Journal of
Economic and Social Thought
www.kspjournals.org
Volume 4 June 2017 Issue 2

Currency Demand, the Subterranean Economy and Tax Evasion: The Case of Tanzania

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Abstract. This paper estimates the magnitude of, and changes to the subterranean economy in Tanzania, as well as its adverse effect on tax revenue during the 1966-2015 period. To achieve this objective, the paper applies currency -ratio due to Gutmann and the traditional currency-demand approach *à la* Tanzi. Despite their differences, both approaches suggest the existence of a substantial size of the subterranean economy in Tanzania. This persistent large size of the subterranean economy is an important consequence of economic and social policies over the period of study. Using the currency-demand approach, the paper finds that tax evasion is positively correlated with the size and growth of the subterranean economy. Indeed, results show that the size of the subterranean economy and the magnitude of tax evasion over the 1966-2015 period, are on average, 32.7 percent and 6.6 percent of official GDP respectively. The implication of the results is that minimization of the size of the subterranean economy is necessary for effective addressing the problem of tax evasion and subsequent fiscal deficit in the long run.
Keywords: Subterranean economy, Currency demand deposits, Currency demand approach, Tax evasion.
JEL. E26, E41, H26, K42, O17.

1. Introduction

Fighting the subterranean economy and tax evasion has been a major concern for many countries in recent decades. The subterranean economy comprises all economic activities that would generally be taxable were they reported to the tax authorities. These are economic activities that contribute to value added and should be included in national income in terms of national accounting conventions but are presently not registered by national measurement agencies (Schneider, 1986). Thus, activities in the subterranean economy, also called shadow economy or underground economy or informal economy or second economy or hidden economy or unofficial economy or irregular economy or black economy or parallel economy, are always connected with tax evasion, and factors influencing the latter will also always have an effect on the former. This problem has been more accelerated by globalization; as this process extends the range of opportunities to circumvent taxation while simultaneously reducing the risk of being detected.

The development of the subterranean economy exists in all countries to varying degrees (Schneider & Enste, 2002 and Schneider, 2005). According to Schneider & Enste (2002), in Africa, Nigeria and Egypt have the largest subterranean economies, equivalent to 77 percent and 69 percent of official GDP, respectively. South Africa, by contrast, has the subterranean economy of only 11 percent of

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official GDP. Moreover, Schneider & Enste (2002) show that, in Asia, Thailand has the largest subterranean economy, equivalent to 70 percent of official GDP while Hong Kong SAR and Singapore have the smallest subterranean economies, both at 14 percent of GDP. In Latin America, the biggest subterranean economy is in Bolivia, at 67 percent of GDP, and the smallest is in Chile, at 19 percent (Schneider & Enste, 2002). Over the 1988-2000 period, the average size of the subterranean economy as a percentage of official GDP ranged between 14 percent and 16 percent in OECD countries whereas in developing countries it ranged from 35 percent to 44 percent (Schneider & Enste, 2002). In Tanzania, Bagachwa & Naho (1995) estimate the subterranean economy at 21-33 percent of the official GDP.

The fact that the subterranean economy is associated with tax evasion; it weakens the ability of the government to collect taxes. Also, it undermines established institutions, and distorts relative prices and allocations of resources to the extent that they become less productive. Indeed, the subterranean economy competes with the official sector, and in general, misrepresents official statistics in which many policies are based (see for example Schneider & Enste, 2000 and Gërxhani, 2004). In the same vein, a growing subterranean economy may cause severe difficulties because official indicators such as unemployment, labour force, income, GDP, and consumption are distorted. As a result, policy based on inaccurate indicators is likely to be ineffective.

As presented above, the subterranean economy is associated with tax evasion and avoidance. Thus, it creates tax gaps and reduces tax revenue. This may lead to persistent increasing fiscal deficit because the government expenditures grow with the overall economy i.e. official and unofficial economies, while public revenues grow at the slower rate of the official economy from which the government collects taxes. Unambiguously, revenue generated through taxes ensures sustainability and ownership in development process. Taxation has the potential beneficial effect on governance and state building. Understandably, taxation is the only viable strategy to exit foreign aid dependency. Against this arguments, developing and least developed countries give taxation a higher profile in the policy agenda. However, the main challenge remains to be high level of tax evasion in these low income countries. For example, many professionals operate on cash basis and they do not pay taxes to the governments. Property taxes are very low despite the fact that large numbers of people own a lot of property. The low revenue collection is also linked to misreporting actual sales and incomes by registered enterprises leading to low payment of taxes or evade taxes (Tadesse & Taube, 1997). According to IMF (2011), the ratio of tax to GDP in low-income countries is between 10 percent and 20 percent whereas in OECD economies it ranges from 30 percent to 40 percent.

Tax evasion is a common problem in most countries, particularly in developing countries including Tanzania where the information systems are weak. Several studies have found strong evidence that tax regime influences the subterranean economy. Countries with more regulation of their economies have larger subterranean economies. A heavily regulated economy combined with weak and discretionary administration of the law provides fertile ground for informal activities. These also are the conditions under which corruption thrives. By contrast, subterranean economies tend to be smaller in countries where government institutions are strong and efficient. Indeed, some studies have found that it is not higher taxes per se that increase the size of the subterranean economy, but ineffectual and discretionary application of the tax system and regulations by governments. By and large, the key factors influencing informal activities have been related to aspects of public policy and public administration including the burdens of taxation and social security contributions, the complexity of the tax system, bureaucracy and regulations, and corruption (see Friedman *et al.*, 2000; Johnson *et al.*, 1998; Loayza, 1996; Schneider & Enste, 2000; 2002; Schneider & Neck, 1993 and Blackburn *et al.*, 2012).

Because the subterranean economy and tax evasion have been a source of persistent low tax base and low tax elasticity and buoyancy, and consequently fiscal deficit problem, understanding the size and scope of the subterranean economy is of great importance to policymakers. In fact, proper policies should be developed to reduce the size of the subterranean economy, fight tax evasion and avoidance. Notably, reduction of subterranean economy would ensure that consumers, legitimate businesses and employees are protected through compliance with laws and regulations. In addition, efficiency of allocation of resources would ensure increased revenue for the government. However, by its nature, the subterranean economy is difficult to study empirically. There is no official statistics on this subject and it has to be estimated using indirect approaches. Monetary approach is the most commonly used indirect method to estimate the size and growth of the subterranean economy. In the class of monetary approach, the most applicable methods are simple currency ratio method of Gutmann (1977), the transaction method of Feige (1979) and the currency demand method of Tanzi (1983), based on the work of Cagan (1958). This paper aims at estimating the magnitude of, and changes to the subterranean economy in Tanzania, as well as its adverse effect on tax revenue applying both currency ratio approach and currency demand approach. The paper uses time series data spanning from 1966 to 2015.

2. Review of Literature

Measuring subterranean economy is a difficult task and those who try to measure or estimate it face a challenge in defining it precisely. According to Öğünç & Yilmaz (2000), there is no agreement on the precise definition of the subterranean economy. The reason for the disagreement is that the subterranean economy is not directly observable. As such, trying to measure a unobservable phenomenon raises a number of issues. According to Smith (1994), subterranean economy refers to the market based production of goods and services, whether legal or illegal, that escapes detection in the official estimates of gross domestic product. In another definition, Tanzi & Schuknecht (1997) define subterranean economy as the economic activities that are hidden from public authorities to avoid taxation. This definition assumes tax evasion as the only motivation for the existence of the subterranean economy. Similarly, Field & Larsen (2005) define subterranean economy as income from productive economic activities which are legal and taxable, but on which income tax, VAT and social security contributions are not paid, because they are not reported to the tax, social security or customs authorities. In this paper, the term subterranean economy is used to indicate those activities which are obscured from the tax authorities in an attempt to evade taxes. This certainly is the narrow definition of the subterranean economy which includes all market-based legal production of goods and service that are deliberately concealed from public authorities to avoid the payment of taxes and social security contributions, having to meet certain legal labour market standards, such as minimum wages, maximum working hours, and safety standards, and complying with certain administrative procedures (Schneider, *et al.,* 2010). This definition, therefore, does not include illicit transactions such as drugs income and incomes from other unlawful activities and gambling which are unrecorded in official statistics.

Theoretical attempts to analyze the size of the subterranean economy can be traced back to the work of Cagan (1958) on the demand for currency. Cagan's method was then developed by Gutmann (1977) by assuming that the ratio of currency in circulation to demand deposits remains unchanged in the absence of a growing subterranean economy. The main argument here is that currency is regarded as a superior medium of exchange for conducting unofficial transactions. According to Gutmann (1977) the subterranean economy of USA was almost 10 per cent of official GNP in 1976. During the 1937-1941 period, there was no

subterranean economy in the USA, therefore, the ratio of currency in circulation to demand deposits was constant during this period (Gutmann, 1977).

Tanzi (1980; 1983) apply similar approach to measure the subterranean economy with some modification on the dependent variable as the ratio of currency to M2 instead of currency per se. Tanzi (1980; 1983) argue that the demand for currency is assumed to be a function of, *inter alia*, taxes. Assuming that economic agents engage in subterranean economic activity in order to circumvent their tax obligations then an estimate of the tax elasticity of currency demand can be used to calculate the stock of currency held in the informal sector. This approach uses the correlation between currency demand and tax pressure, assuming that informal activities operate with cash. This implies that, if the tax burden increases and so does the demand for money, then that increase in the demand for money reflects an increase in the subterranean economy.

In order to calculate the excess in money demand, the economists behind this approach estimate an equation for money demand using econometric methods. They control for development of income, payment habits, interest rates and other related variables. In the equation, they also include government regulation, direct and indirect tax burden, and the complexity of the tax system (see Restrepo-Echavarria, 2015).

Many research works have been given considerable efforts in estimating the size of the subterranean economy in countries around the world, deploying different methods (see for example Ott, 2002; 2004; Ariyo & Bekoe, 2012; Barbosa, Pereira & Brandao, 2013; Belv, 2003; Buehn & Schneider, 2008; Chiumya, 2007; Blackburn *et al.*, 2012; Dabla-Norris & Feltenstein, 2003; Eikat & Zinnes, 2000; Feige & Urban 2003; Hildegart *et al.*, 2006; Frey, Ihendinihu *et al.*, 2008; Ogunc & Yilmaz, 2000; Chipeta, 2002; Osoro, 1995; Kitine, 1993; Schneider & Enste, 2003; Schneider, 2002; and Vuletin, 2008). Unfortunately, these methods tend to generate divergent estimates. Many empirical works show that the size of the subterranean economy has been most dramatic in the planned socialistic economies with maximum governmental intervention. In line with this view, Giles (1999) suggests that the size of the subterranean economy has been growing over the past two or three decades in almost all of the countries for which comparative data have been assembled. According to Giles (1999), growth in the subterranean economy is associated with increases in the actual or perceived tax burden but also with the degree of economic regulation. To put more emphasis, Thomas (1999) argues that a growing subterranean economy may be an indication of over taxation and over regulation.

Similarly, as reported earlier, empirical evidence shows that countries with more general regulation of their economies tend to have a higher share of the unofficial economy in total GDP, according to Johnson *et al.*, (1997), a one-point increase in the regulation index[1], *ceteris paribus*, is associated with an 8.1 percentage point increase in the share of the subterranean economy. It is the enforcement of regulation, which is the key factor for the burden levied on firms and individuals, and not the overall extent of regulation (Johnson *et al.*, 1997).

There are a number of empirical studies however, that show a strong impact of the tax burden on the subterranean economy (See for example Osoro, 1995; Schneider, 1994; 1986; Dreher & Schneider, 2010 and Schneider, 2000; 2005 and Cebula, 1997). For detailed demonstration, Schneider (1994) finds out that direct taxes including social and security payments have the biggest effect on the subterranean economy followed by the intensity of regulations and complexity of the tax system. Overall, Schneider (1986) reveals that average tax rate, average indirect rate, average total tax rates, and marginal tax have positive sign, suggesting that both direct and indirect taxation are the driving forces for the subterranean. This strong influence of direct and indirect taxation on the

[1] Ranging from 1 to 5, with 5 equal to the most regulation in a country

subterranean economy is further demonstrated by Cebula (1997). Using Feiges's data for the subterranean economy, Cebula (1997) finds out evidence of the influence of income tax rates on the relative size of the subterranean economy. Similar results are reached by Kirchgaessner (1983) and Klovland (1984).

Although a number of empirical studies show that tax rates influence the subterranean economy, the causal relationship between taxation and the size and growth of the subterranean economy is not straightforward. In fact, it is a subject of further empirical study. For example, Freidman *et al.* (2000) find out that higher taxes are associated with a smaller subterranean economy. According to Freidman *et al.* (2000), raising taxes by one point[2], leads to a 9 percent fall in the size of the subterranean economy. The contention here is that higher tax rates lead to stronger revenues and better public goods provision, including a more robust legal environment, thereby encouraging firms to operate in the official sector. However, this argument is subject to discussion, as revenue collections depend not only on tax rates but also on tax base and equally important, on tax elasticity and buoyancy. Still, even the argument that income tax rates lead to growth of the subterranean economy does not go unchallenged. Hill & Kabir (1996), for example, find empirical evidence that marginal tax rates are more relevant than the average tax rates and that a substitution of direct taxes by indirect taxes seems unlikely to improve tax compliance.

The controversies on the study of the subterranean economy and its association with tax evasion reflect the hidden nature of that economy, and that it is certainly not exhaustive. The controversies may emanate from lack of a unifying agreement on the terminologies used to describe the unrecorded portion of the total economy, as well as the method of estimation of the size of the unrecorded economy despite the fact that this area of study has intrigued many researchers and policy makers. It is very difficult to define and measure unofficial economy in the real world (Ott, 1998), however, study of the subterranean economy is of very significant. This is because the causes and effect of such an economy are of national and international interest. For example, according to De Soto (2000) much of the potentially productive capital in poor countries is outside the system of formal property rights. Wider participation in the formal economy is hindered because productive capacity of the economy is restricted due to fundamental institutional weakness. Overly stringent labour market regulations have the unintended consequence of encouraging more informal labour arrangements as they raise the cost of hiring for firms (Singh *et al.*, 2012). Moreover, the World Bank (2004) reports that restrictions on hiring and firing intended to protect workers have instead discouraged firms from hiring in the formal labour market, as compliance tends to be expensive, as a results firms hire informal workers, pay them informally and avoid providing health insurance and other benefits.

According to Schneider (2008), the social welfare system and the welfare beneficiaries have high disincentives to work in the official economy. To shed light on this argument, Finlayson & Peacock (2002) and Lippert & Walker (1997) contend that besides receiving the welfare payments, some people might wish for higher income, as a consequence they would cheat by participating in unofficial economy since working in official economy could reduce their welfare income. Moreover, the bigger the difference between the total cost of labour in the official economy and after-tax earnings, the greater the incentive to avoid this difference and to work in the subterranean economy (Schneider & Enste, 2000). This suggests that social security system and the overall tax burden are key features of the existence and rise of the subterranean economy. This also implies that social security payments are very important factors when one considering policies that aim at reducing the rise of the subterranean economy. In fact, Schneider & Enste (2000) argue that major tax reforms alone, even with major tax rate reduction may only be able to stabilize the

[2] On a scale of 1 to 5, Heritage Foundation measure of tax rates

size of the subterranean economy and avoid further increase but will not lead to substantial decrease of the subterranean economy.

In another study, Ott (1998) reveals that the non-transparency of regulations and rules and the concentration of decision making powers in the hands of state officials lead to unofficial economy. According to Ott (1998) irrational government budget can add financial burden to tax payers thus directly contributing to the growth of unofficial economy. Equally important, Ott (1998) argues that inadequate penalties against those active in the unofficial economy make efforts to control the unofficial economy more difficult.

Notwithstanding the existing literature, there is little agreement on the size of subterranean economy and tax evasion relative to the official economy on one hand and total economy on the other hand across the world and within a particular region or country. Understandably, there is no agreement on the appropriate estimation approach that is commonly adopted to measure the size and growth of the subterranean activities. Even within the class of monetary approaches, selection of variables and data measurement may differ across studies, which in turn may lead to different results and conclusions. Indeed, the skepticism of the correct size and extent of subterranean activities prompt further investigation in order to develop methods and instruments required to fight subterranean economy which has a consequence on government policies and development. In this view, a broad understanding of the subterranean economy is required in order to provide contribution in literature gap and more importantly contribute to reduction of the adverse effects of the subterranean on the economy on government budget and foreign aid dependency.

3. Estimation of the Size of the Subterranean Economy

3.1. The Gutmann Approach

The Gutmann's method, also referred to as the fixed monetary ratio or currency ratio approach, has been widely applied to estimate the size and growth of unreported and unrecorded income in developed nations (Gutmann, 1977; Feige, 1980; 1986; 1989) and in developing countries (Osoro, 1995; Chipeta, 2002; Davidescu, 2013). The method involves the calculation of the ratio of currency in circulation to demand deposit which is assumed to have been relatively stable since an initial normal period. In fact, this approach was developed by Cagan (1958) and refined by Gutmann (1977). Specifically, Cagan (1958) estimates the demand for currency relative to total money supply in the US whereas Gutmann (1977) estimates the underground economy in the US by using the currency to deposit ratio method of the monetary approach. The Gutmann's approach can be used to generate rough estimates of the overall size of the subterranean economy activities by tracing movements in the ratio of currency in circulation to demand deposits. The assumption underlying this approach is that, there is monetary ratio that would have remained the same over time had there been no subterranean economy. Also, the method assumes that there was a golden age in the past when there was no subterranean economy. With reference to Tanzania, it is assumed that 1977, the year with the minimum ratio of currency to demand deposit (0.64), was characterized by a normal ratio of currency to demand deposits. Correspondingly, activities in the subterranean economy in that year were, by assumption, insignificant. It is assumed that the cash to deposit ratio of 0.64 associated with 1977 would have prevailed had it not been for the growth of the subterranean economy. As reported in Figure 1 and Table 1, the ratio increased after 1977 to 1.73 in 1999 and declined in the recent years, reaching 0.65 in 2012. The actual Gutmann formula used to estimate the size of the subterranean economy is:

$$SECON = \frac{OFECON}{DD \bullet (1 + k^*)} \bullet [M_1 - DD(1 + k^*)] \quad (1)$$

$$k^* = \frac{CC}{DD_{77}}$$

where

SECON	=	Subterranean economy nominal GDP
OFECON	=	Official economy nominal GDP
CC	=	Currency in circulation
DD	=	Demand deposits
k^*	=	Ratio of currency in circulation to demand deposits, and
M1	=	Narrow money (currency in circulation plus demand deposits)

Table 1 and Figure 2 summarize the estimates of the subterranean economy GDP. The Table shows the absolute size of the subterranean economy GDP and as a percentage of the official economy GDP. It should be understood, however, that the estimates are biased downwards because the currency to demand deposits approach assumes that transactions in the subterranean economy are strictly paid for by domestic currency alone. The method excludes values of transactions involving barter exchange and exchange of goods for foreign currency. In addition, the method assumes that the ratio of currency in circulation to demand deposits is constant, if it changes over the years then the change must be due to the subterranean economy, however, an increase in the ratio of currency to demand deposits can be due to a lower rate of growth in demand deposits rather than a higher rate of growth in demand for currency. Despite these criticisms, Gutmann's (1977) approach remains one of methods that are most widely used in estimating subterranean economy in many countries.

Results show that in 1966 the size of the subterranean economy GDP was estimated to be 5.6 percent of official economy GDP. It increased to 25.2 percent in 1972. This was possibly attributable to the nationalization and introduction of controls and regulation by the government. The ailing nature of the economy manifested itself in form of corruption, declining output, shortage of foreign currency, balance of payment problems, government deficits, and a rising debts. These malaises led people to take the risk of participating in illegal activities. In addition, many people had to hold cash since the policy discourage private investment in manufacturing sector and construction.

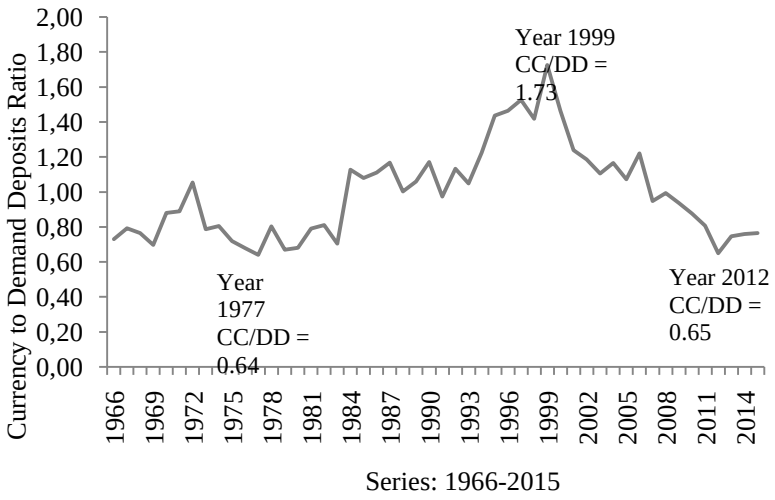


Figure 1. *The Ratio of Currency to Demand Deposits*
Source: Authors' Estimates

Table 1. *Subterranean Economy Estimates Using the Gutmann Approach, TZS Million*

Year	Currency	Demand Deposits	CC/DD Ratio	M1	Official Economy Nominal GDP	Subterranean Economy GDP	Subterranean economy (% of GDP)
1966	431.5	590.0	0.7	1021.5	7217.0	402.0	5.6
1967	539.2	680.4	0.8	1219.6	7356.0	683.9	9.3
1968	588.3	768.8	0.8	1357.1	7866.0	600.6	7.6
1969	650.3	931.8	0.7	1582.1	8098.0	285.9	3.5
1970	861.0	977.1	0.9	1838.1	9173.0	1349.0	14.7
1971	1049.3	1179.6	0.9	2228.9	9814.0	1493.3	15.2
1972	1279.5	1214.4	1.1	2493.9	11172.0	2817.6	25.2
1973	1278.5	1625.4	0.8	2903.9	13103.0	1171.1	8.9
1974	1608.6	1996.1	0.8	3604.7	15994.0	1617.7	10.1
1975	1862.9	2591.8	0.7	4454.7	19011.0	913.1	4.8
1976	2214.9	3260.5	0.7	5475.4	24876.0	596.3	2.4
1977	2565.0	4003.1	0.6	6568.1	28868.0	13.3	0.0
1978	3143.5	3911.7	0.8	7055.2	32933.0	3285.6	10.0
1979	4278.2	6380.0	0.7	10658.2	36283.0	676.2	1.9
1980	5522.9	8100.0	0.7	13622.9	42228.0	1077.3	2.6
1981	6950.0	8785.2	0.8	15735.2	51753.0	4768.3	9.2
1982	8381.9	10334.5	0.8	18716.4	61927.0	6459.3	10.4
1983	8717.3	12370.1	0.7	21087.4	69522.0	2743.0	3.9
1984	11341.2	10064.7	1.1	21405.9	85392.0	25348.4	29.7
1985	13556.6	12551.7	1.1	26108.3	112213.0	30110.1	26.8
1986	19451.6	17499.8	1.1	36951.4	148391.0	42665.4	28.8
1987	26328.5	22550.8	1.2	48879.3	329486.0	105981.9	32.2
1988	33817.0	33698.0	1.0	67515.0	506426.0	112257.2	22.2
1989	43761.0	41323.9	1.1	85084.9	633752.0	161906.5	25.5
1990	62284.5	53165.8	1.2	115450.3	830693.0	269222.7	32.4
1991	70354.8	72321.2	1.0	142676.0	1086273.0	220440.7	20.3
1992	102459.0	90421.7	1.1	192880.7	1369874.0	411901.1	30.1
1993	131067.0	124924.4	1.0	255991.4	1725535.0	430511.0	24.9
1994	187812.5	153316.5	1.2	341129.0	2298866.0	820020.4	35.7
1995	264208.2	183971.4	1.4	448179.6	3020499.0	1466300.1	48.5
1996	280575.8	191550.5	1.5	472126.3	3767642.0	1894759.8	50.3
1997	314487.0	205991.7	1.5	520478.7	4708627.0	2545809.4	54.1
1998	337323.0	237718.3	1.4	575041.3	6283970.0	2984897.6	47.5
1999	427447.0	247723.2	1.7	675170.2	7222561.0	4780553.7	66.2
2000	443050.9	302602.3	1.5	745653.2	8152789.0	4096955.1	50.3
2001	439261.8	354381.0	1.2	793642.8	9100274.0	3326696.6	36.6
2002	549184.0	463340.9	1.2	1012524.9	10444507.0	3472606.6	33.2
2003	619038.2	560333.3	1.1	1179371.5	12107060.0	3431080.4	28.3
2004	759995.0	651591.3	1.2	1411586.3	13971591.0	4484264.2	32.1
2005	981420.1	915652.8	1.1	1897072.9	19112830.0	5032566.5	26.3
2006	1162877.1	952774.1	1.2	2115651.2	23298435.0	8247036.8	35.4
2007	1354603.8	1428008.9	0.9	2782612.7	26770432.0	5037349.6	18.8
2008	1710160.6	1719661.5	1.0	3429822.1	32764940.0	7081924.7	21.6
2009	1896843.3	2024045.4	0.9	3920888.7	37726824.0	6835790.5	18.1
2010	2298635.0	2624303.7	0.9	4922938.7	43836018.0	6305512.2	14.4
2011	2694169.5	3336156.9	0.8	6030326.4	52762581.0	5391009.8	10.2
2012	2682630.4	4123775.9	0.7	6806406.3	61434214.0	394366.0	0.6
2013	3324794.6	4453155.6	0.7	7777950.2	70953227.0	4612626.5	6.5
2014	3828376.6	5039430.8	0.8	8867807.4	79718416.0	5817710.4	7.3
2015	4431833.2	5786975.1	0.8	10218808.3	90863681.0	6971514.5	7.7

Source: Authors' Estimates

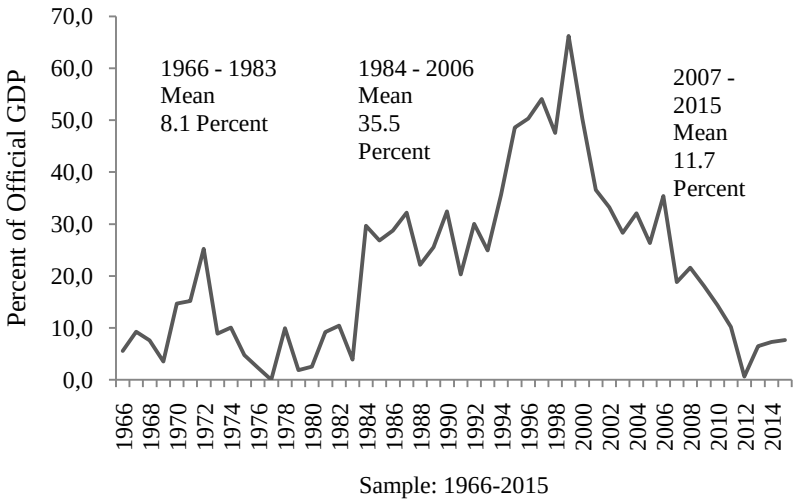


Figure 2. *The Subterranean Economy Estimate Using Gutmann Approach, Percent of Official GDP, 1966-2015*
Source: Authors' Estimates

In 1977 where the ratio of currency to demand deposit was lowest, the subterranean economy declined to approximately 0 percent of the official economy GDP. By and large, during the second half of the 1970s, the subterranean economy as a proportion of official economy GDP declined until the Uganda war in 1978. In the 1980s the subterranean economy grew rapidly, reaching 32.2 percent in 1987. During that period, economic conditions had worsened. Terms of trade worsened due to deteriorating traditional commodity prices putting adverse pressure on the balance of payments. The shares of investment and of domestic savings dropped, while the share of household consumption rose. Also, severe drought in the 1983-1984 period, forced some people to transact the scarce goods and services illegally. It was the depth of crisis such as severe shortages of consumer goods and corruption in the business and public services that prompted policy reforms including the adoption of Structural Adjustment Policies in 1986. The reforms started with the Economic Recovery Programme (ERP), 1986, intending to help restore macroeconomic balance and stability. Notwithstanding, the ERP period has seen either a constant or slightly declining trend in the growth of the subterranean economy. The annual levels remained high in the 1980s and increased rapidly in the 1990s.

The probable explanation for the relative growth of the subterranean economy in the 1990s is the national wide debate on political reforms and the introduction of a multiparty political system in 1992 and the subsequent general election in 1995. This might be true because some people were uncertain about the political future of the country. As a result, they increased their involvement in the subterranean economy (also see Kitine, 1992).

Overall, during the last two decades, the second economy as a percentage of official economy GDP has significantly declined. During that period, economic performance has remained stable and strong.

3.2. The Currency Demand Method

3.2.1. Model Specification

Tanzi (1980; 1983) developed the demand for currency equation to estimate the subterranean economy. In this approach, the influence of the subterranean economy on currency demand, proxied by tax rates to indicate the incentive to avoid taxes and participate in a cash based subterranean economy, is estimated directly in the regression equation associating currency demand and tax rates. After estimating this equation, the effect of a change in the tax level on that demand can then be

inferred. Like the Gutmann approach, Tanzi approach is based on key assumptions. First, the subterranean economy is a direct result of high taxes and second, currency is used mainly for carrying out transactions in the subterranean economy. Hence, the size and growth of the subterranean economy directly influences demand for cash by the public. The main advantage of this approach is that monetary data are most reliable within official statistics even in developing countries such as Tanzania.

The model estimated here applies a demand for currency specification to measure the size of the subterranean economy by looking at the excess sensitivity of real currency holdings to average tax rates (Bajada, 1999). As currency is part of money demand, the model has the standard demand for money arguments (income and opportunity costs of holding currency) and also incorporates the average tax rates and other structural changes in the financial sectors (Faal, 2003). Interest rate and inflation are used to capture the opportunity cost of holding currency. Moreover, inflation accounts for financial uncertainties on the currency ratio arising from instability or uncertainties in the financial sector. Cagan (1958) discusses the degree of urbanization as a potential factor affecting the currency ratio. However, the relationship between demand for currency and urbanization is not straight forward. On one hand, urbanization may cause people to trade where they are not known, which in turn reduces the use of cheques. As a result, urbanization will lead to an increase in the demand for currency. On the other hand, the use of cheques is lower in rural areas than in urban areas where populace is more sophisticated. In this case demand for currency decreases with urbanization. The regression equation for the demand for currency is expressed as follows

$$\ln\left(\frac{C_t}{M1_t}\right) = \theta_C + \theta_T \ln\left(T_t^Y\right) + \theta_Y \ln\left(Y_t^P\right) + \theta_\pi \pi_t + \theta_U \ln\left(U_t\right) + \theta_R R_t^d + u_t \qquad (2)$$

where

$\frac{C_t}{M1_t}$	=	Natural log (ln) of currency to M1 ratio at time t
T_t^Y	=	Average tax rate computed as a ratio of total tax to GDP. This is a proxy for changes in the size of the subterranean economy.
Y_t^P	=	Real GDP per capita
π_t	=	Inflation rate. It captures the opportunity cost of holding cash
U_t	=	Urbanization
R_t^d	=	the rate of interest on savings deposits (R). It also captures the opportunity cost of holding cash
u_t	=	white noise error term, i.e. $u_t \sim N\left(0, \sigma^2\right)$
θ_C	=	Constant term

The ratio of taxes to GDP can affect currency holding by creating incentive to avoid tax payments by involving in more cash transaction. Thus, the coefficient for taxes θ_T, is hypothesized to be positive as burden of taxation in the economy increases the public will want to hold more cash *ceteris paribus*. This also holds true because the currency demand or Tanzi approach assumes that the subterranean economy is more cash incentive than official economy. Real GDP per capita is a basic indicator of economic development and presumably the resulting innovations in the financial markets. Thus, the coefficient for real income per capita, θ_Y, is hypothesized to be negative. The explanation is that economic development leads to an increase in demand deposits (Shabsigh, 1995) and a replacement of currency by cheques (Chipeta, 2002 and Kitine, 1992) leading to a fall in the ratio of currency to money. However it is very difficult to predict with certainty whether economic development would lead to an increased usage of non cash monetary

aggregates. In fact, Faal (2003) argues that a rise in disposable income will increase currency demand. Similarly, Schneider (1986) expects a positive influence of real per capita income on the ratio of currency to money. A rise in the opportunity costs of holding money can reduce demand for money. In this case, the coefficients for the rate of inflation, θ_{π} and the rate of interest, θ_{R} are expected to be negative as the rates of inflation and interest increase, the demand for cash should decrease.

Once regression equation (2) is estimated for the period of the study, it is then applied to estimate currency holdings by making the assumption that the tax variable takes a value of zero. Once currency holdings at zero taxes are estimated, they are in turn, used to determine the extent of the subterranean economy by multiplying excess currency by income velocity (see also Kitine, 1992, Tanzi, 1980; 1983; Schneider, 2007; Schneider & Enste, 2000; 2002; Ariyo & Bekoe, 2012).

As mentioned above, the procedure to estimate the amount of illegal money in the economy, legal money, velocity of money, the subterranean economy and finally tax evasion is well documented in the literature (see for example Osoro, 1995; Iqhal & Qureshi, 1998 and Ariyo, & Bekoe, 2012). The increase in the demand for currency, which in the literature has been defined as illegal money, is presumed to indicate the magnitude of tax evasion and it is expressed as follows:

$$\text{Illegal money, } IM = \left[\left(\frac{C}{M1}\right)_{t} - \left(\frac{C}{M1}\right)_{wt}\right] \bullet M1 \qquad (3)$$

where

$\left(\frac{C}{M1}\right)_{t}$ = The currency to M1 equation with the tax rate.

$\left(\frac{C}{M1}\right)_{wt}$ = The currency to M1 equation with the tax rate.

$M1$ = Narrow definition of money (currency plus demand deposits)

Following Tanzi (1980; 1983), the difference between narrow money and the estimated illegal money gives the legal money *(LM).* Mathematically, LM is expressed as

$$\text{Legal money}\left(LM\right) = M1 - IM \qquad (4)$$

where IM = Illegal money obtained from equation (3)

Dividing GDP by legal money gives an estimate of the income velocity of legal money (V). Mathematically, income velocity of money can be expressed as follows:

$$\text{Velocity}\left(V\right) = \frac{GDP}{LM} \qquad (5)$$

where GDP = Gross Domestic Product

LM = Legal Money obtained from equation (4)

Assuming that the velocity of illegal money is the same as that of legal money, an estimate of the subterranean economy *(SE)* can be obtained by multiplying illegal money by the income velocity of money. The mathematical expression for the subterranean economy is as follows

$$\text{Subterranean economy}\left(SE\right) = IM \bullet V \qquad (6)$$

where IM = Illegal Money
V = Velocity of money derived from equation (5)

Intuitively, when illegal money is used in regular market for transactions, it should behave in the same way as legal money in order to appear regular and trustworthy. The level of total tax evasion *(TE)* in Tanzania can be obtained by multiplying the estimates of the subterranean economy with the ratio of total taxes to GDP. Mathematically, the estimate of the level of tax evasion can be expressed as

$$\text{Tax evasion}(TE) = SE \bullet \frac{Total\ \ Taxes}{GDP} \tag{7}$$

where SE = Subterranean economy obtained from equation (6)
GDP = Gross Domestic Product

3.2.2. Pre estimation Tests

Given that the model uses time series data, unit root tests are carried out to ensure that unbiased and inconsistent estimates of standard errors are avoided and hence avoiding misleading inferences. The Augmented Dickey-Fuller (ADF) test is employed to test the stationarity of the variables used in the estimation. The ADF test in this paper is conducted by including a constant only and a constant with a time trend expressed as follows

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \sum_{i=1}^{q} \beta_i \Delta y_{t-i} + u_t \tag{8}$$

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 t + \sum_{i=1}^{q} \beta_i \Delta y_{t-i} + u_t \tag{9}$$

where y_t is the individual variable at time *t*, $\Delta y_t = y_{t-1} - y_t$, u_t is a pure white noise error term, α_0 is the constant, q is the number of lags which should be large enough to ensure that the error terms are white noise and small enough to save degree of freedom, t is the trend variable and $\alpha_1 = \rho - 1$. In each case, the *null hypothesis* is that $\alpha_1 = 0$ suggesting that the series is nonstationary or there is a unit root. The *alternative hypothesis* is that $\alpha_1 < 0$, implying that the variable is stationary. At 95 percent confidence level, if the *p*-value is less than or equals to 0.05, we reject the *null hypothesis*, otherwise we fail to reject the *null hypothesis*.

Also, cointegration test is conducted to ascertain if there exists an equilibrium or long-run relationship between the variables. The Johansen cointegration technique and the Engle-Granger (two-step) single equation procedure are used for cointegration analysis. The Johansen cointegration model is a vector autocorrelation (VAR) based test and it is expressed as

$$\Delta y_t = \mu + \Pi y_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta y_{t-i} + u_t \tag{10}$$

where Δ is the difference operator, y_t is an $(n \times 1)$ column vector of *k*-endogenous variables that are integrated of order one, and u_t is also an $(n \times 1)$ vector of white noise error term, μ is a constant. Π denotes the short run coefficient matrix and Γ denotes the long run coefficient matrix. If the null hypothesis of no co-integrating vector is rejected, it indicates that there is a long-run relationship among the variables in the model. This method is preferred to the two-step Engle-Granger

procedure because it can test for multiple cointegrating vectors. However, the use of Engle-Granger (two-step) single equation procedure is deemed appropriate, at least with respect to preserving the degree of freedom. It uses a single equation error correction model (ECM), in which a static regression model is estimated. Such a method allows for the possibility of including more than one independent variable in the static regression.

3.2.3. Nature of Data and Data Sources

This paper uses annual time series data spanning from 1966 to 2015. Data on variables such as currency in circulation, demand deposits, M1, nominal GDP, real per capita GDP, total tax revenue, rate of inflation, and rate of interest on saving deposits are obtained from (1) A Review of the Role and Functions of the Bank of Tanzania (1961-2011) and (2) Annual Reports (2014; 2016) published by the Bank of Tanzania. Data on Urbanization is obtained from World Bank's World Development Indicators, 2016. Urbanization measures the percentage of population living in urban areas. Currency is defined as the notes and coins held outside the banks where as M1 consists of currency in circulation and demand deposits. Tax rate is measured as total tax revenue as a percentage of GDP. The interest rate used is the bank deposit rate. The rate of inflation is calculated as the percentage change in the price level.

3.3. Empirical Results of the Currency Demand Method

3.3.1. Unit Roots and Cointegration Tests

As explained above, ADF method is conducted to check for a unit root for all variables in both levels and first differences. The results of this test are presented in Table 2. These results show that the hypothesis of a unit root cannot be rejected in all variables in levels. It is therefore concluded that the ratio of currency to M1, average tax rate, real per capita GDP, inflation rate, urbanization and interest rate are non-stationary at their levels. However, the hypothesis of a unit root or non stationary was rejected in first differences. This also implies that all variables are integrated of degree one, $I(1)$. These results suggest that, further estimations could be carried while all variables are in first difference in order to avoid spurious correlation.

Table 2 . *ADF Unit Root Test*

	Levels		First Difference, Δ	
Optimal Lag = 1	Constant $\alpha_1 = 0$	Constant and Trend $\alpha_1 = \alpha_2 = 0$	Constant $\alpha_1 = 0$	Constant & Trend $\alpha_1 = \alpha_2 = 0$
$\ln(C/M1)$	-1.408	-1.024	-9.822	-9.907
$\ln(T_t^Y)$	-2.059	-3.318	-6.561	-6.512
$\ln(Y_t^P)$	-1.456	-0.247	-3.002	-3.855
π_t	-2.019	-2.225	-7.904	-7.894
$\ln(U_t)$	-1.997	-1.550	-4.677	-7.892
R_t^d	-1.208	-1.167	-5.947	-5.981
5% Critical Value	-2.924	-3.506	-2.924	-3.506

Note: Null Hypothesis: *there is a unit root*
Source*: Authors' estimates*

Having ascertained that the variables are integrated of the same order, the next procedure is to test the possibility of cointegration among the variables using Johansen procedure. Maximum Eigen value is used to determine the presence of long run relationship between the variables. On the basis of the maximum eigenvalue test, the null hypothesis of no co-integration ($r = 0$) is rejected at the 5 percent level of significance. Results suggest that there is at most 3 cointegrating

vector ($r = 3$). Similarly, cointegration test results based on Engle-Granger two step method, suggest existence of equilibrium in the estimating model. The ADF test applied to the error term of the cointegrating equation is integrated of order zero, $I(0)$. Overall, the results show that the errors in the cointegration regression are stationary (Table 4). Figure 3 also confirms the existence of cointegration between variables because the disequilibrium error fluctuates about zero.

Table 3. *Johansen Tests of Cointegration*

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.685242	53.17378	40.07757	0.0010
At most 1 *	0.602633	42.45311	33.87687	0.0037
At most 2 *	0.479917	30.07328	27.58434	0.0234
At most 3	0.354562	20.14003	21.13162	0.0683
At most 4	0.240095	12.62983	14.26460	0.0892

Notes: Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 4. *Static model: Tests for Cointegration between C/M1 and Explanatory Variables*

	Levels		Levels	
Optimal Lag = 1	Constant $\alpha_1 = 0$	Probability 0.005	Constant & Trend $\alpha_1 = \alpha_2 = 0$	Probability 0.003
C/M1 Residuals	-4.615***		-4.558***	
1% Critical value	-3.571		-4.156	
5% Critical value	-2.922		-3.504	

Notes: Null Hypothesis: *Residuals are non-stationary*
****denote rejection of the null hypothesis at 1% critical value*
Source*: Authors computations*

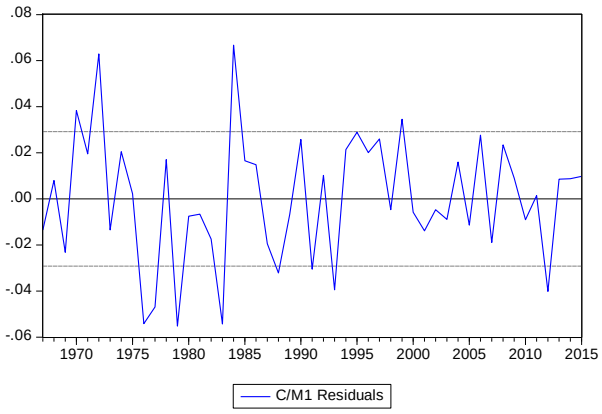


Figure 3. *Figure Long Run Contegrating Vector*
Source: Authors' estimates

3.3.2. Interpretation of the Empirical Results

Results for the regression function (2) are reported in Table 4. The preferred estimation is an error correction model *(ECM).* The *ECM* embodies both the short-run dynamics and the long-run equilibrium of the series. It also allows for suitable economic interpretation of the results, while at the same time it is robust to standard diagnostic testing (Faal, 2003). It is evident from the results that the error correcting term, ECT_{t-1}, is well behaved and significant. Specifically, results suggest that currency demand adjusts partially by about 13 percent in the short run toward its long run value. The diagnostic tests performed on the *ECM* show that the model conforms to econometric theory. The calculated F-statistic is significant at 1 percent, rejecting the null hypothesis that all the explanatory variables have

coefficients not different from zero. The adjusted R-squared, which measures the goodness of fit of the variables, is sufficiently large; suggesting that about 73 percent of the variations in currency to narrow money ratio is jointly explained by the specified set of explanatory variables over the 1966-2015 period. Moreover, the Durbin-Watson statistic (DW) of 2.1 fails to reject the null hypothesis of no serial correlation in the regression model. Moreover, the diagnostic tests show that the error correction model does not suffer from non-normality as we fail to reject the null hypothesis of normality using Jacque-Bera at 5 percent (Figure 4). The test for functional form (Ramsey RESET) shows no evidence of misspecification at 5 percent significance level (Table 5). Furthermore, the Breusch-Godfrey serial correlation Lagrange Multiplier *(LM)* confirms that the residual terms in the model are not serially correlated. Finally, the ARCH LM test strongly suggests that there exists no heteroscedasticity in the residual terms of the model.

Econometrics results further show that the coefficients on average tax rate and real GDP per capita are positive and significant. Both average tax rate and real GDP are statistically significant at 1 percent. The implication here, which is also consistent with some previous studies (see for example Tanzi, 1980; 1983; Hanousek & Palda, 2007; Osoro, 1995 and Schneider, 1994b), is that an increase in these variables have the tendency of raising the ratio of currency to narrow money thereby fueling activities in the subterranean economy. Similarly, the coefficient on urbanization is positive and statistically significant at 1 percent level. The coefficient on the rate of inflation is negative and significant at 5 percent, reflecting the opportunity costs of holding money. Finally, the coefficient on interest rate on saving deposits turned out to be insignificant and therefore it was dropped from empirical estimation.

Table 4. *Empirical Results*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.404340	0.460454	5.221672	0.0000
T_t^Y	0.182580	0.045695	3.995616	0.0002
Y_t^P	0.567802	0.087096	6.519265	0.0000
π_t	-0.001091	0.000518	-2.103404	0.0413
U_t	0.189016	0.042186	4.480483	0.0001
ECT_{t-1}	-0.395588	0.137758	-2.871608	0.0063
R-squared	0.756299	Mean dependent var		-0.312664
Adjusted R-squared	0.727962	S.D. dependent var		0.055984
S.E. of regression	0.029200	Akaike info criterion		-4.115037
Sum squared resid	0.036663	Schwarz criterion		-3.883385
Log likelihood	106.8184	Hannan-Quinn criter.		-4.027148
F-statistic	26.68921	Durbin-Watson stat		2.135161
Prob(F-statistic)	0.000000			

Table 5. *Diagnostics Tests*

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.619620	Prob. F(2,41)	0.5431
Obs*R-squared	1.437590	Prob. Chi-Square(2)	0.4873
Heteroskedasticity Test: ARCH			
F-statistic	0.182303	Prob. F(1,46)	0.6714
Obs*R-squared	0.189478	Prob. Chi-Square(1)	0.6634
Ramsey RESET Test			
	Value	Df	Probability
t-statistic	0.437279	42	0.6641
F-statistic	0.191213	(1, 42)	0.6641
Likelihood ratio	0.222576	1	0.6371

Source: Authors' estimates

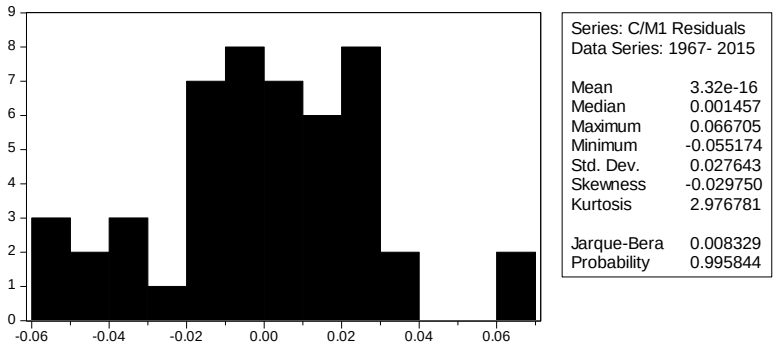


Figure 4. *Normality Test of the Residuals*
Notes: The Normality test indicates that residuals are normally distributed as we unable to reject the null hypothesis of normality using Jacque-Bera at 5 percent.
Source: Authors' estimates.

3.3.3. Estimates of Underground Economy from the Tanzi Method

Table 6 and Figures 4 and 5 confirm the presence of a large subterranean economy in Tanzania. These estimates represent a significant part of overall economic activity. Results show significant fluctuations of the subterranean economy as a percentage of official nominal GDP, which averaged about 46.4 percent during the 1966-1970 period and 78.1 percent over the 1971-1980 period. Overall, a remarkable size of the subterranean economy is noticeable in the 1970s and 1980s. The existence of a large subterranean economy during these periods is explained by a rise of urbanization in the 1970s and 1980s which in turn led to emergence of diverse range of urban activities. Moreover, the increase in the subterranean economy in 1970s and 1980s reflects the excessive government regulation and policies.

The subterranean economy as a proportion of official nominal GDP fell from 65.5 percent in 1985 to 25 percent in 1987. However, it rose again to 35.4 percent in 1991. Generally, the subterranean economy at an average of 49.2 percent over the 1981-1990 period and 30 percent during the 1990-2000 period is still higher than the levels of the 1966-1977 period. The increase in the subterranean economy in the second half of the 1980s was partly attributed to the economic recovery programme. During that time, there was a substantial increase in informal sector activities following the decline in real wages and deteriorating employment (Osoro, 1995).

In the last 15 years, the size of the subterranean economy took another upward trend, rising from 30 percent on average during the 1991-2000 period to 32.7 percent over the 2000-2015 period. In fact, it rose from 25.5 percent in 2005 to 42 percent in 2014. The growth of the subterranean economy in the 2000s might be due to the restructuring of public sector that saw many employees who could not be absorbed into formal employment turn into the informal activities as income-earning opportunities.

Figure 6 shows the growth rate of real GDP per capita and the subterranean economy. There are appear to be a systematic positive relationships bwtween changes in real GDP and the subterranean economy. This also confirms the computed positive regression coefficient of 0.57, suggesting that, *ceteris paribus*, if real GDP per capita increases by 1 percent, the subterranean economy will grow by 0.57 percent. The implication of this relationship is that cyclical movements in the subterranean economy tend to coincide with the movements in the official economy. The variance of gowth in both the real GDP per capita and the subterranean economy was significantly higher during the 1967-1997 period. This indicates that there was more volatility in both official and informal economies.

During the late 1990s to 2015 the rate of growth of the subterranean economy is relative low. Also its variance of growth is significantly low. This may be

cntributed to the financial sector reform of 1990s and a subsequent establiment of many financial intitutions in Tanzania including commercial banks.

Table 6. *Size of the Subterranean Economy in Tanzania (TZS Million), 1966-2016*

	IM	LM	Velocity	SE	GDP	SE/GDP
1966	189.2	832.3	8.7	1640.4	7217.0	22.7
1967	274.6	945.0	7.8	2137.7	7356.0	29.1
1968	456.6	900.5	8.7	3989.1	7866.0	50.7
1969	587.6	994.5	8.1	4784.1	8098.0	59.1
1970	759.7	1078.4	8.5	6461.6	9173.0	70.4
1971	918.3	1310.6	7.5	6876.9	9814.0	70.1
1972	997.6	1496.3	7.5	7448.7	11172.0	66.7
1973	1306.9	1597.0	8.2	10722.8	13103.0	81.8
1974	1626.5	1978.2	8.1	13150.6	15994.0	82.2
1975	2220.6	2234.1	8.5	18895.6	19011.0	99.4
1976	2149.4	3326.0	7.5	16075.4	24876.0	64.6
1977	2698.7	3869.4	7.5	20134.1	28868.0	69.7
1978	3414.0	3641.2	9.0	30877.7	32933.0	93.8
1979	4549.2	6109.0	5.9	27019.0	36283.0	74.5
1980	5956.1	7666.8	5.5	32806.0	42228.0	77.7
1981	6220.9	9514.3	5.4	33838.4	51753.0	65.4
1982	6810.9	11905.5	5.2	35426.8	61927.0	57.2
1983	9135.9	11951.5	5.8	53143.7	69522.0	76.4
1984	8074.0	13331.9	6.4	51715.1	85392.0	60.6
1985	10338.1	15770.2	7.1	73561.3	112213.0	65.6
1986	13039.3	23912.1	6.2	80918.2	148391.0	54.5
1987	9774.3	39105.0	8.4	82354.7	329486.0	25.0
1988	13639.2	53875.8	9.4	128207.1	506426.0	25.3
1989	20360.7	64724.2	9.8	199364.0	633752.0	31.5
1990	27220.2	88230.1	9.4	256280.8	830693.0	30.9
1991	37339.9	105336.1	10.3	385065.9	1086273.0	35.4
1992	51909.1	140971.6	9.7	504420.0	1369874.0	36.8
1993	52220.0	203771.4	8.5	442198.1	1725535.0	25.6
1994	78608.3	262520.7	8.8	688364.3	2298866.0	29.9
1995	106974.8	341204.8	8.9	946989.1	3020499.0	31.4
1996	115601.8	356524.5	10.6	1221644.6	3767642.0	32.4
1997	119022.5	401456.2	11.7	1395999.0	4708627.0	29.6
1998	124540.4	450500.9	13.9	1737195.2	6283970.0	27.6
1999	141602.7	533567.5	13.5	1916784.8	7222561.0	26.5
2000	150634.2	595019.0	13.7	2063948.8	8152789.0	25.3
2001	173549.8	620093.0	14.7	2546958.5	9100274.0	28.0
2002	218897.7	793627.2	13.2	2880797.4	10444507.0	27.6
2003	258941.6	920429.9	13.2	3406039.9	12107060.0	28.1
2004	326142.0	1085444.3	12.9	4198025.2	13971591.0	30.0
2005	385418.4	1511654.5	12.6	4873095.0	19112830.0	25.5
2006	424904.2	1690747.0	13.8	5855165.0	23298435.0	25.1
2007	632056.7	2150556.0	12.4	7867933.6	26770432.0	29.4
2008	847801.1	2582021.0	12.7	10758297.6	32764940.0	32.8
2009	1010287.0	2910601.7	13.0	13095202.7	37726824.0	34.7
2010	1195416.2	3727522.5	11.8	14058207.4	43836018.0	32.1
2011	1613315.0	4417011.4	11.9	19271551.8	52762581.0	36.5
2012	1915266.2	4891140.1	12.6	24056328.4	61434214.0	39.2
2013	2192772.9	5585177.3	12.7	27856646.6	70953227.0	39.3
2014	2622663.8	6245143.6	12.8	33477949.8	79718416.0	42.0
2015	2954188.9	7264619.4	12.5	36950108.3	90863681.0	40.7

Source: Authors' estimates

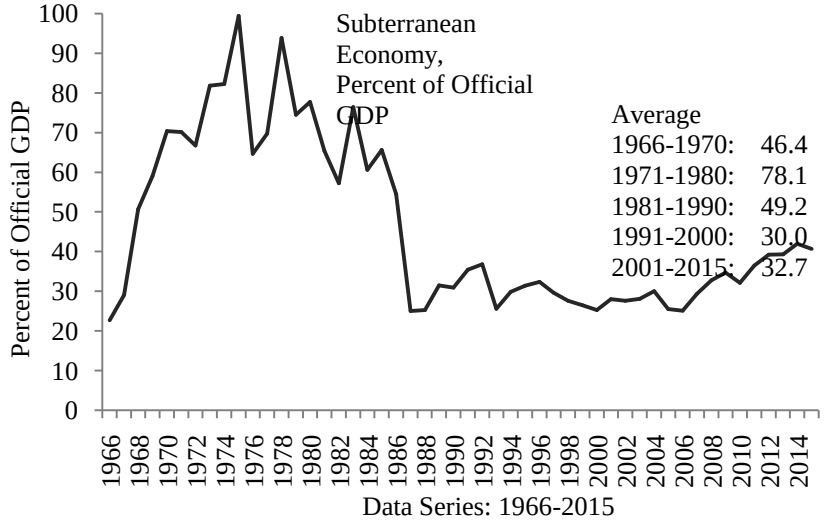


Figure 5. *Size and Development of the Subterranean Economy, Currency Demand Approach*
Source: Authors' estimates

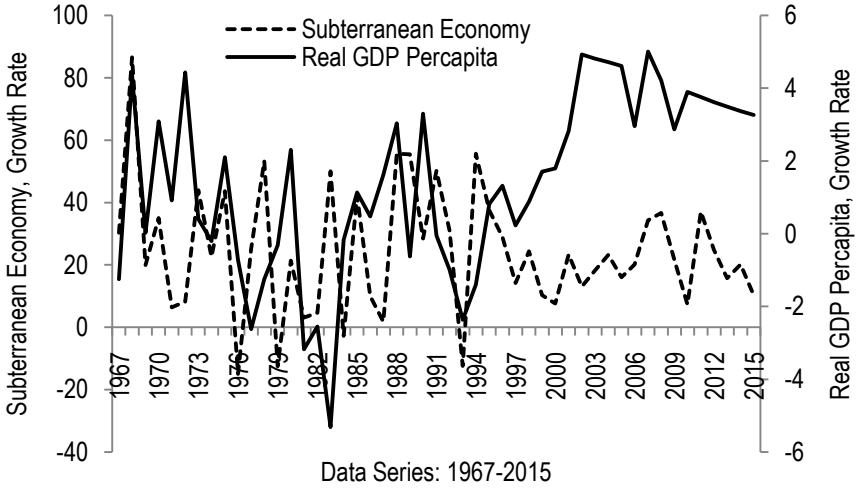


Figure 6. *Growth Rate: Official and Subterranean Economy*
Source: Authors' estimates

3.3.4. Estimating Tax Evasion

The estimates of tax evasion are obtained by multiplying the estimates of the subterranean economy GDP by the average tax ratio. This indicates the extent at which the observed tax rates and the estimates of the subterranean economy provide insights to the level and proliferation of tax evasion. The assumption here is that productive activities in the subterranean economy would be have been taxed at the same rate as incomes in the formal economy.

Table 7 and Figure 7 report the estimates of level of tax evasion in Tanzania over the 1966-2015 period. The average size of tax evasion during the 1966-2015 period, was 6.6 percent of official GDP and 45.9 percent of official total tax revenue. This also indicates that, on average, if the subterranean economy had been incorporated in the formal sector, total tax revenue would have been higher by an estimated 6.6 percent of official GDP per year over the 1966-2015 period.

Table 7. *Estimates of Tax Evasion (TZS Million), 1966-2015*

	Tax Evasion (TE)	Tax Revenue (TR)	Potential Tax Revenue	Official GDP	TE (% of TR)	TE (% of GDP)
1966	126.4	556	682.4	7217.0	22.7	1.8
1967	200.2	689	889.2	7356.0	29.1	2.7
1968	558.3	1101	1659.3	7866.0	50.7	7.1
1969	739.1	1251	1990.1	8098.0	59.1	9.1
1970	1110.9	1577	2687.9	9173.0	70.4	12.1
1971	1178.6	1682	2860.6	9814.0	70.1	12.0
1972	1239.4	1859	3098.4	11172.0	66.7	11.1
1973	2007.4	2453	4460.4	13103.0	81.8	15.3
1974	2468.3	3002	5470.3	15994.0	82.2	15.4
1975	3918.1	3942	7860.1	19011.0	99.4	20.6
1976	2625.0	4062	6687.0	24876.0	64.6	10.6
1977	3441.2	4934	8375.2	28868.0	69.7	11.9
1978	6215.3	6629	12844.3	32933.0	93.8	18.9
1979	4797.2	6442	11239.2	36283.0	74.5	13.2
1980	5966.4	7680	13646.4	42228.0	77.7	14.1
1981	5564.9	8511	14075.9	51753.0	65.4	10.8
1982	5362.6	9374	14736.6	61927.0	57.2	8.7
1983	9577.4	12529	22106.4	69522.0	76.4	13.8
1984	8114.1	13398	21512.1	85392.0	60.6	9.5
1985	12116.5	18483	30599.5	112213.0	65.6	10.8
1986	11877.8	21782	33659.8	148391.0	54.5	8.0
1987	6850.4	27407	34257.4	329486.0	25.0	2.1
1988	10773.8	42557	53330.8	506426.0	25.3	2.1
1989	19845.1	63085	82930.1	633752.0	31.5	3.1
1990	25135.0	81471	106606.0	830693.0	30.9	3.0
1991	41920.2	118257	160177.2	1086273.0	35.4	3.9
1992	56469.3	153356	209825.3	1369874.0	36.8	4.1
1993	37522.7	146420	183942.7	1725535.0	25.6	2.2
1994	65983.2	220358	286341.2	2298866.0	29.9	2.9
1995	94024.2	299898	393922.2	3020499.0	31.4	3.1
1996	124427.6	383744	508171.6	3767642.0	32.4	3.3
1997	149826.1	505355	655181.1	4708627.0	29.6	3.2
1998	156504.0	566123	722627.0	6283970.0	27.6	2.5
1999	167223.4	630108	797331.4	7222561.0	26.5	2.3
2000	173440.7	685107	858547.7	8152789.0	25.3	2.1
2001	231678.9	827788	1059466.9	9100274.0	28.0	2.5
2002	259068.0	939267	1198335.0	10444507.0	27.6	2.5
2003	311075.9	1105746	1416821.9	12107060.0	28.1	2.6
2004	403468.7	1342798	1746266.7	13971591.0	30.0	2.9
2005	411830.8	1615247	2027077.8	19112830.0	25.5	2.2
2006	489160.8	1946432	2435592.8	23298435.0	25.1	2.1
2007	743411.9	2529439	3272850.9	26770432.0	29.4	2.8
2008	1106194.4	3368971	4475165.4	32764940.0	32.8	3.4
2009	1403582.7	4043673	5447255.7	37726824.0	34.7	3.7
2010	1420006.0	4427834	5847840.0	43836018.0	32.1	3.2
2011	2144670.5	5871782	8016452.5	52762581.0	36.5	4.1
2012	2815828.2	7190964	10006792.2	61434214.0	39.2	4.6
2013	3266802.4	8320821	11587623.4	70953227.0	39.3	4.6
2014	4118610.9	9807325	13925935.9	79718416.0	42.0	5.2
2015	4443439.4	10926822	15370261.4	90863681.0	40.7	4.9

Source: Authors' estimates

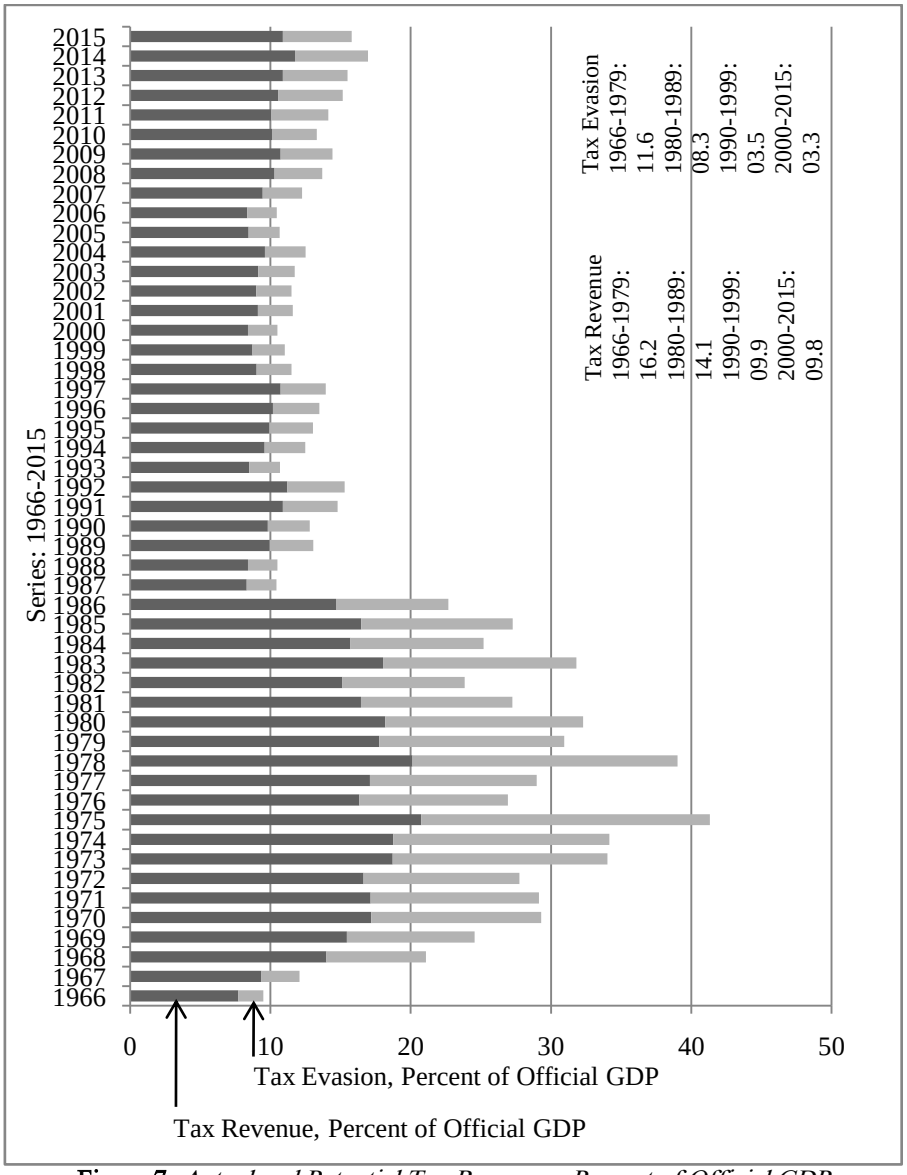


Figure 7. *Actual and Potential Tax Revenues, Percent of Official GDP*
Source: Authors' estimates

The estimates of tax evasion as percentage of official GDP and tax revenue in the 1980s were 8.3 percent and 53.9 percent respectively. These rates declined to 3.5 percent and 30.6 percent, respectively, in the 1990s. This declining trend in tax evasion as percentage of both official GDP and total tax revenue, especially in early 1990s, was a result of measures put in place by the Government of Tanzania to restrict expansion of unofficial economic activities (Osoro, 1995). Also, the relative low tax evasion in the second half 2000s was mainly due to tax reforms and improvement in tax administration which led to capturing some informal economic activities into the tax net. Overall, rising tax evasion in the 1970s and 1980s, reflects the existence and growth of the subterranean economy over that periods. In fact, the widespread of the tax evasion associated with the subterranean economy has by implication, increased the fiscal deficit in Tanzania.

4. Conclusions

The objective of this paper was to estimate and analyze the size and consequences of the subterranean economy in Tanzania. To achieve this objective both Gutmann and error-correction based currency demand model were applied.

The Gutmann method makes use of the ratio of currency demand deposits and it assumes that there is a monetary ratio that would have remained constant over time had there been no second economy. The currency demand model or Tanzi approach assumes that activities in the subterranean economy as direct results of high taxes. This approach performs econometric estimates of monetary aggregates used to finance the informal transactions. Thus income velocity is the same in both economies. The two methods yield different results mainly because of the difference to the manner in which these two methods calculate income velocity. Also, the results may be sensitive to the assumptions made, equations specified, and explanatory variables selected.

Notwithstanding the differences in size and growth of the subterranean economy given by the two approaches, the significance of these results remains largely undiminished. Both approaches suggest the existence of large subterranean economy in Tanzania. The fact that tax evasion is correlated with the size and growth of the subterranean economy, the official tax revenue as a percent of GDP has stagnated. The loss of tax revenues and the demand on public services by subterranean activities, by implication, may be a significant factor for the high fiscal deficit and persistent aid-dependence.

Thus efforts must be taken by the authorities to reduce the size of the subterranean economy. Fiscal reforms such as comprehensive reform of the current tax system and its administration plus improved provision of government services such as land titling and judicial services would likely help reduce the size of the second economy. Also, improved governance and stronger institutions are important factors for reducing the size of subterranean economy which in turn may lead to improve tax collections.

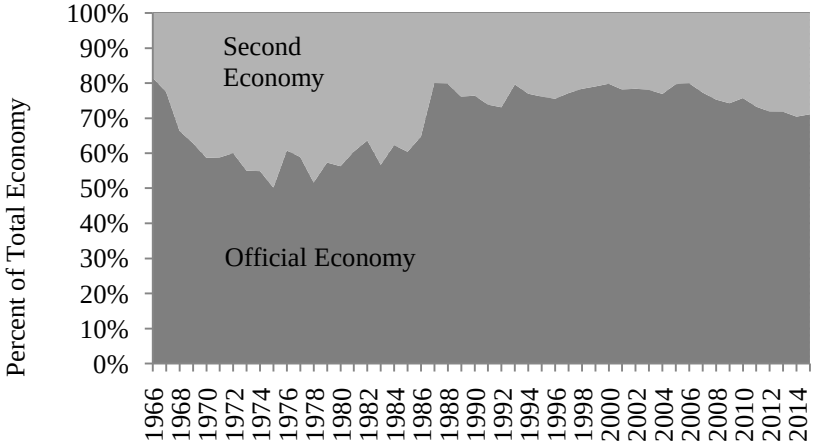
Appendices

Appendix 1. *Autocorrelation and Partial Autocorrelation, Equation (2) Tanzi Approach*

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.*| . |	.*| . |	1	-0.071	-0.071	0.2646	0.607
.|*. |	.|*. |	2	0.155	0.151	1.5478	0.461
.*| . |	.| . |	3	-0.083	-0.065	1.9240	0.588
.| . |	.| . |	4	-0.021	-0.054	1.9480	0.745
.*| . |	.*| . |	5	-0.155	-0.142	3.3183	0.651
.| . |	.| . |	6	0.017	0.006	3.3348	0.766
.*| . |	.*| . |	7	-0.185	-0.153	5.3672	0.615
.*| . |	**| . |	8	-0.163	-0.224	6.9892	0.538
.*| . |	.*| . |	9	-0.089	-0.096	7.4879	0.586
.|*. |	.|** |	10	0.197	0.214	9.9647	0.444
.*| . |	.| . |	11	-0.070	-0.065	10.288	0.505
.|** |	.|*. |	12	0.236	0.105	14.059	0.297
.*| . |	.*| . |	13	-0.106	-0.111	14.835	0.318
.|** |	.|*. |	14	0.225	0.177	18.439	0.188
.*| . |	.*| . |	15	-0.103	-0.073	19.219	0.204
.*| . |	**| . |	16	-0.073	-0.256	19.617	0.238
.*| . |	.*| . |	17	-0.180	-0.134	22.137	0.179
.*| . |	.| . |	18	-0.070	-0.001	22.535	0.209
.| . |	.|*. |	19	-0.042	0.086	22.685	0.252
.| . |	.*| . |	20	-0.029	-0.124	22.759	0.301

Notes: No serial correlation in the model because none of the lag is found to be significant at 1 percent level.
Source: Authors' estimates

Appendix 2. *Proportion of Official and Subterranean Economy, Tanzi Approach*



Data Series: 1966-2015

Source: Authors' estimates

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