. This insignificance might be due to Sri Lankan SE for not being a separate part of official economic activities and it over-valuate and de-valuate the official estimates.

MIMIC 4-1-2b

Benchmark calculations for MIMIC 4-1-2b demonstrate an increasing trend of estimated SE as a percentage of Sri Lankan GDP over 1990-2012.

Figure 9: Estimated SE from 1990-2012 According to MIMIC 4-1-2b



Source: Authors preparation using MINITAB 13 statistical software

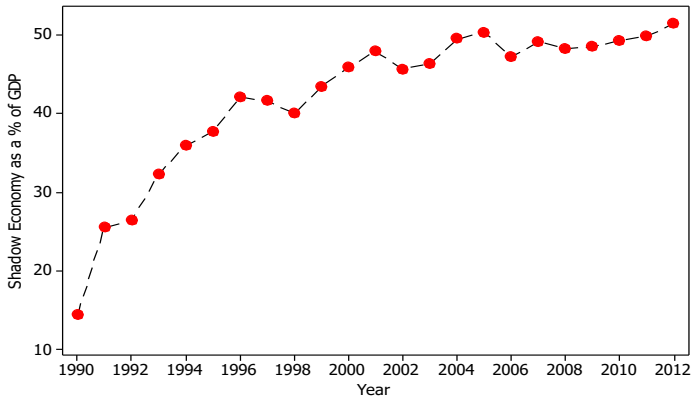
There are two causal variables which were used to estimate above percentages. Unemployment rate demonstrates a positive relationship with the size of SE and persuade 0.69 of coefficient. Therefore, higher the unemployment rate will leads to higher the size of SE in Sri Lanka. This is in line with the empirical relationship demonstrated in figure 4.3 and accepts the mathematical proven by Dell' Anno and Solomon (2008). On the other hand, private employment demonstrates an inverse relationship to the size of the SE with 0.467 of coefficient. Therefore, it can be concluded that higher the private employment in

Sri Lankan economy will tend to lower the size of the SE. This shows different result to the argument develops through MIMIC 5-1-2a.

MIMIC 3-1-3a

Benchmark calculations for MIMIC 3-1-3a demonstrate an increasing trend of estimated SE as a percentage of Sri Lankan GDP over 1990-2012.

Figure 10: Estimated SE from 1990-2012 According to MIMIC 3-1-3a



Source: Authors preparation using MINITAB 13 statistical software

There are two causal variables such as MIMIC 4-1-2b to estimate above percentages. They are the unemployment rate and the private employment. The unemployment rate demonstrates an inverse relationship with the size of SE and persuade 0.72 of coefficient. It means that higher unemployment rate will lower the size of SE in Sri

Lanka. This is in line with the argument build through the results from MIMIC 5-1-2a. On the other hand, the private employment demonstrates a positive relationship to the size of the SE with of 0.48 coefficient. Therefore, higher the private employment in Sri Lankan economy will tend to higher the size of the SE. This also supports the similar argument that built through the results reached to MIMIC 5-1-2a.

CONCLUSION

The purpose of the current study was to estimate the size of Sri Lankan SE as a percentage of GDP and to estimate the five causal variables and two indicators visualized in the existence SE of the Sri Lanka. With this objective, initial part of the analysis has been attempted to choose appropriate and fitted models through Structural Equation Modelling. To obtain virtuous results for the structural analysis, data series have been tested for the unit root using ADF test and three empirical models were estimated. Most obvious finding found in this study is to an inverse effect from tax on domestic goods and services, unemployment rate and public employment to the SE. Secondly the study found that the a positive effect of private employment to the SE sector. Furthermore, tax on net income and profits is not strong enough to explain the behaviour of SE. On the other hand, SE indicates a positive relationship to the indicators Real GDP Index (GDPI) and M_1/M_2 ratio. After introducing the four causal variables and two indicators to the models, the size of SE in the country positively correlates with the

unemployment rate and negatively to private employment. Results illustrate positive effect from and to. Moreover, public employment and own account workers are not strong enough to explain the behaviour of Sri Lankan SE. Overall results of the study reveals that a less relationship between growth of estimated SE and growth of official GDP. Consequently, it indicates that the growth of Shadow Economy and official economy are not interdependent. In this context policy makers should have paid their attention to adopt a more pro-active policy package to increase the employment rate in both the sectors of public sector and the private sector.

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