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CASE STUDY

Investigating and estimating the size of Shadow Economy by using monetary approach: Case study of Malaysia

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Abstract: The purpose of this study is to explore and estimate the size of Shadow Economy of Malaysia. This study used annual Time series data from 1980 to 2018, introduced Lending Interest Rate as additional variable for the first time to estimate the Shadow or dim Economy, and focused on the Currency Demand Approach (CDA) which is the best way of estimation the size of S.E. The results of ARDL, Unit Root Test (ADF) and Bound Test have also generated for the purpose. And this study investigated positive relationship between Currency Circulation to Money Supply Ratio and GDP, Inflation, Interest rate, and Total Tax Revenue through ARDL and estimated the required Shadow Economy, and also explored the Shadow Economy of Malaysia and estimated the size of S.E. Size of tax evasion community has also derived by present research which represent that taxes are not the only measures of Shadow Economy.

Keywords: Shadow Economy, ARDL, interest rate, GDP, currency, demand approach

1 Introduction

The shadow or black economy alludes to entire action work and business transactions that happen 'underneath the radar' and intentionally disguised – a financial movement that is undeclared and for which burdens that ought to be paid are not paying. Otherwise called the casual area, the dark economy, the black economy, or the dim economy, Shadow Economy also involves various crimes, for example, drug dealing and sneaking, just as legitimate positions, such as cultivation(involve child labor), working in development(disguised employment), or offering items to road drivers at rush or traffic signal places. Such type of the economy additionally involves such conditions where people are forced to work as serves without remuneration, or conditions where work is done in recompense for material things except cash. When fiscal experts are ascertaining the (GDP) of a nation, they must keep out things which contribute in the Shadow Economy. This scenario shows that each nation around the world is presumably significantly cash-rich than the officials measurements propose.

1.1 Statement of the problem

Malaysia is a developing country and being so it's facing so many economic problems like inflation, corruption, illegal activities, *etc*. that's are some reasons also behind the lower GDP of Malaysia. Unfortunately these illegal activities contribute to an unofficial sector mostly known as "Shadow Economy". Reorganization and measurement of S.E has been always remaining tough job for economist. In recent years there is a great debate about an Informal, Unparalleled and Unofficial sector all around the world, but in Malaysia, a few of piece of attempts are shown to estimate the Shadow Economy and all have done along MIMIC or Electricity Approaches. Entire research which presented long-run estimation of shadow Economy are sufficient till 2015.The need of the time was the computation of the extent of Shadow or dim economy through recent data and the use of advanced methods for best estimation.

1.2 Objective of the study

The core objective of present study insists to explore and estimate the Shadow Economy (S.E) and to see the correlation between different macroeconomic variables. Present study also aims to analyze the effect of Lending Interest Rate (LEINT), Gross Domestic Product (GDP), Inflation (INF) and Total Tax Revenue (TTR) on the Currency Demand. The study also motivated to give

the graphical representation of S.E and Tax Evasion and to give the policy recommendations on the behalf of the study to contribute in the betterment of Malaysia Economy.

1.3 Significance of the study

Present study estimates the size of Shadow Economy (S.E) of Malaysia and discusses the empirical aspect of the S.E and highlights the synchronous methodologies which used for obtaining the purpose. The study also analyzed the long run relationship among macroeconomic variables for the current time period and used Lending Interest Rate as an additional variable for estimation which is never used before for this purpose.

1.4 Scope and limitation of the study

The scope area of the study is to explore that sector of economy which is unofficial and not govern by any Government authority. This article attempts to point out Shadow Economy of Malaysia, so that it can be merged in official economy and contribute in betterment of Malaysia economy.

2 Literature review

There are many studies about developing and non-developing countries in which concept of "Shadow Economy" have been discussed. These studies showed the impact of gross domestic product, inflation and lending interest rate on the Shadow Economy of the Malaysia. These studies analyzed the extent of Shadow Economy how tax evasion encourage the Shadow Economy of Malaysia. Some famous studies reviews are given below.

Tan et al., 2017 [1] examined the area of the black economy for eighty countries for the time span of 1975-2012. The study involves Currency Demand Approach (CDA), Macroeconomic Uncertainty Index (MUI), Dynamic factor model (DFM) and Pooled mean group (PMG). The empirical results showed the presence of long run relationships between variables and interms of the adjustment coefficient. There was a visible cross regional variation with the lowest of 0.182 and the highest of 0.414. The macroeconomic uncertainty index variable show positive relationship, suggested that public tend to hold more currency in an uncertain macroeconomic environment. The developing country had relatively growing shadow economy (ranging from 19.9% to 37.3%). On average, the world computed the shadow economy as share % of GDP about 23.1%.

Ashok et al., 2016 examined observational and hypothetical ideas that inferred the shadow exercises in the official economy. The strategy includes MIMIC, ARDL, Error Correction terms (ECM), Engle, and Granger approach. Itemized econometric examinations have been directed to assess area and/or elements of Malaysia's unofficial economy. Investigation utilized the ARDL technique in the money request model to get a point assessor of the shadow Economy which is utilized in the MIMIC model to comprehend the elements of Shadow Economy since quite a while ago run. The assessed width of the Shadow Economy depended on just a pointer taxation rate. The length of the shadow or dim economy is steady for the test timeframe around half of the official GDP. While in the 1990s abnormal enlargement of the Shadow Economy around 70% of official one has seen because of bountiful tax avoidance in this period. Shahid (2014) [2] examined the short-run relationship and since quite a while ago run the connection between workforce, net fixed capital, and monetary development in Malaysia. The technique utilized Augmented Dicky Fuller, Phillip Perron, Johnson co-joining test, and vector blunder adjustment model. The time arrangement information was utilized from 1980-2012. Asiedu and Stengos (2014) [3] determined the extent of underground economy in country of Ghana. The time series data has been used from 1983 to 2003. The study adopted currency demand-approach to estimate the area of Shadow Economy in Ghana. Results of the currency demand model showed impact of the unofficial economy, this make interest rate statistically insignificant. The study estimated the average of underground economy which was approximately 35% of GDP from 1983 to 2003. In 1985 the average is high as 54% and in 1999 low as 25%. The long run average size of the Shadow Economy/to/GDP for Ghana by time series data was 40%.

Schneider and Buehn (2013) [4] examined the Size of the black economy, Methodologies, Open Questions and hurdles driven by it. The examination focused on two points. The first is the nonappearance of the ideal method for evaluation of the size of the Shadow Economy. The investigation similarly prescribed the MIMIC strategy used to get full-scale examinations of the size of the shadow economy. Also, the investigation underlined the definition and causal factors of the Shadow Economy to assess the size of the Shadow Economy using particular evaluation procedures. The findings showed that the genuine significance of the Shadow Economy is up 'til now missing. The association among the speculation and trial appraisal of the Shadow Economy

is up 'til now unacceptable thusly a satisfactory endorsement procedure should be created for the observational results to make it less difficult to condemn their believability.

Schneider (2011) [5] inspected the turn of events and the size of the black economy, undeclared work of workforce in OECD. The examination has taken creating and progress nations additionally into thought. The most persuasive variables on the Shadow Economy or potentially shadow workforce are charge arrangements and state guidelines, which, if they rise, increment both. Ongoing examinations cleared the financial chances, the general circumstance on the work market, and joblessness are critical for a comprehension of the elements of the shadow economy and its workforce. 48 million Shadow Economy workforces in exceptionally created OECD nations (Austria, Denmark, France, Germany, Italy, Spain, and Sweden) work illegally from 1997 to 1998.

Ahmed & Hussain (2010) [6] investigated the estimation about the extent of black economy of Malaysia, long run r/p between currency demand and rest of concerned variables including tax/to GDP ratio, financial development, interest rate and education. The study involved monetary approach, electricity consumption approach, MIMIC model and ARDL model. The time series data used from 1966-2008, findings showed ARDL technique for estimation of currency demand equation and education even as a -tv impact factor for unofficial economy. The ARDL approach and electricity consumption approach showed increased underground economy. The MIMIC mode reflects the size of informal economy, which is about 30%.

Buehn et al. (2010) [7] analyzed that the elasticity for money for shadow economy and for official GDP of German economy. The study emphasized difference between recorded output and actual output in monetary approach. In the unofficial economy all business transactions are typically carried out using payment method of cash. The findings proved that elasticity for money of Shadow Economy is much smaller than for official GDP. The second model which used to estimate money demand, is error correction model. The error correction model indicate that inclusion of Shadow Economy output measures can perform fast and better estimation of a money demand function.

Masood and Hussain (2008) explored the connection between the dark economy and macroeconomic variables (charge changes). The examination said that it was the first complete exercise to apply duty and tax change of the 1990s, it turns out to be exceptionally attractive to measure its effect on the dark economy and tax avoidance rehearses. The dark economy in Malaysia ends up being most noteworthy in the mid-60s when the corporate and individual annual expense rates were high. Total corporate pay and super duty rate were dropped to 40 percent in the later piece of the 80s. During the 1960s the underlying degree of the dark economy was high, so its development rate was low, around 2%. The most extreme individual annual assessment rate making the dark economy stay well above 30% of GDP throughout the timeframe of 1960-64. All the outcomes appear to accord with financial instinct. They indicated the dark economy as a level of GDP is diminishing over the long haul particularly after the thorough time of expense changes from 1997. A decrease in charge income because of diminished duty rates may adversely affect the financial government assistance of society.

Kemal (2007) [8] estimated the black economy by utilizing K and Q technique, the fundamentally disparity technique essentially they have determined the absolute utilization in private areas, from the household review of populace then it is changed for net exchange and ascertain genuine gauge of/GDP, which is contrasted with the GDP of National Income Accountability. The distinction b/w these two Gross Domestic Products is equivalent to the parallel economy. This investigation shows that size of the unofficial economy is ascending till the 1990s.

Alfredo et al. (2006) [9] investigated the interest of the Currency Approach and the extent of the Shadow or parallel Economy. As per the investigation, a way to deal with estimation of the area of the parallel economy, refer as "the money-related technique" depends on econometric appraisals of the cash interest. Appraisals ascertain the abundance dissemination of cash held by financial operators for money enrolled exchanges. This measure gave the concealed estimation of GDP. The standard cash approach utilizes the 17 abundance of money duplicated by the speed of flow to quantify concealed GDP. Just money is utilized for exchanges in the black economy. The reasoning of technique depends on the possibility of various pay/cash proportions. Discoveries recommended that the suspicion normally made in applied works of equivalent speeds along with pay versatility gauges comparatively lower than one result in figures, one-sided upwards and vice versa for the Shadow Economy.

3 Methods

3.1 Theoretical framework of the model

The money demand approach was first used by Cagan (1958) who considered the association between cash revenue and appraisal pressure (as one explanation behind the Shadow Economy)

for the United States over the period 1919 to 1955. Following 20 years Gutmann (1977) used a comparable technique anyway with no quantifiable systems. Cagan's philosophy was also advanced by Tanzi (1980, 1983) who evaluated a money demand work for the United States for the period 1929 to 1980 to discover the size of the Shadow Economy. His strategy anticipates that shadow (or concealed) trades are held onto as cash portions, to leave no discernible follows for the pros. Development in the size of the Shadow Economy will in this manner extend the premium in cash. To disengage the resulting plenitude of premium for cash, a condition for money demand is evaluated after some time. All customary likely components, for instance, the progression of pay, portion inclinations, advance charges, credit, and other commitment cards as a substitute for cash, and so forth, are controlled for. Also, such factors as the prompt and circumlocutory tax collection rate, government rule, state associations, and evaluation soul, which are believed to be the principal contemplations making people work in the Shadow Economy, are associated with the appraisal condition. The fundamental backslide condition for the cash revenue, proposed by Tanzi (1983) is the going with:

$$\ln(\mathrm{C/M2})\mathrm{t} = \alpha 0 + \alpha 1 \ln(1 + \mathrm{TW})\mathrm{t} + \alpha 2 \ln(\mathrm{WS/Y})\mathrm{t} + \alpha 3 \ln \mathrm{Rt} + \alpha 4 \ln(\mathrm{Y/N})\mathrm{t} + \mathrm{ut} \quad (1)$$

Where $\alpha 1 > 0$, $\alpha 2 > 0$, $\alpha 3 < 0$, $\alpha 4 > 0$, where ln implies basic logarithms, C/M2 is the extent of cash property to current and store accounts, TW is a weighted ordinary evaluation rate (to middle person changes in the size of the Shadow Economy), WS/Y is an extent of wages and pay rates in broad daylight pay (to find changing portion and money quick pauses), R is the superior paid on saving finances stores (to get the open entryway cost of holding cash) and Y/N is the per-capita installments. Any "excess" increase in real money or the aggregate unexplained by standard or run of the mill segments is then credited to raise the assessment rate and various reasons driving people to work in the Shadow Economy. Figures for the size and improvement of the shadow economy can be resolved in an underlying advance by differentiating the qualification between the headway of cash when the prompt and variant tax collection rate and government-rule have held all things considered diminished characteristics and the progression of money with the present higher load of duty evaluation and government-rule. Expecting in a second step a comparable compensation speed for money used in the Shadow Economy concerning genuine money in the official economy, the size of the shadow can be enlisted and diverged from the official GDP. This is one of the most typically used philosophies. It has been applied to various countries wherever on the planet.

3.2 Hypothesis of concerned study

Examination is attempting that theory of zero-effect of self-ruling components on a subordinate variable. Its undertaking to check whether the free factors hugely affect the subordinate variable or not so, there is Π to check whether it is equivalent to zero digit or not. The Mathematical form of this hypothesis is made as: H_0: $\Pi 0$; H_1: $\Pi 0$.

3.3 Brief explanation of variable

3.3.1 Currency circulation to money supply ratio (CM)

CM is the proportion of cash course to cash gracefully proportion, which speaks to the interest in money. (Current possessions to M2 and stores accounts)

3.3.2 Gross Domestic Product (GDP)

Total national output per capita is GDP apportioned by mid-year people. Gross Domestic Product is the measure of gross worth adds up by all occupant suppliers of the economy notwithstanding anything costs and less any gifts rejected from assessment of the material things. It is resolved without making inductions for the disintegration of made assets or fatigue and defilement of trademark resources.

3.3.3 Inflation (INF)

Expanding as evaluates by the client esteem list reflects the yearly rate change in price for the ordinary customer of getting a container consists on items and endeavors that sometimes changed at decided schedules fixed in nature, for instance, yearly.

3.3.4 Interest Rate (LEINT)

The advancing rate is the percentage levied from the banks on credits to the private region. It is commonly the bank rate that by and large meets the short-term and also medium-term financial needs of the private territory.

3.3.5 Total Tax Revenue (TTR)

Hard and fast cost pay exhibits the part of a country's yield that is assembled by the organization through obligations. It will in general be one extent of how much the organization controls the economy's resources.

3.4 Sources and data type

Examination used yearly (discretionary) course of action data for the time span of 1980-2018. The reason behind period has been chosen is the concerned data in light of a legitimate concern for cash work was likely going to be available. Condition is evaluated using the Auto-Regressive Distributed Lag system with picked data on Malaysia. Except if regardless decided, all the data has been drawn from the official locales of "trading money related angles", "world progression marker" and "The GlobalEconomy.com".

4 Computation, empirical results, and interpretation

4.1 Augmented Dickey-Fuller

Above all conditions, we have applied the expanded Augmented Dickey-Fuller refer as ADF, unit root test for each factor that tested for criticalness of the free factors expecting that the preference of slacks is consisted to guarantee non-extra autocorrelation. After first differentiation results over entire the period and at the level both are represented in Table 1. The overall test exhibits that entire components contain mixes of unit root at the level as they were got going to be fixed behind the chief qualification and at the level.

Table 1 Results of Unit Root test (Augmented Dickey-Fuller test)

Variables	On Level		On 1st Difference		Conclusion
	Intercept	Trend & Intercept	Intercept	Trend & Intercept	
LCM	–	- -	-4.486659 (0.0010)	- -	I(1)
GDP	-3.861527 (0.0002)	- -	–	- -	I(0)
INF	-4.961567 (0.0002)	- -		- -	I(0)
LEIR		- -	- -	-5.231087 (0.0007)	I(1)
TTR		-4.296982 (0.0082)			I(0)

Source: Authors own calculation based on E-views 9

Table 1 shows unit root tests. The notations: (LCM), (GDP), (INF), (LEIR), (TTR) indicate respectively the Demand for Cash, Gross Domestic Product, Inflation, Lending Interest Rate, and Total Tax Revenue.

4.2 Autoregressive Distributed Lag (ARDL)

This method of ARDL was created by Pesaran and Shin to decide the since quite a while ago run connection between factors. This brand-new testing has a preferred position over the past systems of Johanson that it might be applicable in specific circumstance when entire elements are composed at dual solicitation I(0) and I(1) instead of all elements should be at a similar solicitation of the fuse. ARDL results are given in Table 2 and 3.

Table 2 ARDL Results with TTR (n = 39, from 1980 to 2018))

Regressors	Coefficient	Standard Error	T-Ratio	Prob.
GDP	0.000008	0.000002	3.384399	[0.0028]
INF	0.023307	0.014790	1.575901	[0.1300]
LEINT	0.032110	0.007640	4.202690	[0.0004]
TTR	0.327027	0.126046	2.594506	[0.0169]

Note: Authors own calculation based on E-views 9; Estimated Long Run Coefficients using the ARDL Approach; ARDL (1, 1, 1, 0, 5) selected based on Akaike info Criterion; LMC is dependent variable.

4.3 The empirical results and interpretation of the regression

In Table 1, 2 and 3, value of coefficient of Gross Domestic Product (GDP) shows that there is +tv and significant r/p between the dependent variable MONEY CIRCULATION TO MONEY SUPPLY RATIO (CM) and Gross Domestic Product (GDP). Empirical result shows that in

Table 3 ARDL Results without Tax (n = 39, from 1980 to 2018))

Regressors	Coefficient	Standard Error	T-Ratio	Prob.
LEIR	0.021716	0.006863	3.164267	0.0057
INF	0.003150	0.012810	0.245905	0.8087
GDP	0.000004	0.000001	3.583498	0.0023

Note: Authors own calculation based on E-views 9; Estimated Long Run Coefficients using the ARDL Approach; ARDL (3, 3, 5, 2) selected based on Akaike info Criterion; LMC is dependent variable.

the long run, 1 unit change in GDP leads to 0.000008 percent (with tax) and 0.000004 percent (without tax) increase in the CM. This shows that an increase in GDP impacts CM positively and it seems to express that increase in GDP is efficient to increase the CM in the country. My study supports the results of Farooq et al., 2010 that there is an increase in Gross Domestic Product (GDP) that impacts Currency to Money Supply ratio positively. There may be different reasons behind this but the most ostensible reason is the increased GDP reflects the increased underground economic activities that are leads to more currency demand in society.

The value of coefficient of Interest Rate LEINT has positive and significant impact on Currency to Money Supply ratio. A unit increase in value of LEINT increases 0.032110(with tax) and 0.021716(without tax) percent point of CM. The positive sign of coefficient of LEINT indicates that the currency demand. People will earn money from illegal sources instead of borrowing from financial institution.

In our empirical testing, coefficient of Inflation (INF) shows a unit increase in Currency to Money Supply ratio (CM) will improve CM by 0.023307(with tax) and 0.003150(without tax) percent. The coefficient's value of INF shows +tv and significant impact. Our studies reinforce the findings of Sumeet et al., 2015 that Demand for cash is most affected in the presence inflation factor. When inflation rises up, people demand more cash for day to day transactions. Their tendency to earn money through unfair means will lead them to Shadow Economy.

The coefficient of TTR there is also found +tv and significant impact. A unit increase in TTR will expend Currency to Money Supply ratio (CM) 0.327027 percent. The positive impact of TTR on CM demonstrates significant r/p and macroeconomic strength. Our results also found TTR an important causation of CM. An increase in direct and indirect taxation increases the Shadow Economy. Friedrich S (2011) [10] exhibit the +tv r/p between TTR and our Shadow Economy also supporting our study. The theory demonstrates that a rise in Total Tax Revenue (TTR) contribute in the area of Shadow or dim Economy That leads to increased money circulation among people and demand for money.

All coefficients values indicate significant results and exhibit +tv impact on Shadow or dim Economy in Malaysia.

5 Estimated size of Shadow Economy

After the predicted calculated value of the currency demand model, the magnitude of underground economy determined as follows. For every year the estimated values of currency demand model with taxes (CM)T and without taxes (CM)WT are determined by employing predicted regression equations:

$$LCM = a_0 + a_1 GDP + a_2 INF + a_3 LEINT + a_4 TTR \text{ (with taxes)} \quad (2)$$

$$LCM = a_0 + a_1 GDP + a_2 INF + a_3 LEINT + a_4 TT \text{ (without taxes)} \quad (3)$$

The change of (CM) T – (CM) WT demonstrates the level of cash holding that is because of taxes alternatively have limit that total tax Revenue have influence people to hold higher amount of cash. The extent of increased demand for cash demonstrates the size of community of tax evasion which termed as "illegal money". The mathematical expression for illegal-money (IM) can be confined as:

$$\text{IM} = [(\text{CM})\text{T} - (\text{CM})\text{WT}] \times \text{M2} \quad (4)$$

Since Tanzi witnessed that legal money (LM) can be obtained with the difference between M1 and IM. M1 is the sum of currency and demand deposits that is total money supply and estimated illegal money. The mathematical form is stated as follow:

$$\text{LM} = \text{M1} - \text{IM} \quad (5)$$

After obtaining the legal money, the income velocity (circulation velocity) of legal money can be computed, dividing the GNP by LM which mathematical elaboration is given below:

$$\text{IV} = \text{GNP}/\text{LM} \quad (6)$$

As the basic assumption of the model considers the velocity of legal money and illegal money same-thing, thus the magnitude of Shadow Economy is the result of the product of illegal money and income velocity of money. Mathematically it can be stated as follow:

$$\mathrm{SE} = \mathrm{IM} * \mathrm{IV} \tag{7}$$

Taxes are one of the biggest reasons of Shadow Economy but we don't blame them for the cause of entire Shadow Economy, Shadow Economy even also exists when taxes are not levied on the people. According to an economist corruption, non-registered businesses, beggars, hawkers etc. are also lied in the category of Shadow Economy and above graphs are reflection of this definition. As we can see slope of these graphs are almost same but still there is difference between values. Shadow Economy has greater values and tax evasion represented comparatively low ones in corresponding years. The gap of these values is the reason that taxes are not the only reason of Shadow Economy, other factors also contribute in it. (see in Figure 1, 2 and 3)

Figure 1 Size of Shadow Economy

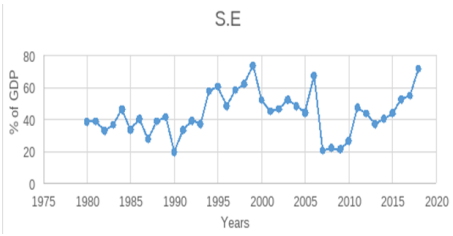

Figure 2 Shadow Economy as % of GDP

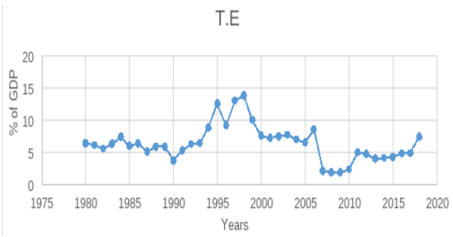

Figure 3 Tax Evasion as % of GDP

6 Conclusion and policy advices

Magnitude of Shadow Economy is highly responding to taxes, so government should make easy tax collection methods so that non tax payers can easily come in the category of tax payers. Good governance system and government check n balance may help in reducing magnitude of the black economy in Malaysia. As we know taxes are not the only measures of S.E and other factors are also involved so government should improve and update its record keeping system so that they can detect the hidden economic activities. An adoption of policy based on these findings would lead to a successful emergence of the Shadow Economy in to the official

Availability of data and material

All results reported in this research was carried out in Eviews 9 computational environment. Data used in this research are taken from https://www.theglobaleconomy.com.

Conflict of interest

The author declares no conflict of interest.

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